DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

CESPK-PD-R

JUN 05 2017

TO ALL INTERESTED PARTIES:

Following the requirements of the National Environmental Policy Act (NEPA), and the California Environmental Quality Act (CEQA), a draft Supplemental Environmental Assessment/ Environmental Impact Report (SEA/EIR) has been prepared for the Folsom Dam and Lake Water Control Manual Update (Manual Update) and is now available for review along with a draft update of the Water Control Manual. The Water Control Manual outlines the regulation schedule for Folsom Dam and specifications for storage and reservoir releases when water encroaches into the designated flood storage space at the dam.

Folsom Dam and its appurtenant structures are located in Folsom, California within portions of Sacramento, Eldorado, and Placer County. The Manual Update involves updating the operation rules for Folsom Dam and Lake to incorporate the flood risk management and dam safety benefits of the Folsom Dam Modification Project, or Joint Federal Project (JFP). The U.S. Army Corps of Engineers (USACE), the Federal lead agency, and the State of California Central Valley Flood Protection Board (CVFPB), the lead State agency, have prepared this supplement to the 2007 JFP Environmental Impact Statement/Environmental Impact Report in cooperation with the U.S. Department of Interior, Bureau of Reclamation (Reclamation) and the Sacramento Area Flood Control Agency. A Record of Decision for the JFP was signed on May 3, 2007.

Per Section 101(e) of the Water Resources Development Act (WRDA) of 1999, USACE was directed by Congress to update the water control manual for Folsom Dam and Lake to incorporate the flood risk management and dam safety benefits of operating Folsom Dam with the JFP in place. 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 into an updated water control manual. The draft SEA/EIR discusses and discloses any potentially beneficial or adverse effects that may result from the Manual Update. Most of the potential adverse effects that could result from implementation of the proposed alternative would either be less than significant to no effect, with the potential for some incidental beneficial effects to water supply.

In compliance with the National Historic Preservation Act, USACE and Reclamation are developing a draft programmatic agreement, in coordination with the State Historic Preservation Officer, which will establish procedures for the avoidance and minimization of adverse effects from the proposed alternative on cultural resources. While avoidance, minimization, and mitigation measures are expected to resolve adverse effects to cultural resources under NEPA, effects to cultural resources remain potentially significant under CEQA since cultural surveys and a full assessment of effects and mitigation cannot be completed prior to public circulation of the draft CEQA document.

The draft SEA/EIR and draft update to the Water Control Manual provides the opportunity for public and agency involvement and comment. During the 45-day public review period, a series of public meetings will be held to discuss the proposed project and encourage public questions and comments on the project. The public workshops dates, times, and locations are:

June 14, 2017 3:00 p.m. to 4:30 p.m. Sacramento Library Galleria 828 I Street, Sacramento, CA 95814	June 15, 2017 6:00 p.m. to 7:30 p.m. Folsom Community Center 52 Natoma Street Folsom, CA 95630

The draft SEA/EIR and draft update to the Water Control Manual are available for download at the following websites:

- USACE website – http://www.spk.usace.army.mil/Missions/Civil-Works/Folsom-Water-Control-Manual-Update/
- CVFPB website – http://cvfpb.ca.gov/public-notices/

In addition, the draft SEA/EIR is available at the following locations:

- Folsom Public Library – 411 Stafford Street, Folsom, CA 95630
- Orangevale Branch Library – 8820 Greenback Lane, Orangevale, CA 95662
- Sacramento Public Library – 828 I Street, Sacramento, CA 95814
- Eldorado Hills Public Library – 7455 Silva Valley Pkwy., El Dorado Hills, CA 95762
- Roseville Public Library – 225 Taylor St., Roseville, CA 95678

Comments on the draft SEA/EIR will be accepted from June 7, 2017 to July 21, 2017.

Written comments on the draft SEA/EIR and the draft Water Control Manual may be submitted to: U.S. Army Corps of Engineers, Sacramento District, Attn: Public Affairs Office, 1325 J Street, Room 1513, Sacramento, California 95814, or email to SPK-PAO@usace.army.mil; or Attn: David Martasian, California Department of Water Resources, 3464 El Camino Avenue Room 150, Sacramento, CA 95821 or email to David.Martasian@water.ca.gov.

Copies of the draft SEA/EIR are also available upon request.

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

FOLSOM DAM MODIFICATION PROJECT
WATER CONTROL MANUAL UPDATE

DRAFT
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT/ ENVIRONMENTAL IMPACT REPORT

JUNE 2017

State Clearinghouse SCH # 2012102034

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

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DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

DRAFT FINDING OF NO SIGNIFICANT IMPACT
FOLSOM DAM MODIFICATION PROJECT
WATER CONTROL MANUAL UPDATE, FOLSOM, CALIFORNIA

The U.S. Army Corps of Engineers, Sacramento District, has conducted environmental analysis in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended. This Supplemental Environmental Assessment (SEA) is tiered to the 2007 Folsom Dam Safety and Flood Damage Reduction Final Environmental Impact Statement / Environmental Impact Report (EIS/EIR). The SEA focuses on the effects associated with updating the Folsom Dam and Lake Water Control Manual to implement use of the 2007 EIS/EIR Joint Federal Project facilities. Changes to the Water Control Manual would result in updates to the water control diagram and emergency spillway release diagram for Folsom Dam and Lake.

The proposed action as described in the Final SEA includes use of forecast-informed decision making to guide flood operations at Folsom Dam to initiate releases greater than inflow in advance of precipitation-snowmelt events.

The possible consequences of the work described in this SEA have been studied with consideration given to environmental, cultural, social, and engineering feasibility. The SEA has been jointly coordinated with the State of California Central Valley Flood Protection Board with preparation of a Supplemental EIR in compliance with the California Environmental Quality Act (CEQA), and with the U.S. Bureau of Reclamation and Sacramento Area Flood Control Agency. In addition, multiple public outreach efforts and close coordination with other interested agencies, organizations, and individuals has also occurred.

In evaluating the effects of the proposed project, specific attention has been given to any environmental conditions that could potentially occur. Implementation of the updated would be in compliance with applicable Federal laws, regulations and executive orders. Best management practices, avoidance protocols, and minimization and mitigation measures as summarized within this SEA, CEQA EIR, and 2007 EIS/EIR, would be implemented. Cultural resource issues would follow the Programmatic Agreement process.

Based upon my review of the SEA, incorporated herein by reference, it is my determination that the proposed project would have no significant effects on environmental, social, or cultural resources. Based on these considerations, it is my determination that the proposed project does not constitute a major federal action that would significantly affect the human environment. Therefore, preparation of an Environmental Impact Statement is not required.

____
Date

____
David G. Ray
Colonel, U.S. Army
District Commander

EXECUTIVE SUMMARY

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

Since the flood of record in 1986, 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 is scheduled to be 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 a 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 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.

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 11 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 through 10 identify the preparers, references, and index, 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 authorized 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.

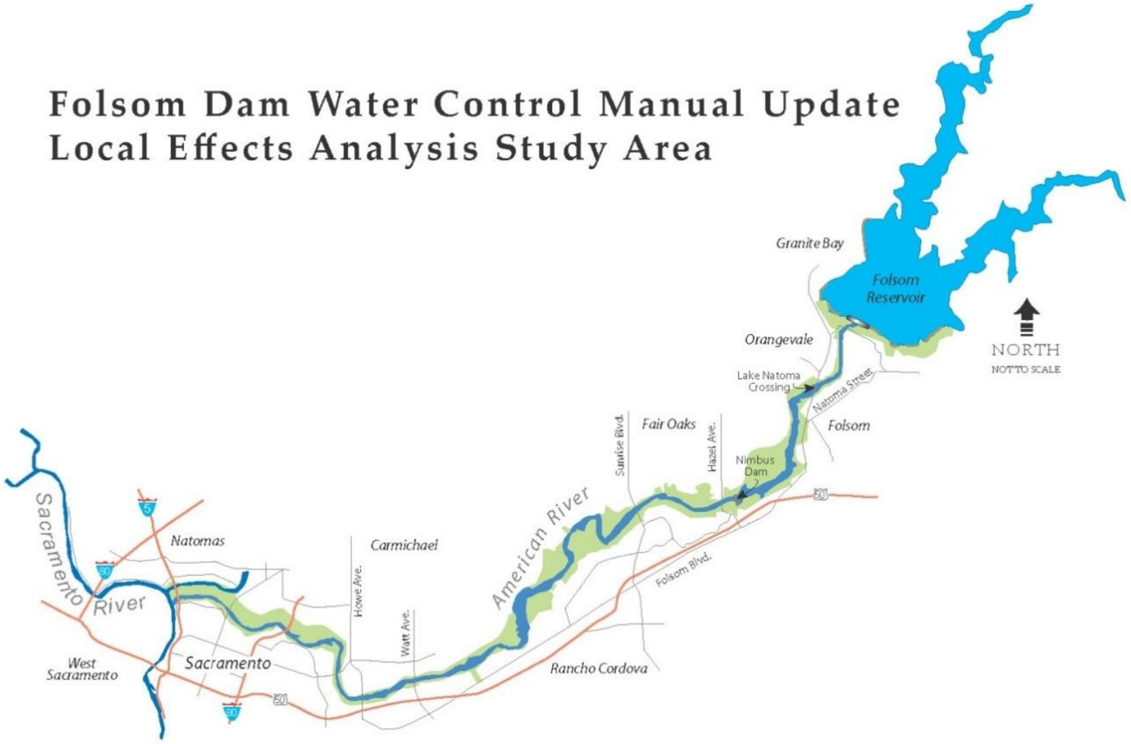


Figure ES-1. American River Local Project Area.

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 (Figure ES-2). 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 affects 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 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.

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.

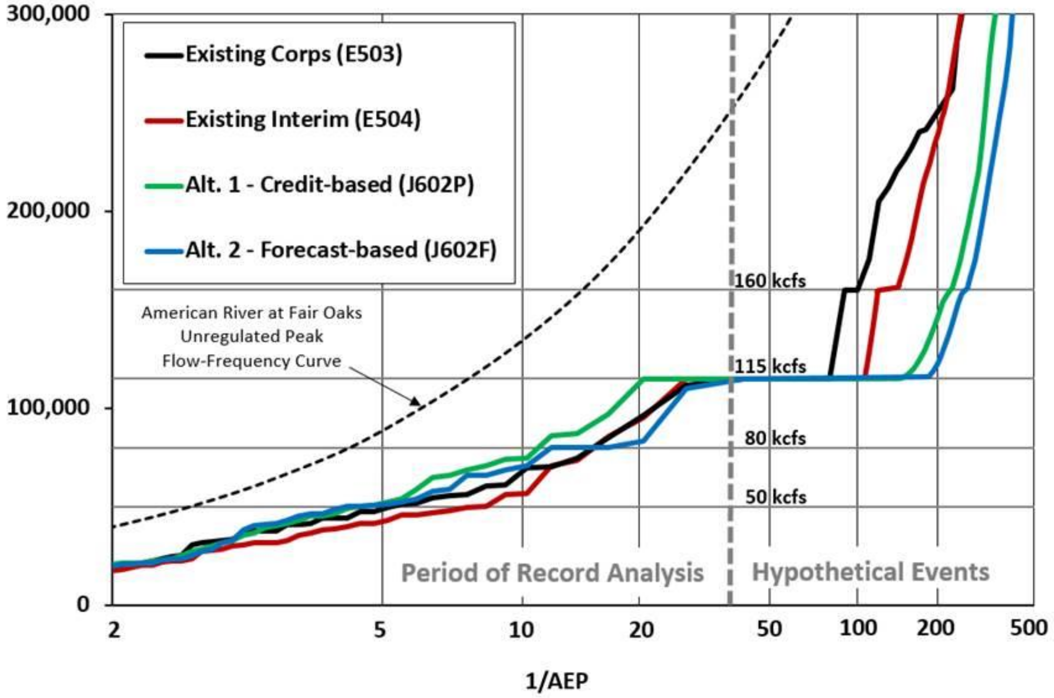


Figure ES-2. Lower American River Flow Frequency Curves of the Operation Scenarios Modeled for the Manual Update.

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.

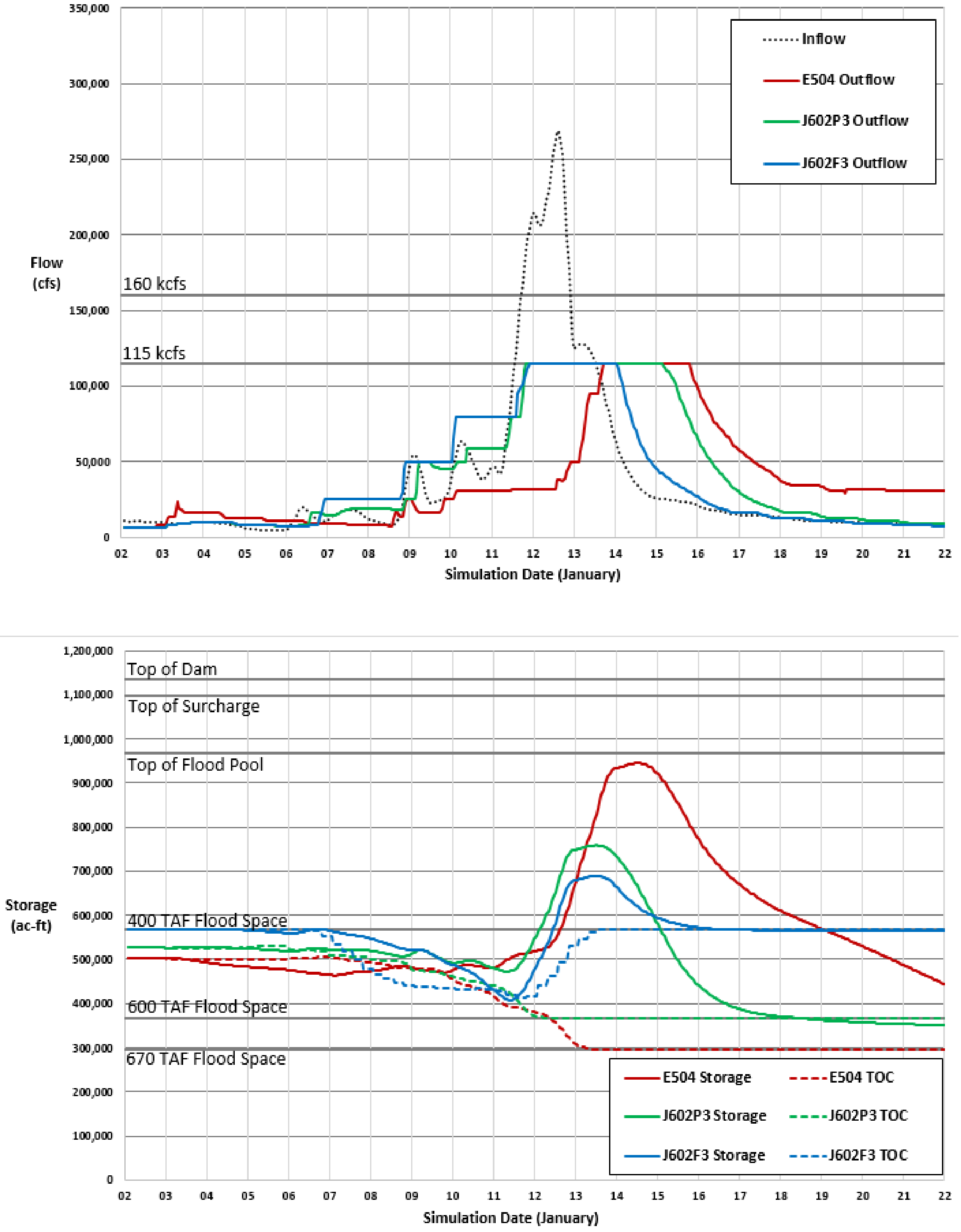


Figure ES-3. Scaled 1-in-100 annual exceedance probability event pattern of the 1997 storm event depicting releases from (top) and flood storage volumes in (bottom) Folsom throughout the event.

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

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-5 and Figure ES-6, 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-6 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.

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. 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.

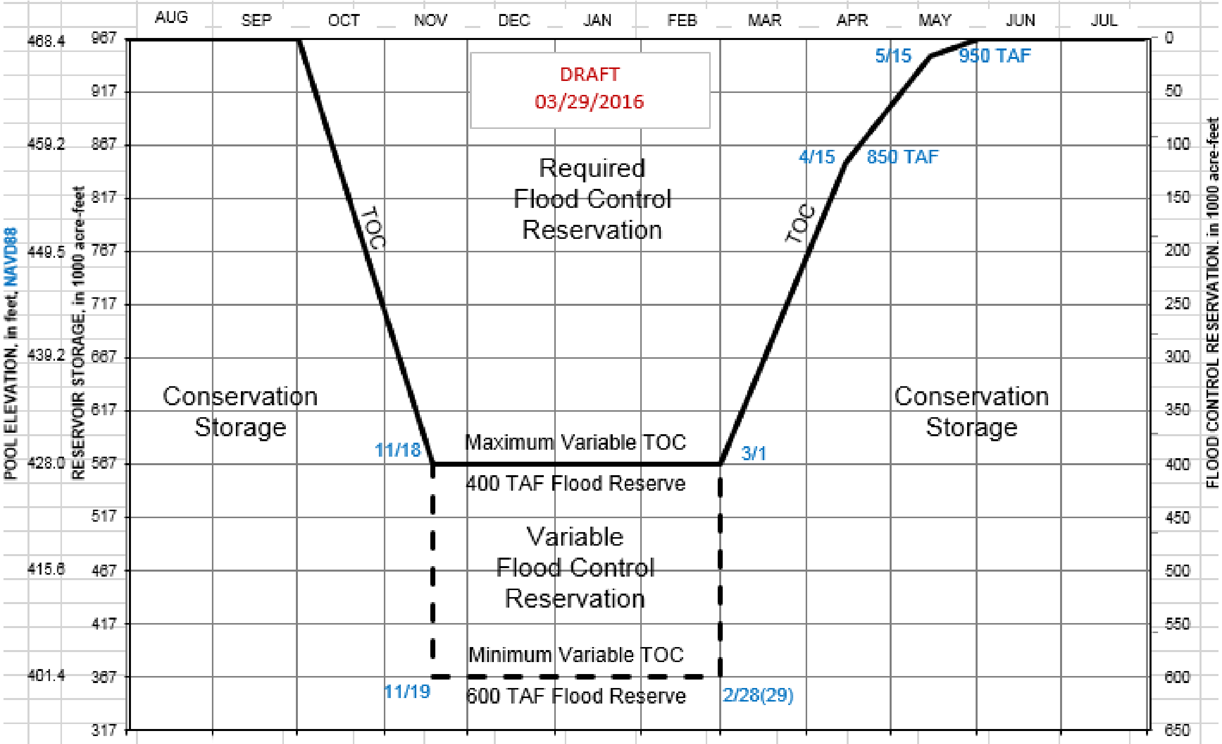
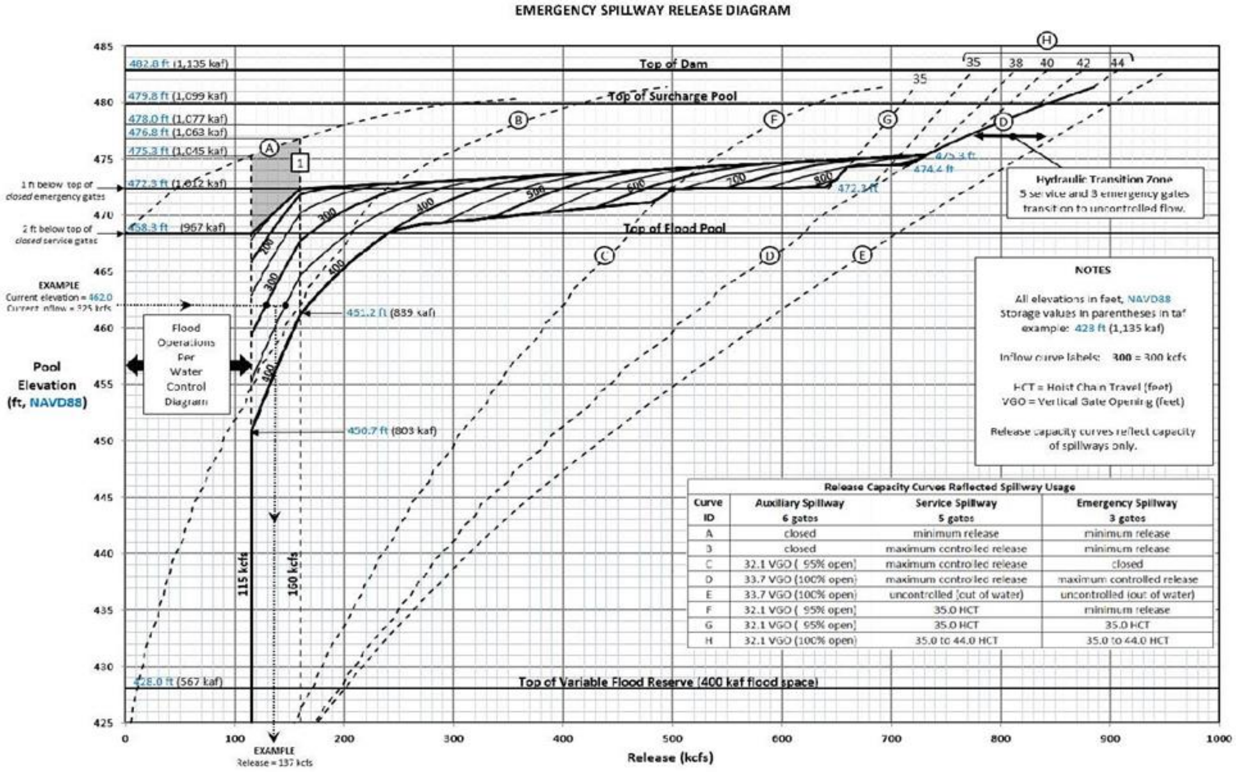


Figure ES-4. Updated Water Control Diagram for Alternative 2.



Hydraulic Transition Zone
5 service and 3 emergency gates transition to uncontrolled flow.

NOTES

All elevations in feet, NAVD88
Storage values in parentheses in taf
example: 428 ft (1,135 kaf)

Inflow curve labels: **300** = 300 kcfs

HCT = Hoist Chain Travel (feet)
VGO = Vertical Gate Opening (feet)

Release capacity curves reflect capacity of spillways only.

Release Capacity Curves Reflected Spillway Usage

Curve ID	Auxiliary Spillway 6 gates	Service Spillway 5 gates	Emergency Spillway 3 gates
A	closed	minimum release	minimum release
B	closed	maximum controlled release	minimum release
C	32.1 VGO (95% open)	maximum controlled release	closed
D	33.7 VGO (100% open)	maximum controlled release	maximum controlled release
E	33.7 VGO (100% open)	uncontrolled (out of water)	uncontrolled (out of water)
F	32.1 VGO (95% open)	35.0 HCT	minimum release
G	32.1 VGO (95% open)	35.0 HCT	35.0 HCT
H	32.1 VGO (100% open)	35.0 to 44.0 HCT	35.0 to 44.0 HCT

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

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-7 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.

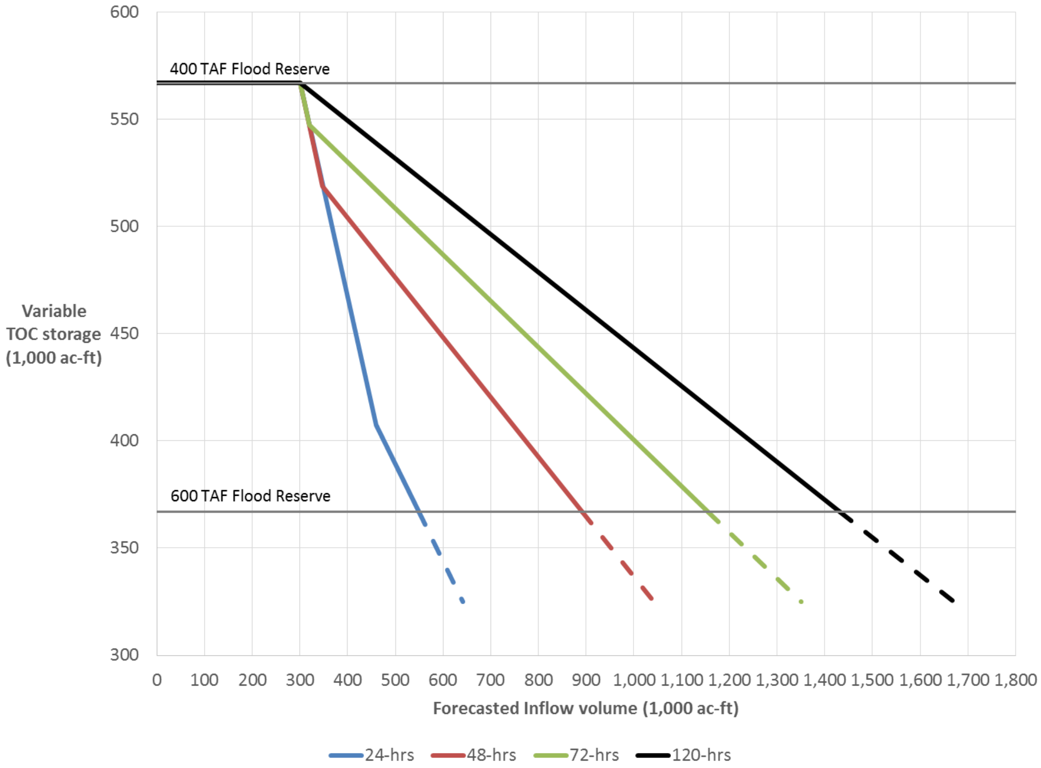


Figure ES-6. Forecast-based Drawdown Relationships.

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.

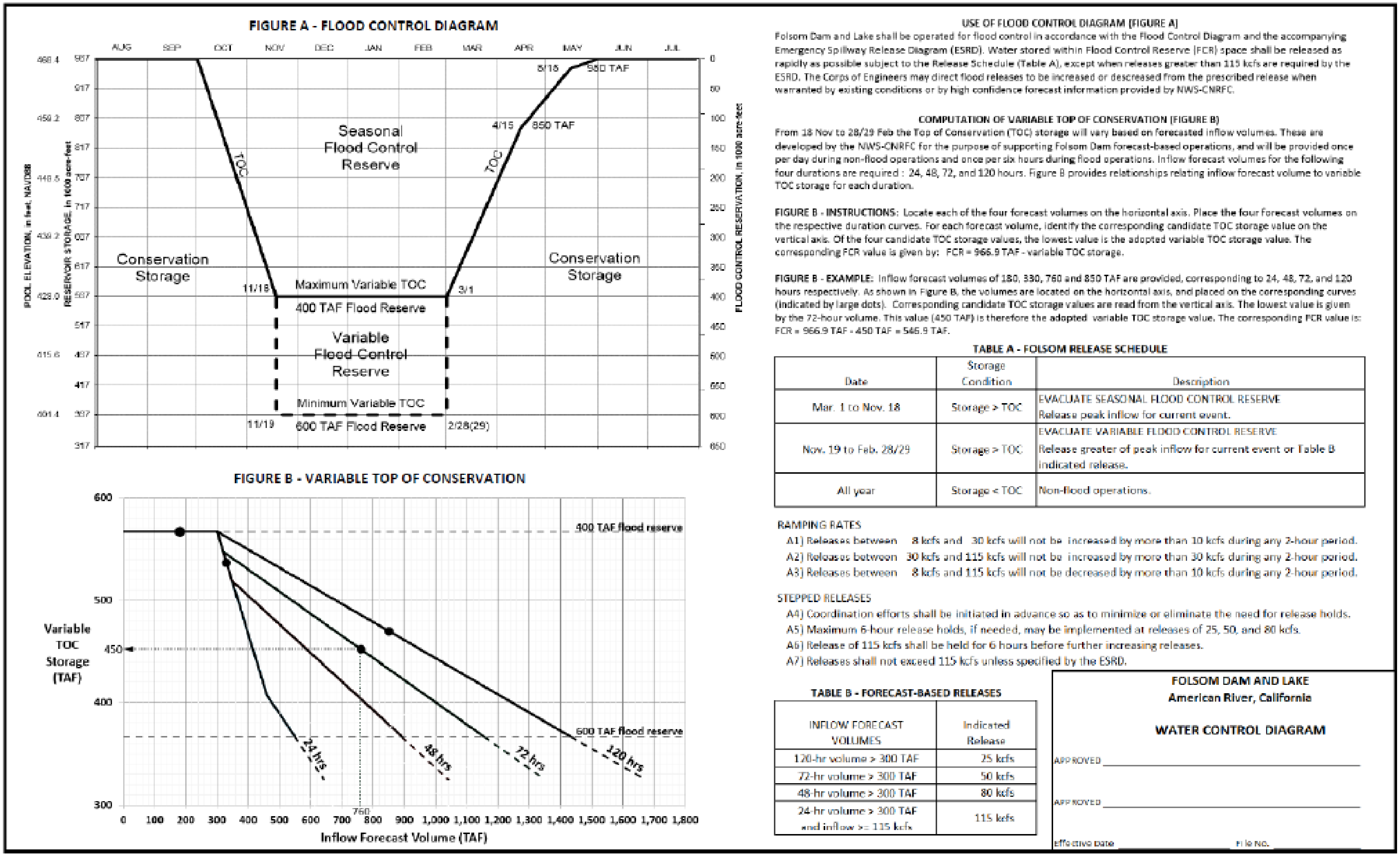


FIGURE A - FLOOD CONTROL DIAGRAM

FIGURE B - VARIABLE TOP OF CONSERVATION

USE OF FLOOD CONTROL DIAGRAM (FIGURE A)

Folsom Dam and Lake shall be operated for flood control in accordance with the Flood Control Diagram and the accompanying Emergency Spillway Release Diagram (ESRD). Water stored within Flood Control Reserve (FCR) space shall be released as rapidly as possible subject to the Release Schedule (Table A), except when releases greater than 115 kcfs are required by the ESRD. The Corps of Engineers may direct flood releases to be increased or descreased from the prescribed release when warranted by existing conditions or by high confidence forecast information provided by NWS-CNRFC.

COMPUTATION OF VARIABLE TOP OF CONSERVATION (FIGURE B)

From 18 Nov to 28/29 Feb the Top of Conservation (TOC) storage will vary based on forecasted inflow volumes. These are developed by the NWS-CNRFC for the purpose of supporting Folsom Dam forecast-based operations, and will be provided once per day during non-flood operations and once per six hours during flood operations. Inflow forecast volumes for the following four durations are required : 24, 48, 72, and 120 hours. Figure B provides relationships relating inflow forecast volume to variable TOC storage for each duration.

FIGURE B - INSTRUCTIONS: Locate each of the four forecast volumes on the horizontal axis. Place the four forecast volumes on the respective duration curves. For each forecast volume, identify the corresponding candidate TOC storage value on the vertical axis. Of the four candidate TOC storage values, the lowest value is the adopted variable TOC storage value. The corresponding FCR value is given by: FCR = 966.9 TAF - variable TOC storage.

FIGURE B - EXAMPLE: Inflow forecast volumes of 180, 330, 760 and 850 TAF are provided, corresponding to 24, 48, 72, and 120 hours respectively. As shown in Figure B, the volumes are located on the horizontal axis, and placed on the corresponding curves (indicated by large dots). Corresponding candidate TOC storage values are read from the vertical axis. The lowest value is given by the 72-hour volume. This value (450 TAF) is therefore the adopted variable TOC storage value. The corresponding FCR value is: FCR = 966.9 TAF - 450 TAF = 546.9 TAF.

TABLE A - FOLSOM RELEASE SCHEDULE

Date	Storage Condition	Description
Mar. 1 to Nov. 18	Storage > TOC	EVACUATE SEASONAL FLOOD CONTROL RESERVE Release peak inflow for current event.
Nov. 19 to Feb. 28/29	Storage > TOC	EVACUATE VARIABLE FLOOD CONTROL RESERVE Release greater of peak inflow for current event or Table B indicated release.
All year	Storage < TOC	Non-flood operations.

RAMPING RATES

A1) Releases between 8 kcfs and 30 kcfs will not be increased by more than 10 kcfs during any 2-hour period.
A2) Releases between 30 kcfs and 115 kcfs will not be increased by more than 30 kcfs during any 2-hour period.
A3) Releases between 8 kcfs and 115 kcfs will not be decreased by more than 10 kcfs during any 2-hour period.

STEPPED RELEASES

A4) Coordination efforts shall be initiated in advance so as to minimize or eliminate the need for release holds.
A5) Maximum 6-hour release holds, if needed, may be implemented at releases of 25, 50, and 80 kcfs.
A6) Release of 115 kcfs shall be held for 6 hours before further increasing releases.
A7) Releases shall not exceed 115 kcfs unless specified by the ESRD.

TABLE B - FORECAST-BASED RELEASES

INFLOW FORECAST VOLUMES	Indicated Release
120-hr volume > 300 TAF	25 kcfs
72-hr volume > 300 TAF	50 kcfs
48-hr volume > 300 TAF	80 kcfs
24-hr volume > 300 TAF and inflow >= 115 kcfs	115 kcfs

FOLSOM DAM AND LAKE
American River, California

WATER CONTROL DIAGRAM

APPROVED ______________________

APPROVED ______________________

Effective Date ______________ File No. ______________

FINAL DRAFT 1/12/2017 PLATE A-9

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

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.

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. The table is still being developed and will be included in Final SEA/EIR

ES.7. COMPLIANCE WITH APPLICABLE LAWS

This document will be adopted as a joint SEA/EIR and will fully comply 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 will distribute the document to interested or affected agencies, groups, and individuals for review and comment. A series of public meetings will be held within the Manual Update project area during the 45-day public review of the Draft SEA/EIR. All comments received will be considered and incorporated into the final document, as appropriate.

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 expect to overtop levees in the lower American River at the 1 in 150 annual chance exceedance event. Therefore, there is 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 the 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. Because the effects are potentially 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 wetlands. 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. 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.

No Action/No Project Alternative	Alternative 2 – Forecast-informed Operation
	Given the less than significant effect of Alternative 2 on cottonwood growth and backwater recharge in the lower American River, effects on special-status plant and animal species that are likely to occur within the local project area, no significant adverse effects to these species are expected.
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 affects 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 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 negligible to less than significant with the continued implementation of USBR's CVPIA spawning gravel augmentation program.
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 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

No Action/No Project Alternative	Alternative 2 – Forecast-informed Operation
	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 affects 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 affects 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	
Local Project Area	

No Action/No Project Alternative	Alternative 2 – Forecast-informed Operation
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 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. It is not clear whether mitigation will or will not be required. USACE must complete identification efforts which cannot be completed prior to circulation. If adverse effects are found, USACE would develop means to resolve those adverse effects through the PA.

No Action/No Project Alternative	Alternative 2 – Forecast-informed Operation
	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 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. Under NEPA adverse effects to historic properties may result due to the action. If effects are determined to be potentially significant and adverse, those effects would be resolved through mitigation as a stipulation of the PA.

CONTENTS

TABLES

FIGURES

APPENDIXES

ACRONYMS AND SHORTENED FORMS

af	acre-feet
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
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

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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. Scheduled to be 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-ft-high and 1,400-ft-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-ft 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-ft-tall by 42-ft-wide radial gates for the service spillway and three 53-ft-tall by 42-ft-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-ft by 9-feet 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.

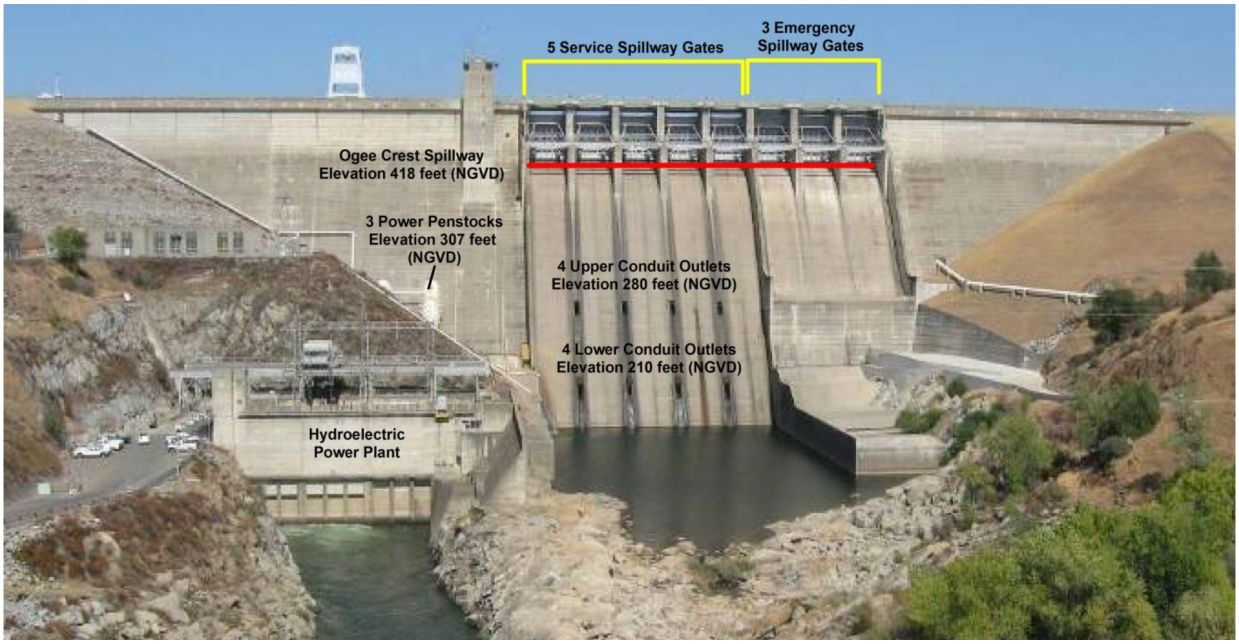


Figure 1-3. Concrete Gravity Section of Folsom Dam.

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 warmwater 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°F to 80°F 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 twenthieth 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

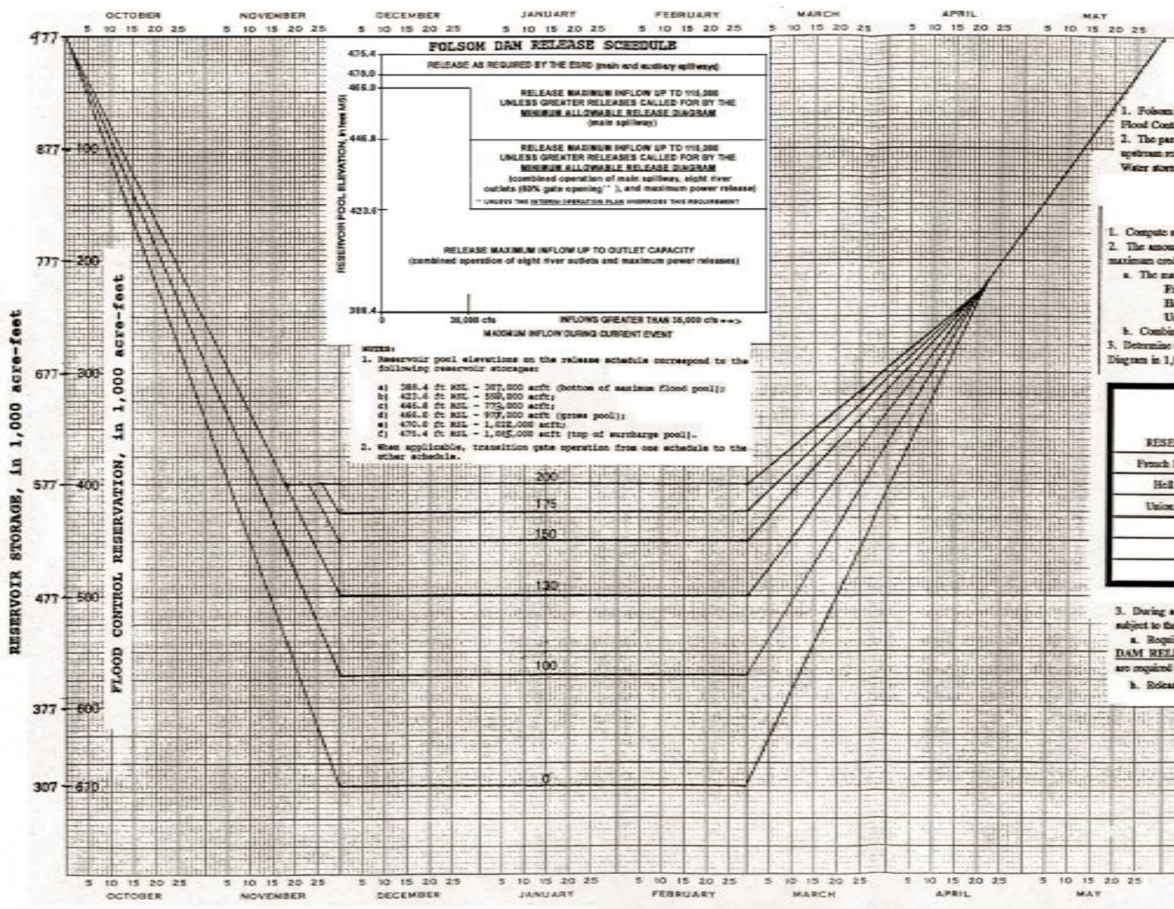
While Reclamation is responsible for daily operation of the dam, USACE's Sacramento District is responsible for developing and prescribing flood risk management operations for Folsom Dam and Reservoir. The dam's Water Control Manual (WCM), which includes the Water Control Diagram (WCD) and Emergency 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 the 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.



NOTES:

1. Reservoir pool elevations on the release schedule correspond to the following reservoir storages:

   a) 388.4 ft MSL - 367,000 acft (bottom of maximum flood pool);
   b) 423.6 ft MSL - 550,000 acft;
   c) 446.8 ft MSL - 775,000 acft;
   d) 466.0 ft MSL - 977,000 acft (gross pool);
   e) 470.0 ft MSL - 1,022,000 acft;
   f) 475.4 ft MSL - 1,085,000 acft (top of surcharge pool).

2. When applicable, transition gate operation from one schedule to the other schedule.

FLOOD CONTROL DIAGRAM FOR FOLSOM DAM AND LAKE

USE OF DIAGRAM

1. Folsom Dam and Lake shall be operated for flood control in accordance with the Flood Control Diagram. When water is stored within the Flood Control Reservation, reservoir releases must be in accordance with requirements of this diagram.

2. The parameters on the flood control diagram define the required Flood Control Reservation, on any given day, based on available space in the upstream reservoirs. Once the required Flood Control Reservation is computed, the Required Reservoir Storage for flood control can be determined. Water stored in excess of the Required Reservoir Storage must be evacuated. Computation of the parameter is discussed below:

FOLSOM DAM AND LAKE
COMPUTATION OF REQUIRED RESERVOIR STORAGE

1. Compute space available below spillway crest, in acre-feet, for the following reservoirs: French Meadows, Hell Hole and Union Valley.

2. The amount of creditable flood control transfer space in each reservoir is then computed by taking the smaller of the space available or the maximum creditable space for that reservoir.

   a. The maximum creditable space by reservoir is as follows:

      French Meadows - 45,000 acre-feet
      Hell Hole - 80,000 acre-feet
      Union Valley - 75,000 acre-feet

   b. Combine the creditable flood control transfer space for each reservoir to compute the total creditable space.

3. Determine the Flood Control Reservation at Folsom Lake by applying the creditable flood control transfer space (parameter on the Flood Control Diagram in 1,000 acre-feet).

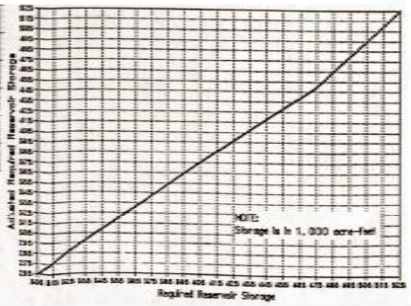
SAMPLE COMPUTATION OF REQUIRED RESERVOIR STORAGE

RESERVOIR	STORAGE ON JAN 1 (TAF)	STORAGE AT SPILLWAY CREST (TAF)	SPACE AVAILABLE (TAF)	MAXIMUM CREDITABLE SPACE (TAF)	CREDITABLE FLOOD CONTROL TRANSFER SPACE (TAF)
French Meadows	75.7	110.7	35	45	35
Hell Hole	87.6	207.6	120	80	80
Union Valley	170.1	235.1	65	75	65
TOTAL CREDITABLE FLOOD CONTROL TRANSFER SPACE (TAF)					180
FLOOD CONTROL RESERVATION AT FOLSOM LAKE (TAF)					420
REQUIRED RESERVOIR STORAGE AT FOLSOM LAKE (TAF)					557

3. During a potential flood situation, water stored within the Flood Control Reservation, defined hereon, shall be released as rapidly as possible subject to the following schedule:

   a. Required Flood Control Release - Promptly release inflow up to 115,000 cfs, while inflows are increasing, as discussed in the FOLSOM DAM RELEASE SCHEDULE. Control flows in the American River below the dam to not more than 115,000 cfs, except when larger releases are required by the accompanying INTERIM OPERATION PLAN.

   b. Releases will not be increased more than 15,000 cfs or decreased more than 10,000 cfs during any 2 hour period.



4. Maintenance or repair of any one power generating unit at Folsom Dam which results in loss of the power penstock for more than one day may require additional Flood Control Reservation. The amount of additional reservation is defined by the Adjusted Required Reservoir Storage, as identified on the graph at right, depending on the following conditions:

   a. The Required Reservoir Storage in Folsom Lake, as computed in paragraph 2 above;
   b. The existing and forecasted meteorological conditions in the basin; and,
   c. The duration the generating unit is expected to be off-line.

Required Reservoir Storage greater than or equal to 525,000 acre-feet requires no additional Flood Control Reservation.

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

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).

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 is currently under construction and is anticipated to be completed 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 powerplant 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. 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 11 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 through 10 identify the preparers, references, and index, 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.

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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.

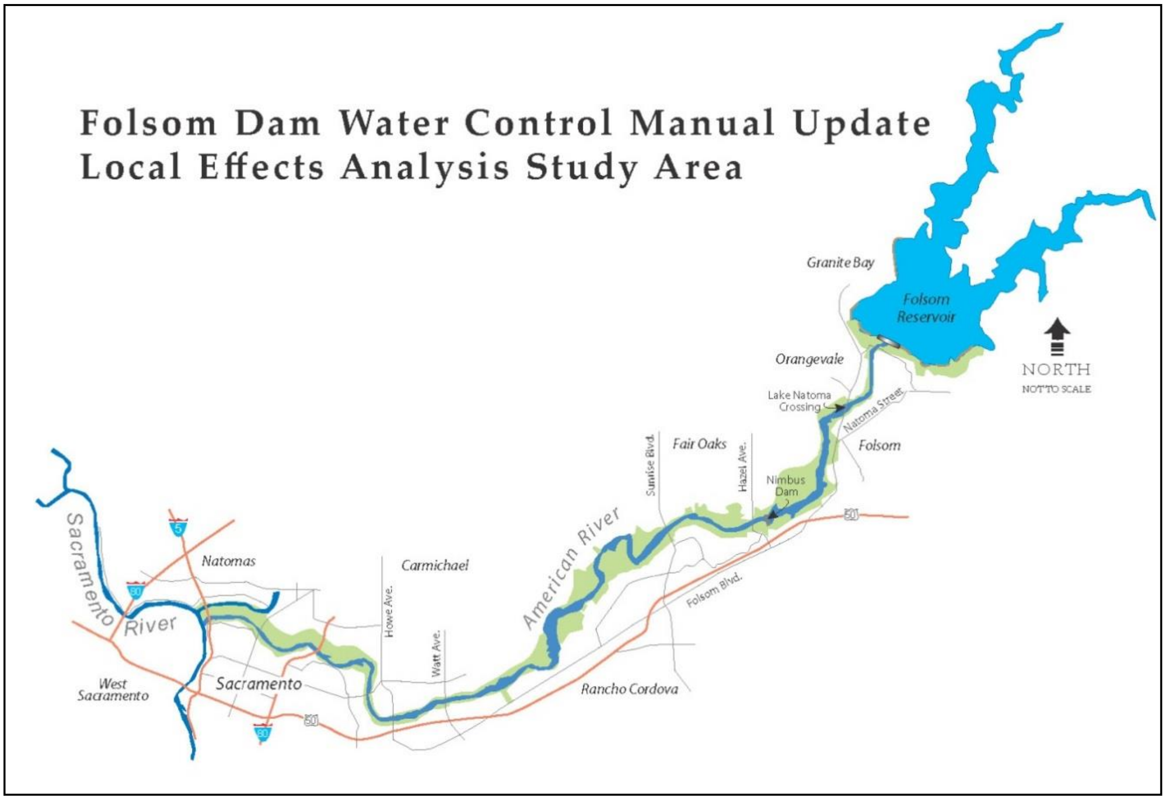


Figure 2-1. Local Project Area.

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 affects 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.

Figure 2-2. Regional Effects Assessment Area.

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. 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. The82-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.

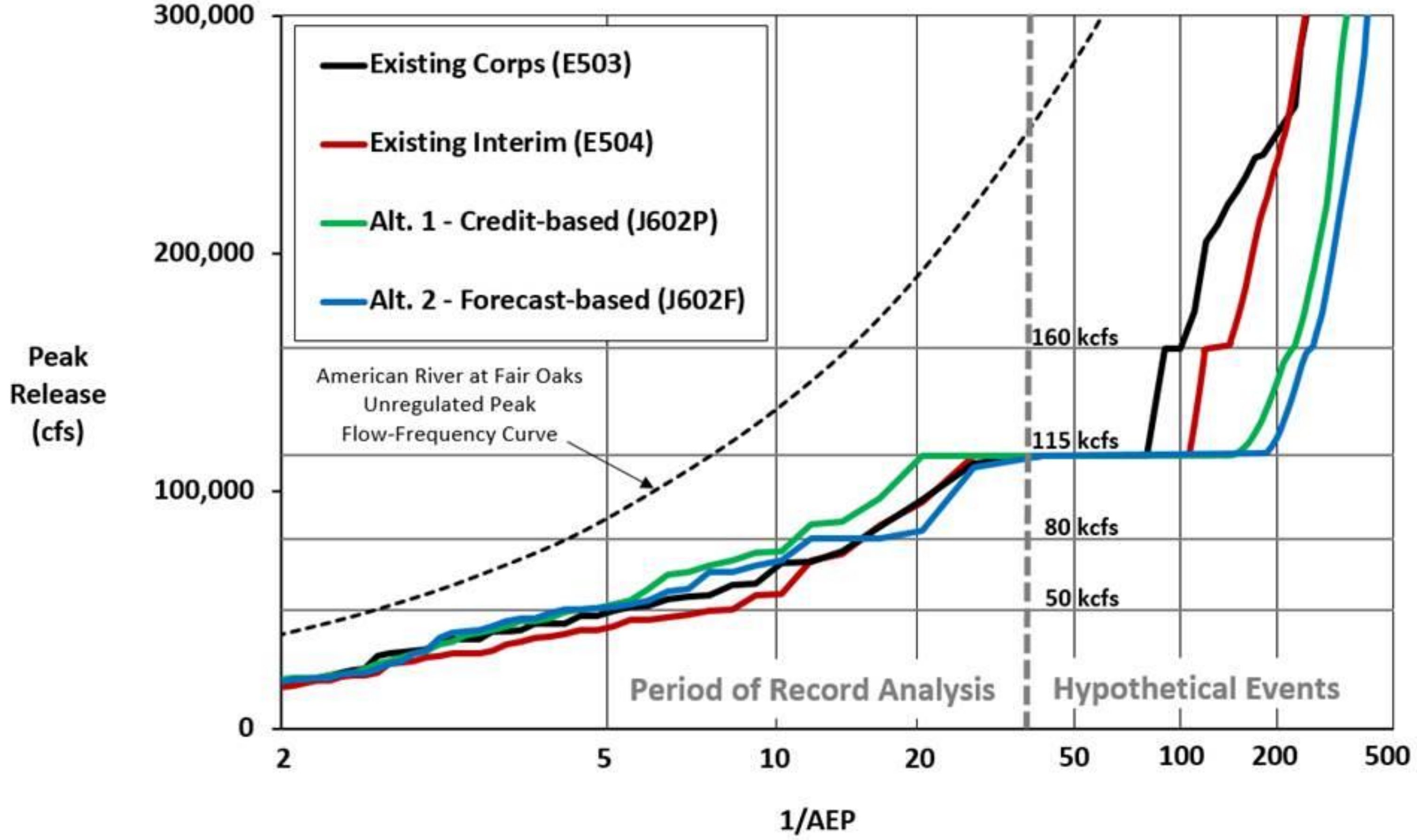


Figure 3-1. Lower American River Flow Frequency Curves of the Operation Scenarios Modeled for the Manual Update.

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.

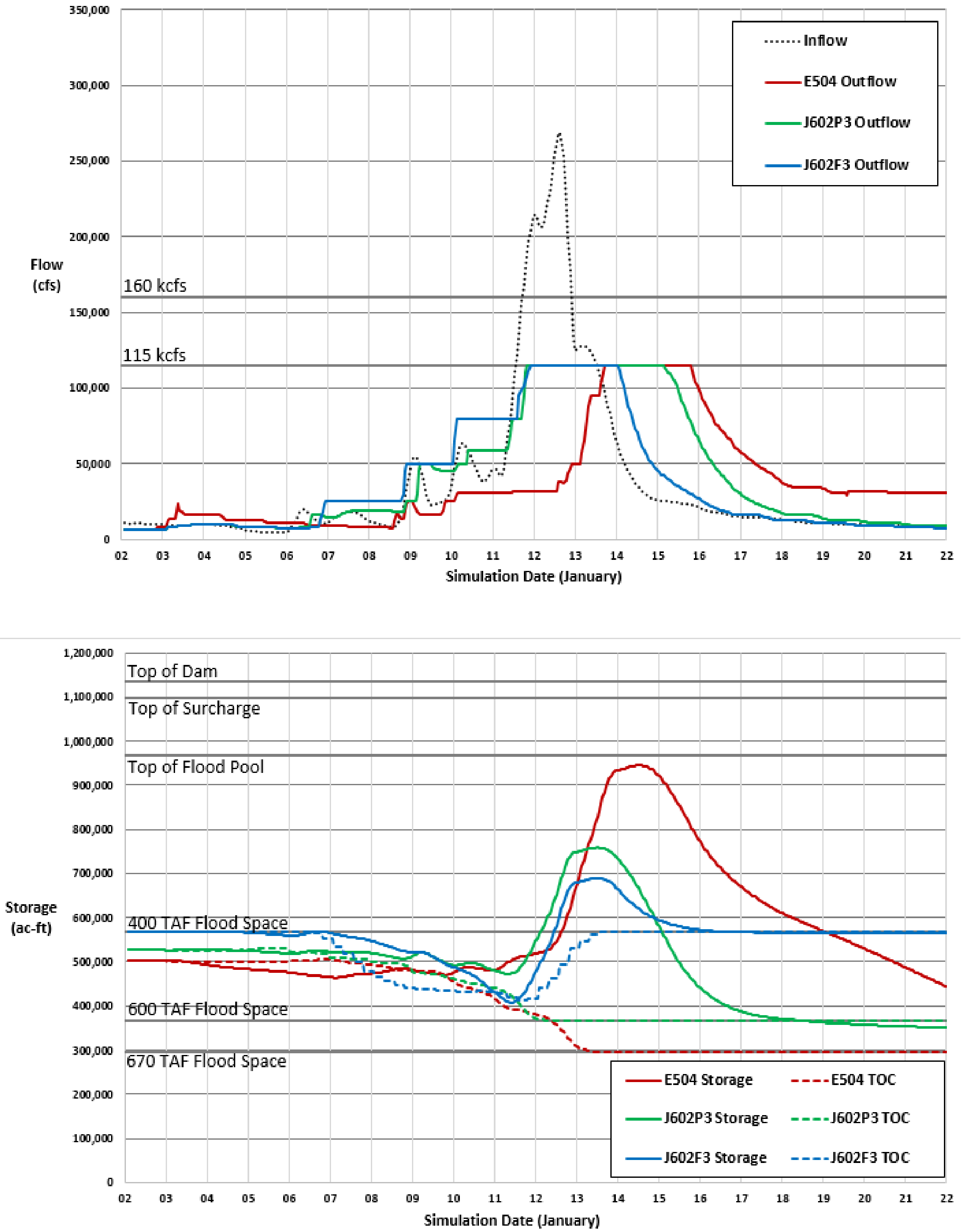


Figure 3-2. Scaled 1-in-100 annual exceedance probability event pattern of the 1997 storm event depicting releases/flows from (top) and flood storage volumes in (bottom) Folsom Reservoir throughout the event.

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.

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 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.

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.

<u>Adjusted Reservoir Storage Schedule</u>

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.

<u>Contractual Commitments</u>

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.

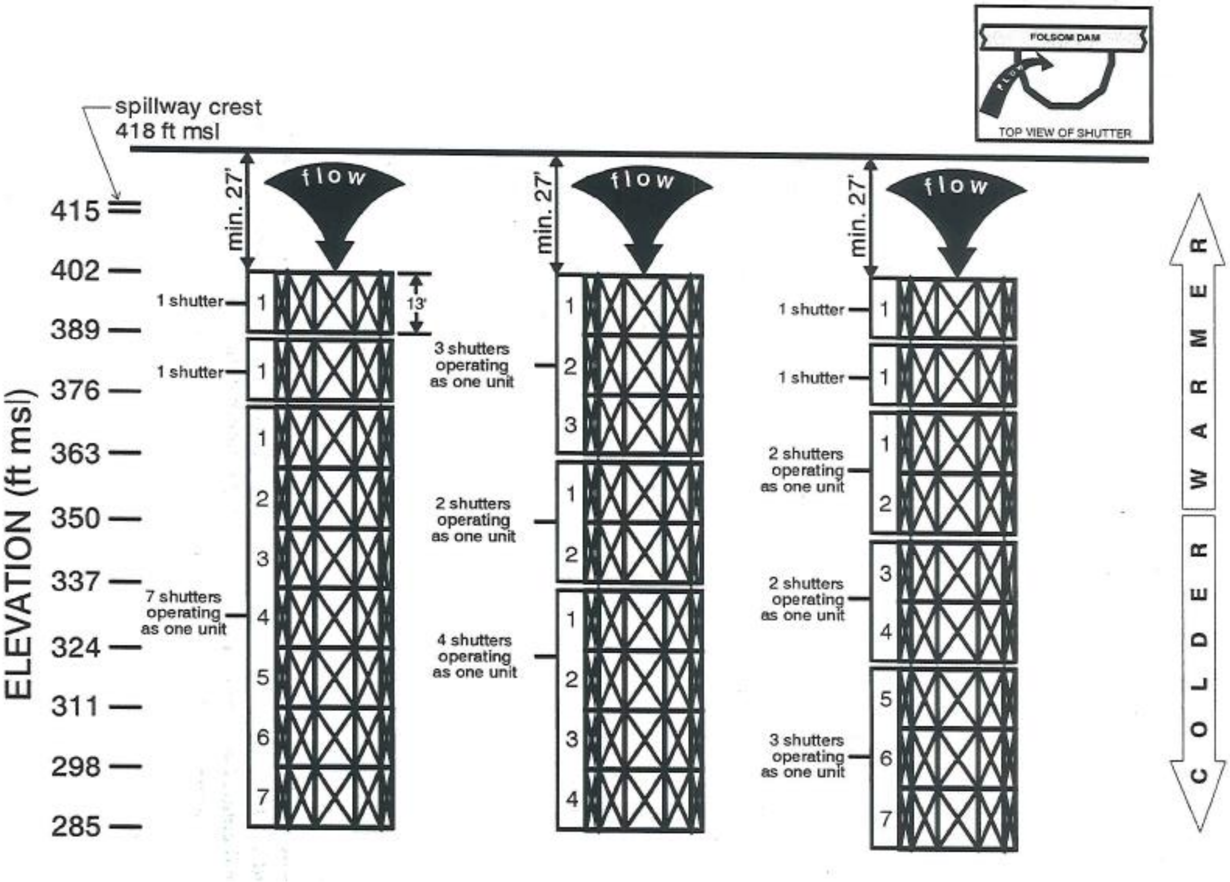


Figure 3-3. Folsom Dam Shutter Configurations.

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. 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.

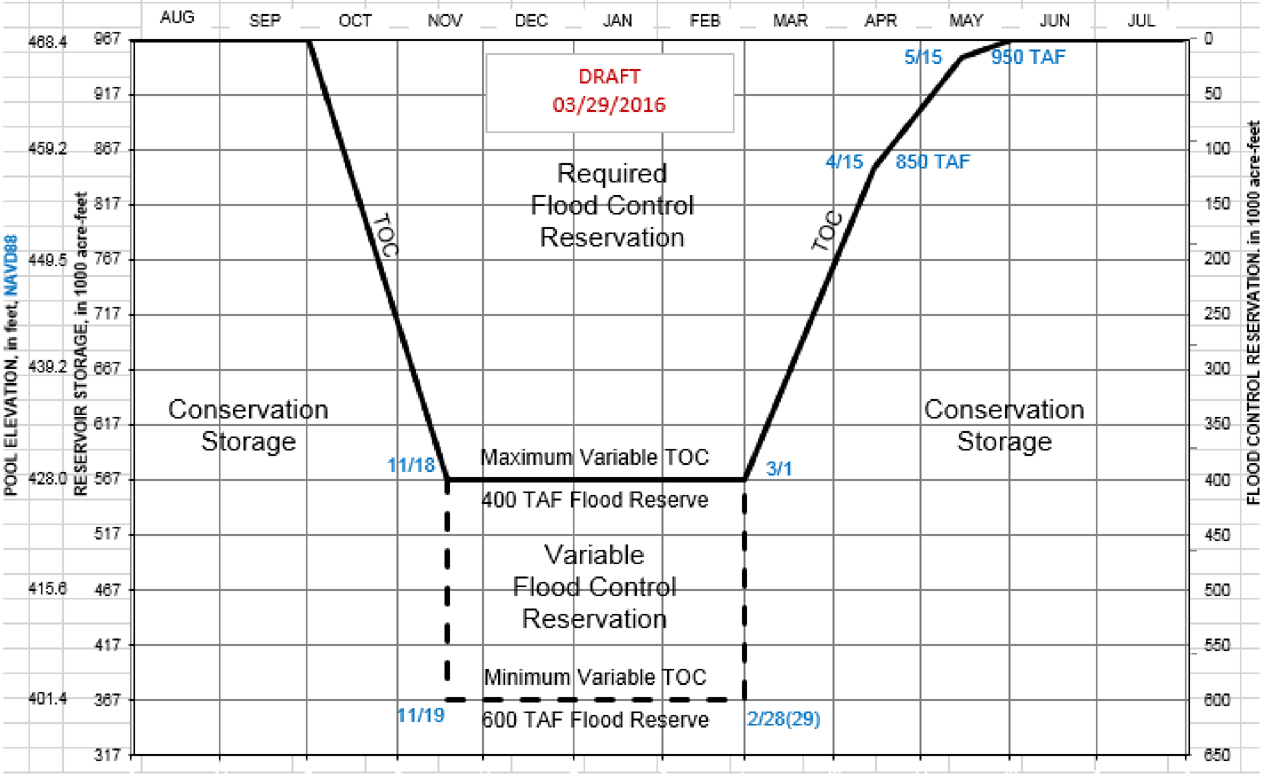
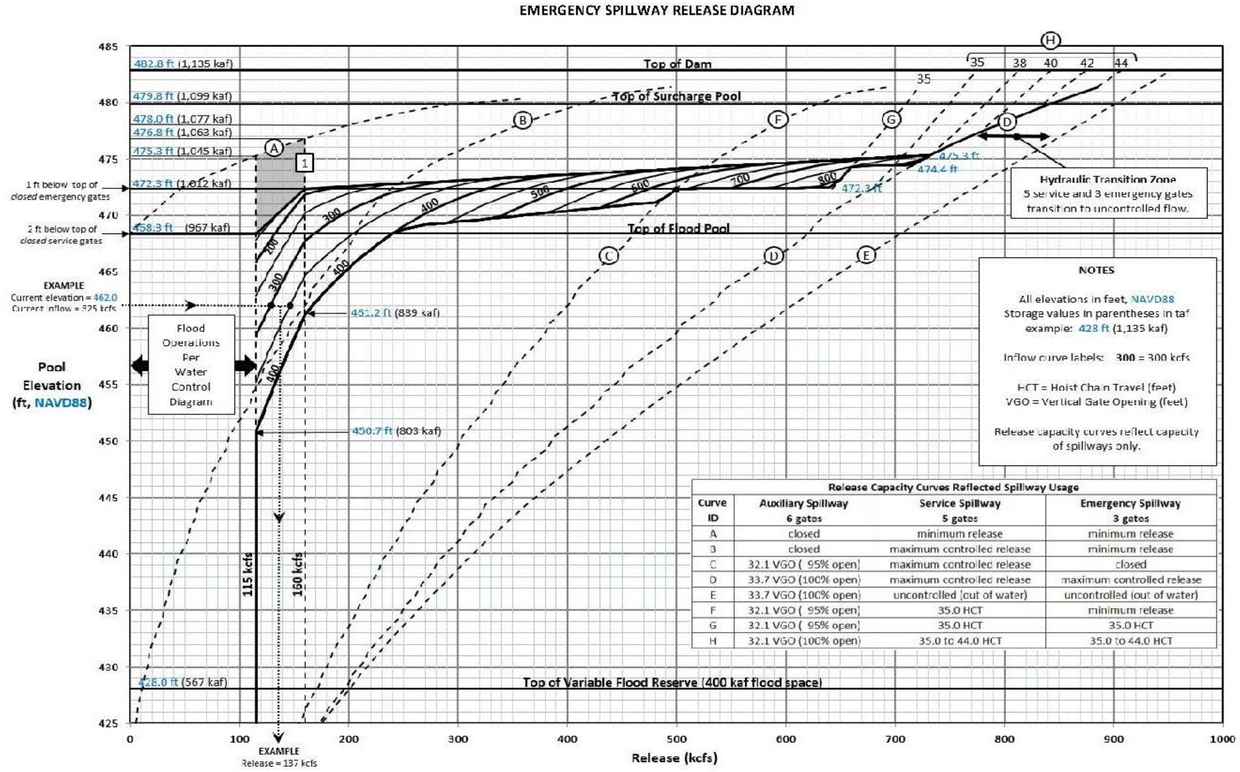


Figure 3-4. Updated Water Control Diagram for Alternative 2.



NOTES

All elevations in feet, NAVD88
Storage values in parentheses in taf
example: 428 ft (1,135 kaf)

Inflow curve labels: **300** = 300 kcfs

HCT = Hoist Chain Travel (feet)
VGO = Vertical Gate Opening (feet)

Release capacity curves reflect capacity of spillways only.

Release Capacity Curves Reflected Spillway Usage

Curve ID	Auxiliary Spillway 6 gates	Service Spillway 5 gates	Emergency Spillway 3 gates
A	closed	minimum release	minimum release
B	closed	maximum controlled release	minimum release
C	32.1 VGO (95% open)	maximum controlled release	closed
D	33.7 VGO (100% open)	maximum controlled release	maximum controlled release
E	33.7 VGO (100% open)	uncontrolled (out of water)	uncontrolled (out of water)
F	32.1 VGO (95% open)	35.0 HCT	minimum release
G	32.1 VGO (95% open)	35.0 HCT	35.0 HCT
H	32.1 VGO (100% open)	35.0 to 44.0 HCT	35.0 to 44.0 HCT

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

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.

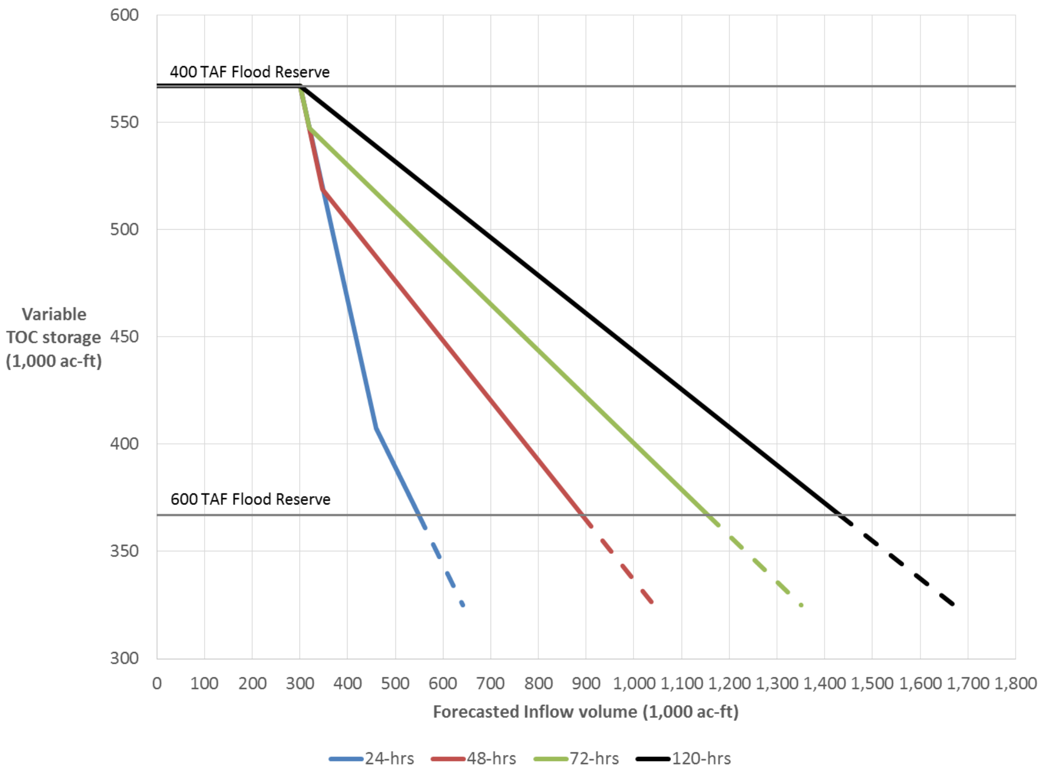


Figure 3-6. Forecast-based Drawdown Relationships.

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 A - FLOOD CONTROL DIAGRAM

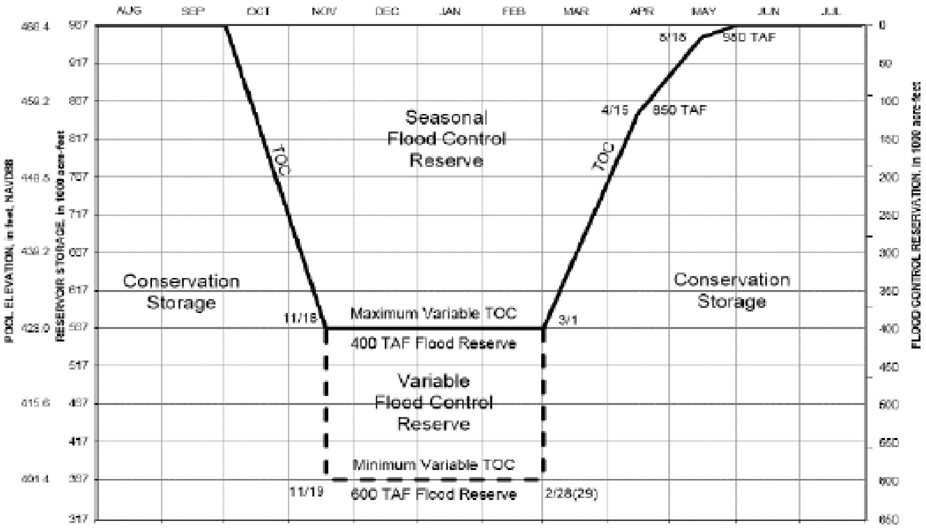
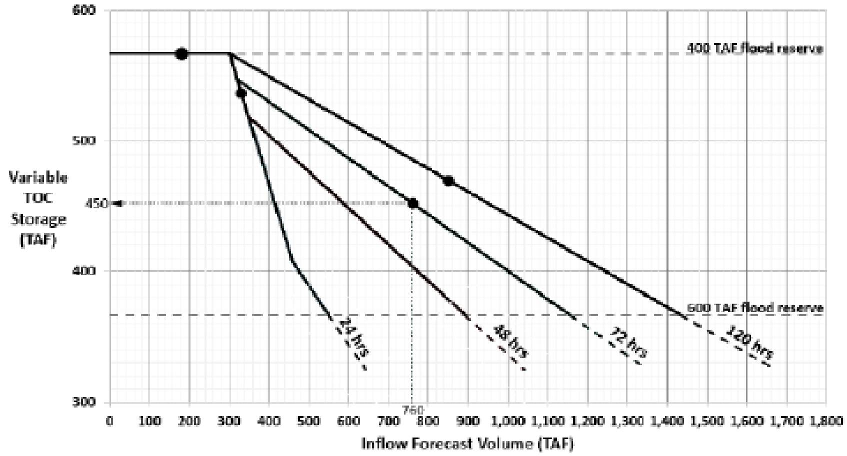


FIGURE B - VARIABLE TOP OF CONSERVATION



USE OF FLOOD CONTROL DIAGRAM (FIGURE A)

Folsom Dam and Lake shall be operated for flood control in accordance with the Flood Control Diagram and the accompanying Emergency Spillway Release Diagram (ESRD). Water stored within Flood Control Reserve (FCR) space shall be released as rapidly as possible subject to the Release Schedule (Table A), except when releases greater than 115 kcfs are required by the ESRD. The Corps of Engineers may direct flood releases to be increased or descreased from the prescribed release when warranted by existing conditions or by high confidence forecast information provided by NWS-CNRFC.

COMPUTATION OF VARIABLE TOP OF CONSERVATION (FIGURE B)

From 18 Nov to 28/29 Feb the Top of Conservation (TOC) storage will vary based on forecasted inflow volumes. These are developed by the NWS-CNRFC for the purpose of supporting Folsom Dam forecast-based operations, and will be provided once per day during non-flood operations and once per six hours during flood operations. Inflow forecast volumes for the following four durations are required : 24, 48, 72, and 120 hours. Figure B provides relationships relating inflow forecast volume to variable TOC storage for each duration.

FIGURE B - INSTRUCTIONS: Locate each of the four forecast volumes on the horizontal axis. Place the four forecast volumes on the respective duration curves. For each forecast volume, identify the corresponding candidate TOC storage value on the vertical axis. Of the four candidate TOC storage values, the lowest value is the adopted variable TOC storage value. The corresponding FCR value is given by: FCR = 966.9 TAF - variable TOC storage.

FIGURE B - EXAMPLE: Inflow forecast volumes of 180, 330, 760 and 850 TAF are provided, corresponding to 24, 48, 72, and 120 hours respectively. As shown in Figure B, the volumes are located on the horizontal axis, and placed on the corresponding curves (indicated by large dots). Corresponding candidate TOC storage values are read from the vertical axis. The lowest value is given by the 72-hour volume. This value (450 TAF) is therefore the adopted variable TOC storage value. The corresponding FCR value is: FCR = 966.9 TAF - 450 TAF = 546.9 TAF.

TABLE A - FOLSOM RELEASE SCHEDULE

Date	Storage Condition	Description
Mar. 1 to Nov. 18	Storage > TOC	EVACUATE SEASONAL FLOOD CONTROL RESERVE Release peak inflow for current event.
Nov. 19 to Feb. 28/29	Storage > TOC	EVACUATE VARIABLE FLOOD CONTROL RESERVE Release greater of peak inflow for current event or Table B indicated release.
All year	Storage < TOC	Non-flood operations.

RAMPING RATES

A1) Releases between 8 kcfs and 30 kcfs will not be increased by more than 10 kcfs during any 2-hour period.
A2) Releases between 30 kcfs and 115 kcfs will not be increased by more than 30 kcfs during any 2-hour period.
A3) Releases between 8 kcfs and 115 kcfs will not be decreased by more than 10 kcfs during any 2-hour period.

STEPPED RELEASES

A4) Coordination efforts shall be initiated in advance so as to minimize or eliminate the need for release holds.
A5) Maximum 6-hour release holds, if needed, may be implemented at releases of 25, 50, and 80 kcfs.
A6) Release of 115 kcfs shall be held for 6 hours before further increasing releases.
A7) Releases shall not exceed 115 kcfs unless specified by the ESRD.

TABLE B - FORECAST-BASED RELEASES

INFLOW FORECAST VOLUMES	Indicated Release
120-hr volume > 300 TAF	25 kcfs
72-hr volume > 300 TAF	50 kcfs
48-hr volume > 300 TAF	80 kcfs
24-hr volume > 300 TAF and inflow >= 115 kcfs	115 kcfs

FOLSOM DAM AND LAKE
American River, California

WATER CONTROL DIAGRAM

APPROVED ____________________

APPROVED ____________________

Effective Date ____________ File No. ____________

FINAL DRAFT 1/12/2017 PLATE A-9

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

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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.

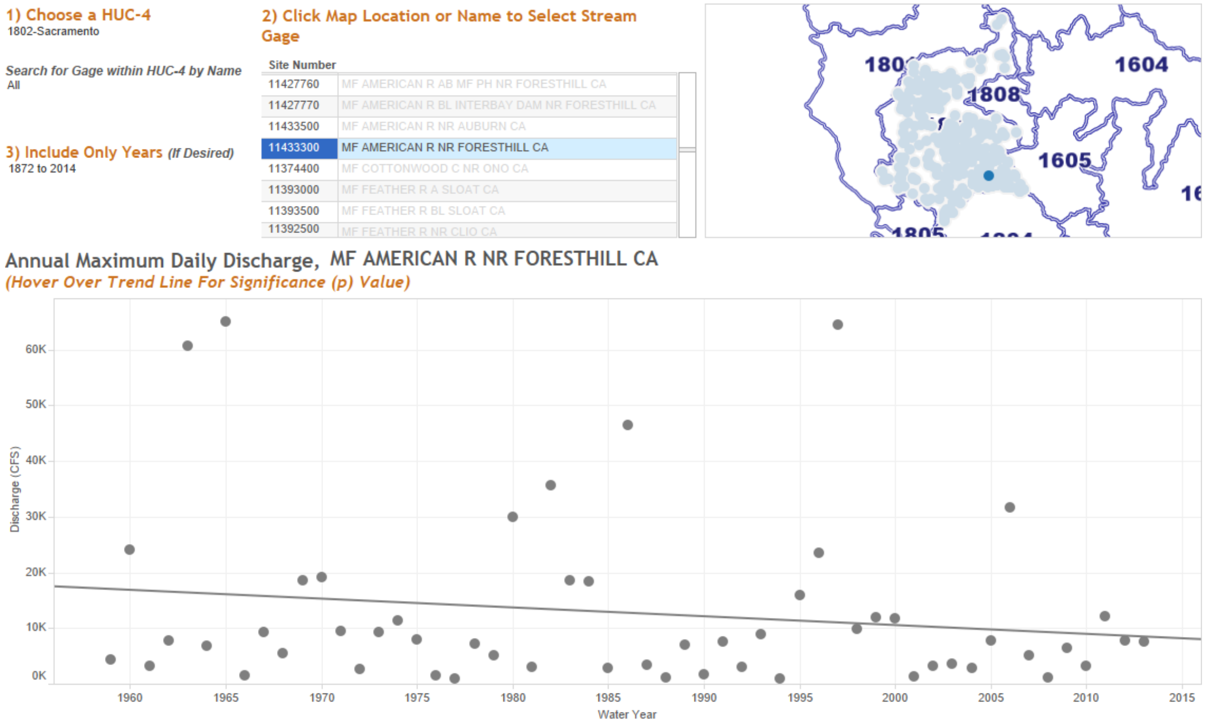
The American River watershed, which flows through Folsom, has many high elevation mountains with peaks ranging from 5,000 to 11,000 feet above sea level. November through March is the period when the most significant and damaging storms hit this region. A significant portion of this watershed is covered 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.



1) Choose a HUC-4
1802-Sacramento

Search for Gage within HUC-4 by Name
All

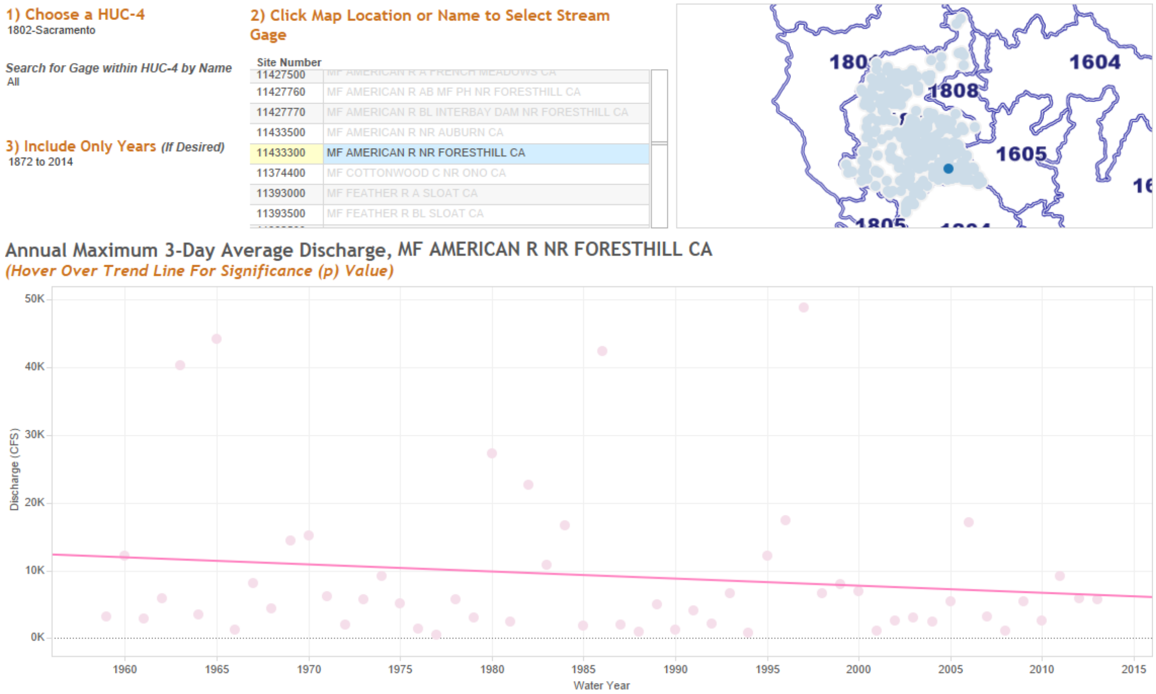
3) Include Only Years *(If Desired)*
1872 to 2014

2) Click Map Location or Name to Select Stream Gage

Site Number	
11427760	MF AMERICAN R AB MF PH NR FORESTHILL CA
11427770	MF AMERICAN R BL INTERBAY DAM NR FORESTHILL CA
11433500	MF AMERICAN R NR AUBURN CA
11433300	MF AMERICAN R NR FORESTHILL CA
11374400	MF COTTONWOOD C NR ONO CA
11393000	MF FEATHER R A SLOAT CA
11393500	MF FEATHER R BL SLOAT CA
11392500	MF FEATHER R NR CLIO CA

Annual Maximum Daily Discharge, MF AMERICAN R NR FORESTHILL CA
(Hover Over Trend Line For Significance (p) Value)

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



1) Choose a HUC-4
1802-Sacramento

Search for Gage within HUC-4 by Name
All

3) Include Only Years *(If Desired)*
1872 to 2014

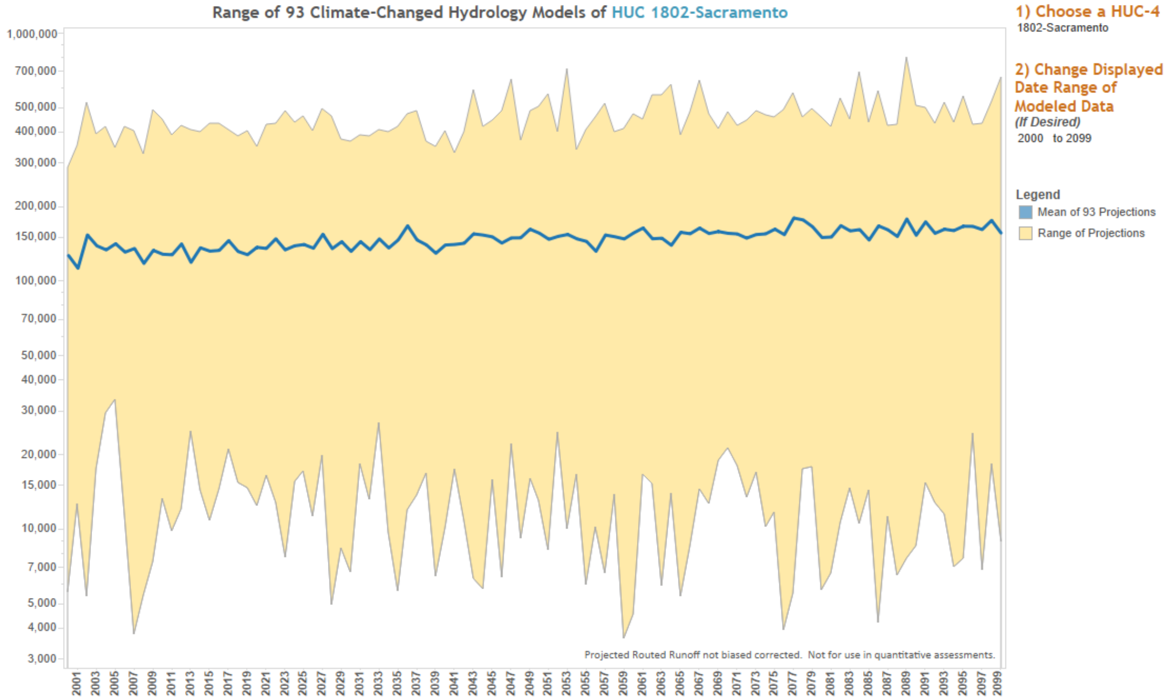
2) Click Map Location or Name to Select Stream Gage

Site Number	
11427500	MF AMERICAN R A FRENCH MEADOWS CA
11427760	MF AMERICAN R AB MF PH NR FORESTHILL CA
11427770	MF AMERICAN R BL INTERBAY DAM NR FORESTHILL CA
11433500	MF AMERICAN R NR AUBURN CA
11433300	MF AMERICAN R NR FORESTHILL CA
11374400	MF COTTONWOOD C NR ONO CA
11393000	MF FEATHER R A SLOAT CA
11393500	MF FEATHER R BL SLOAT CA

Annual Maximum 3-Day Average Discharge, MF AMERICAN R NR FORESTHILL CA
(Hover Over Trend Line For Significance (p) Value)

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.



CMIP-5 Data, Downscaled to HUC-4 level via BCSD Method, Based on 93 combinations of GCM/RCP model projections

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

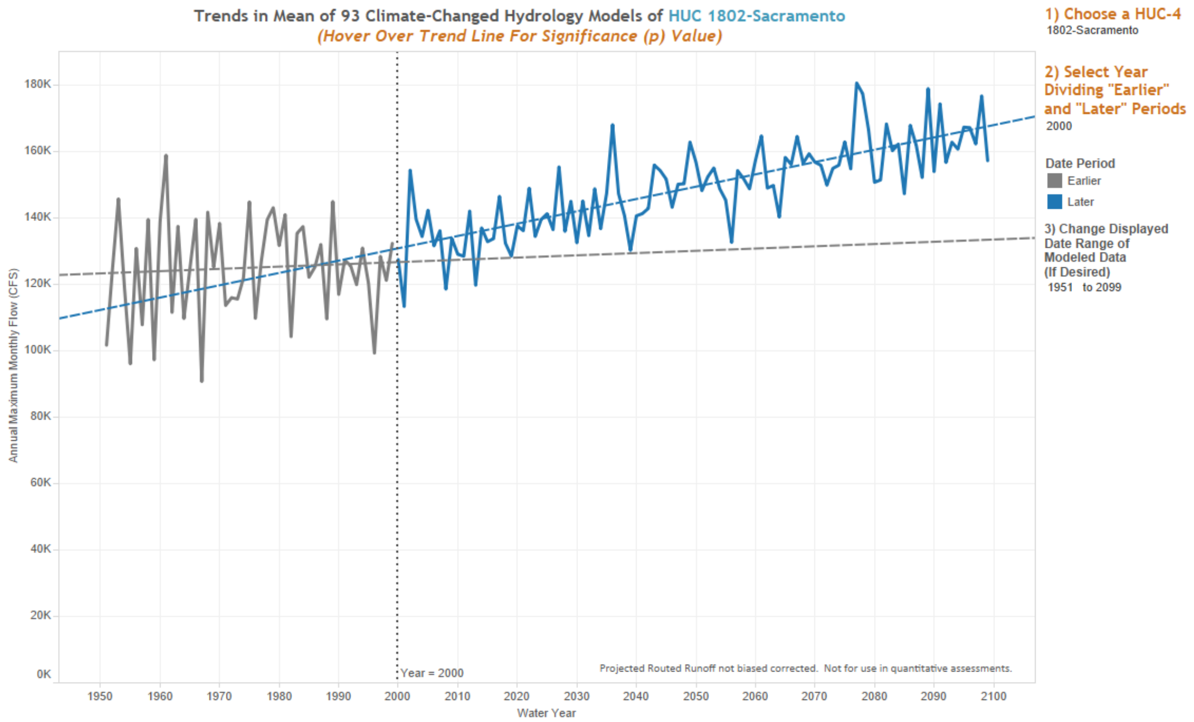
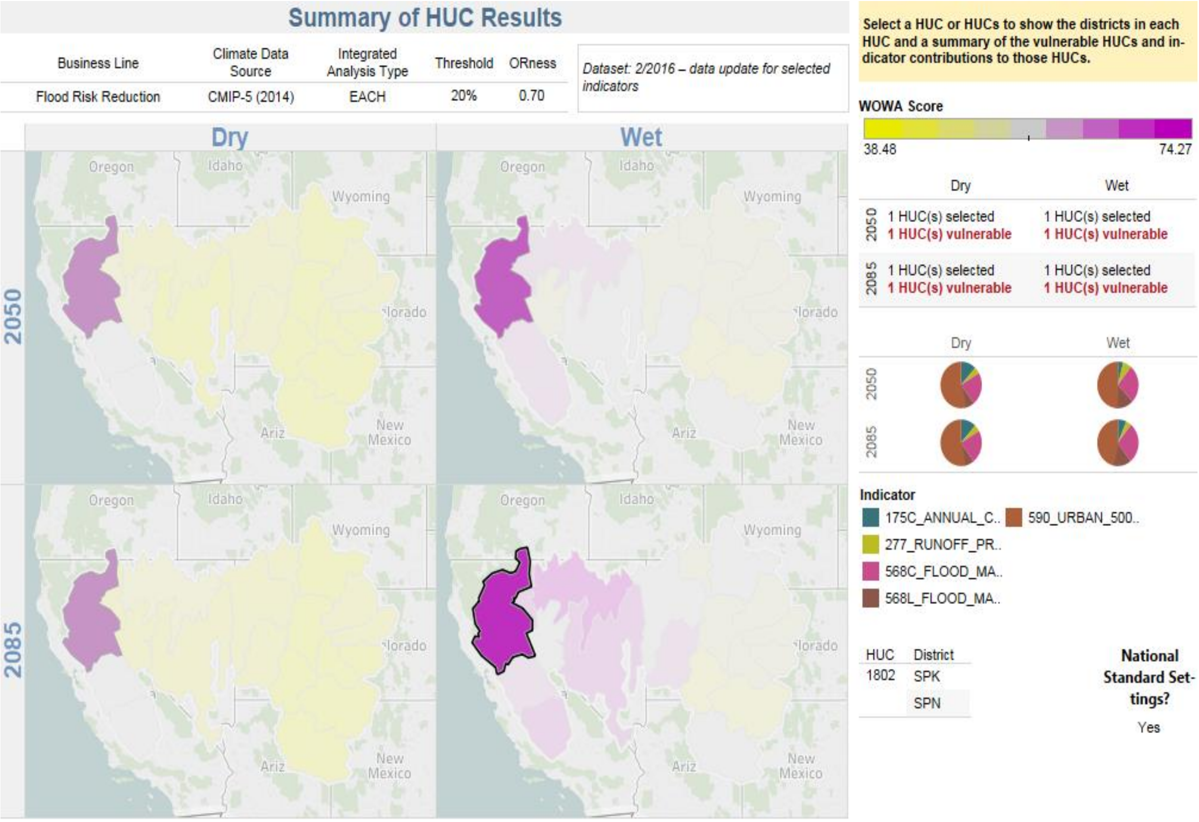


Figure 4-4. Projected trend in Annual Maximum flow for HUC-1802 Sacramento. Dotted line indicates year 2000, gray dashed line indicates present trend from 1950 to 2000 and the blue dashed line indicates projected climate altered trend in streamflow after 2000 to 2100.

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.



Business Line	Climate Data Source	Integrated Analysis Type	Threshold	ORness
Flood Risk Reduction	CMIP-5 (2014)	EACH	20%	0.70

Dataset: 2/2016 – data update for selected indicators

Select a HUC or HUCs to show the districts in each HUC and a summary of the vulnerable HUCs and indicator contributions to those HUCs.

	Dry	Wet
2050	1 HUC(s) selected 1 HUC(s) vulnerable	1 HUC(s) selected 1 HUC(s) vulnerable
2085	1 HUC(s) selected 1 HUC(s) vulnerable	1 HUC(s) selected 1 HUC(s) vulnerable

HUC	District
1802	SPK
	SPN

National Standard Settings?

Yes

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 auxillary spillway has an invert 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.

Regulatory Setting

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) 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:

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

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

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

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 affects 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 neglible 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 signficant 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 affects 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 affects 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.

Floodplains

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.

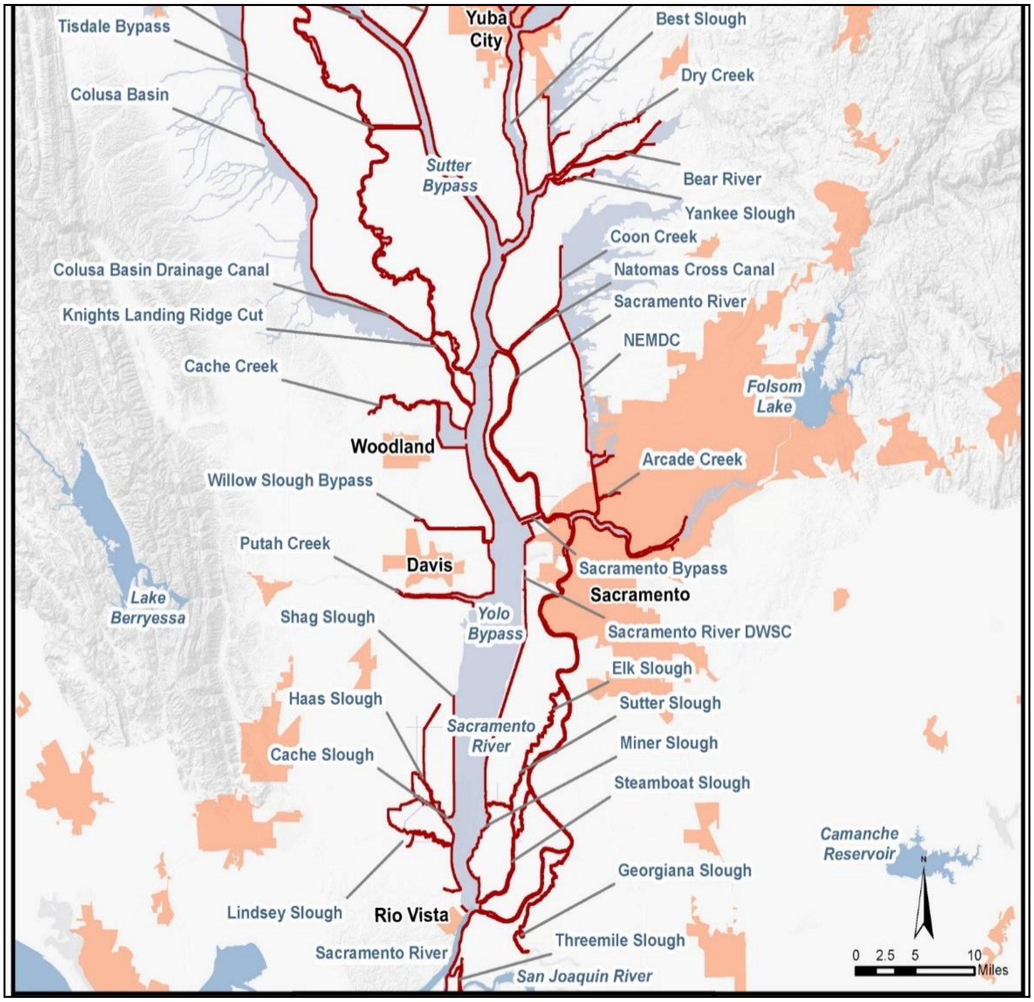


Figure 4-6. Sacramento River Flood Control System.

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.

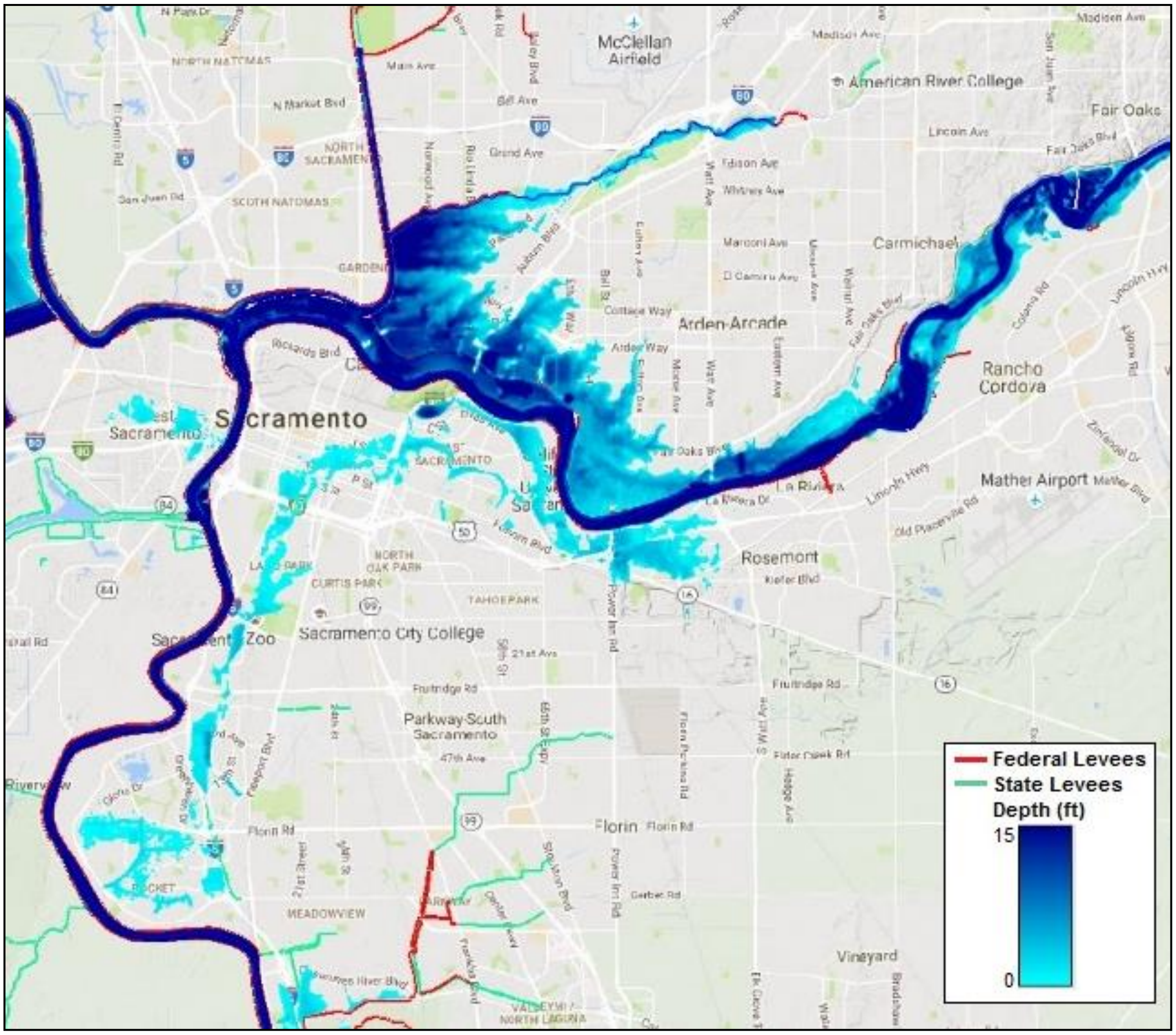


Figure 4-7. 200-Year Floodplain assuming no levee failure (No Action/No Project hydrology).

Channel Stability and Sedimentation

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 existinglevee erosion problems on the American River (USACE 2014b). Over a long time period (eg. the 82-year Period of Recod), 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 affects 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. As stated in Section 4.1, minor fluctuations of up to 5 percent are due to model assumptions and approaches. The CalSimm 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.

Estimating the Potential for Channel Widening

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.

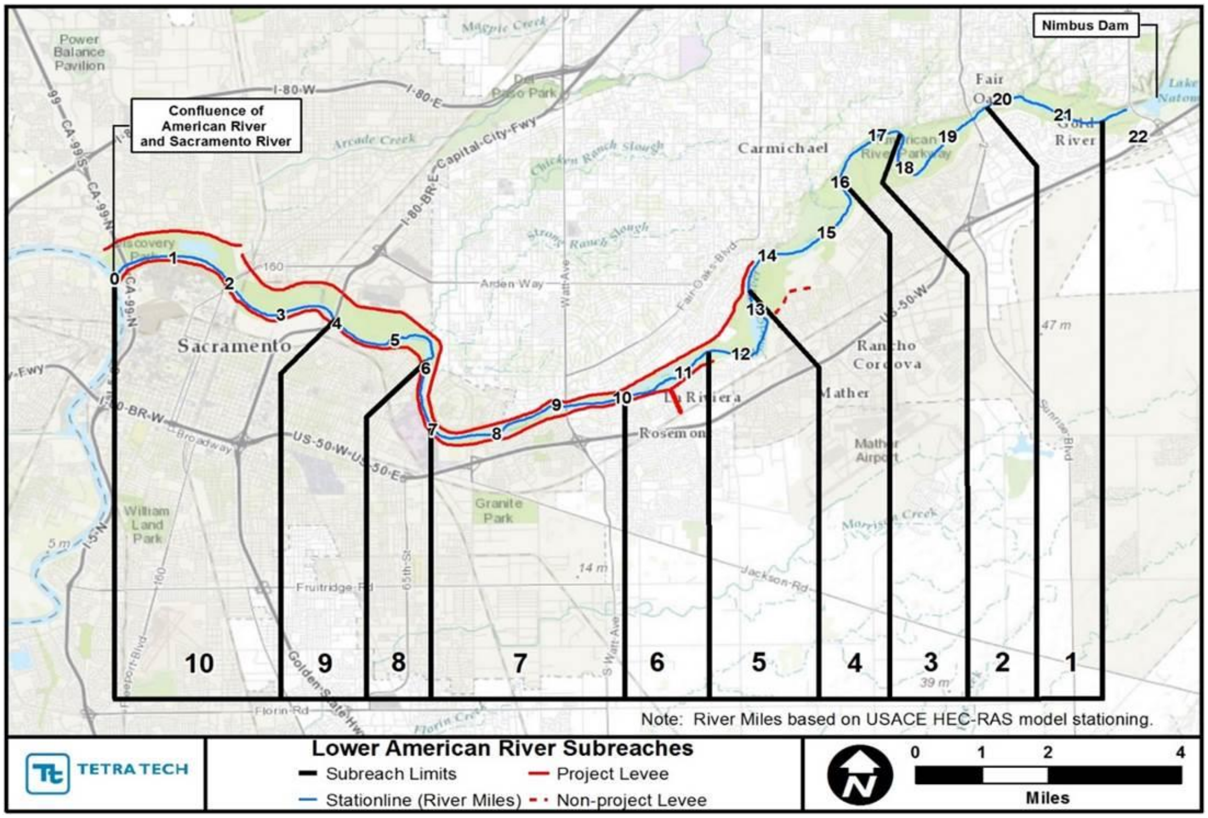


Figure 4-8. Lower American River Geomorphic Subreaches and River Miles Used in the Channel Widening Analysis.

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).

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.

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

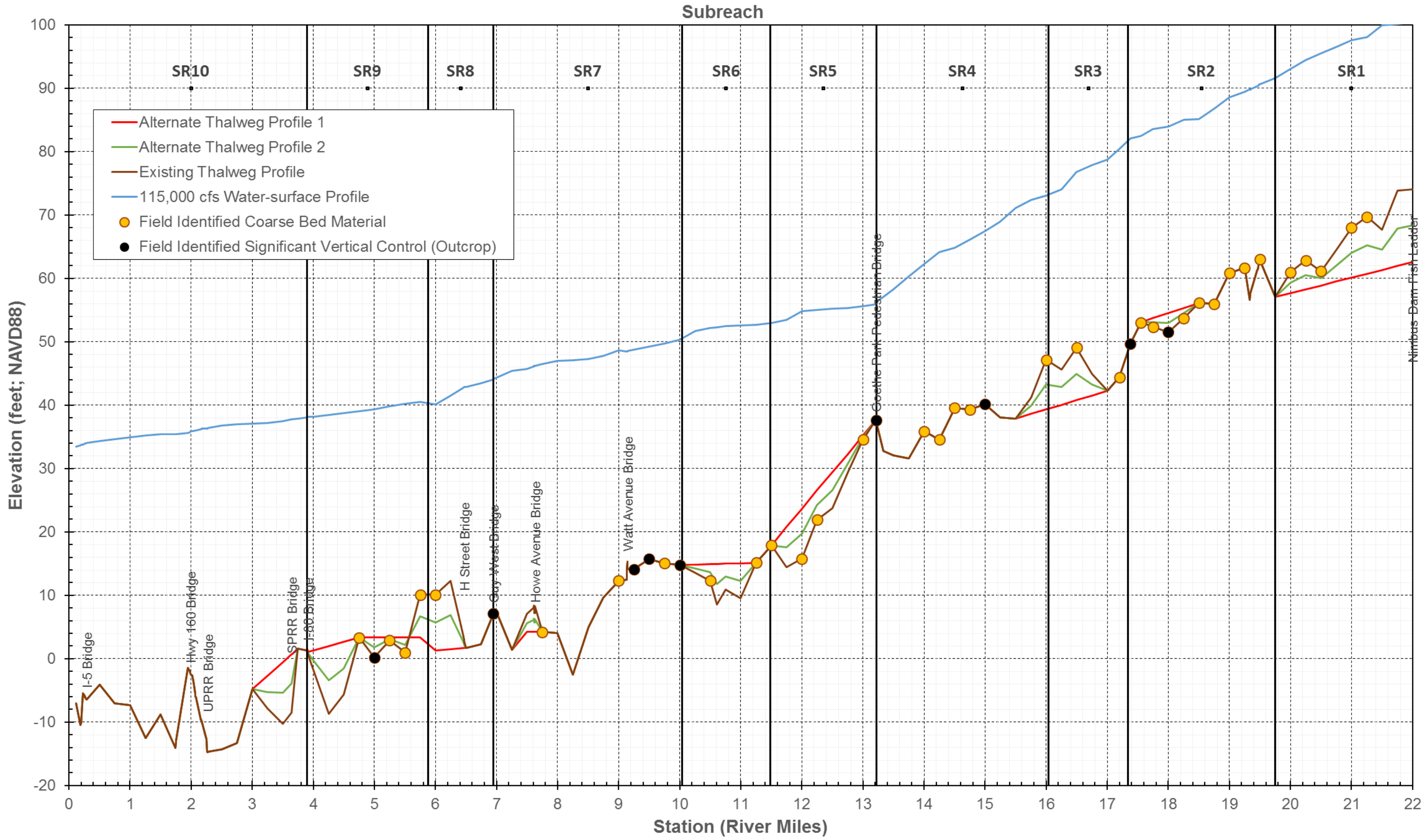


Figure 4-9. 200 Existing Channel Bed Profile of the Lower American River Showing Alternate Channel Bed Profiles to Support the Sensitivity Analysis of Channel-Widening Potential.

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 were also made using HEC-ResSim model outputs.

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.

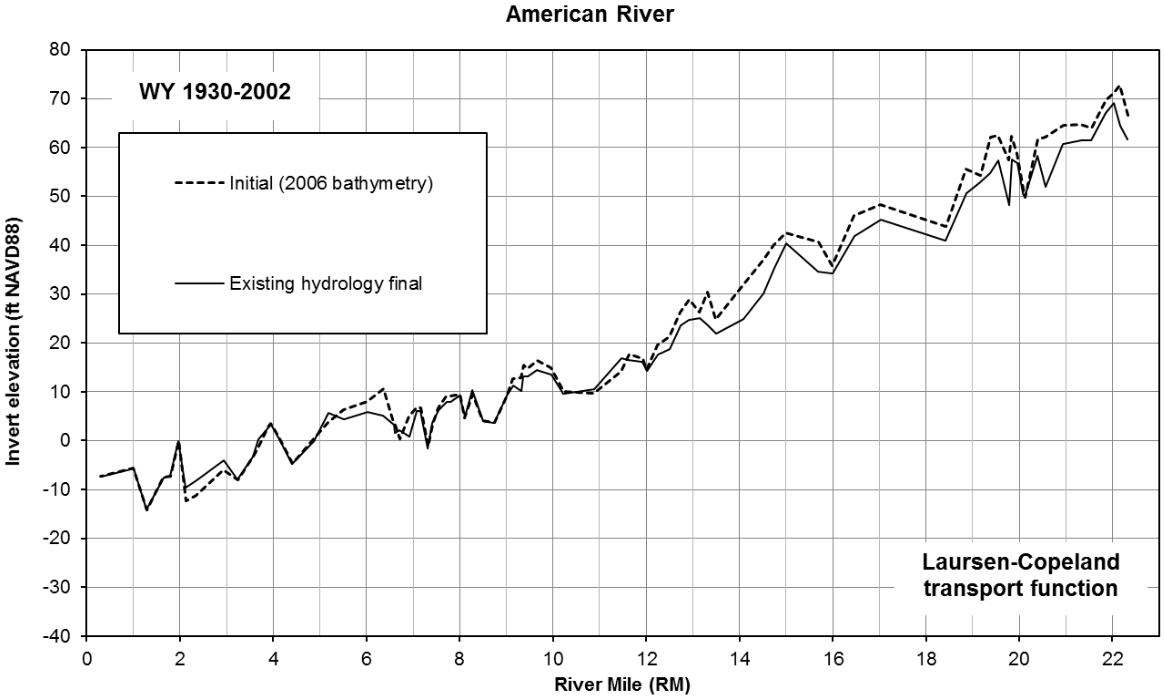
Channel Stability and Sedimentation

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.

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.



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).

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, 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 exceedance probability (AEP) 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.

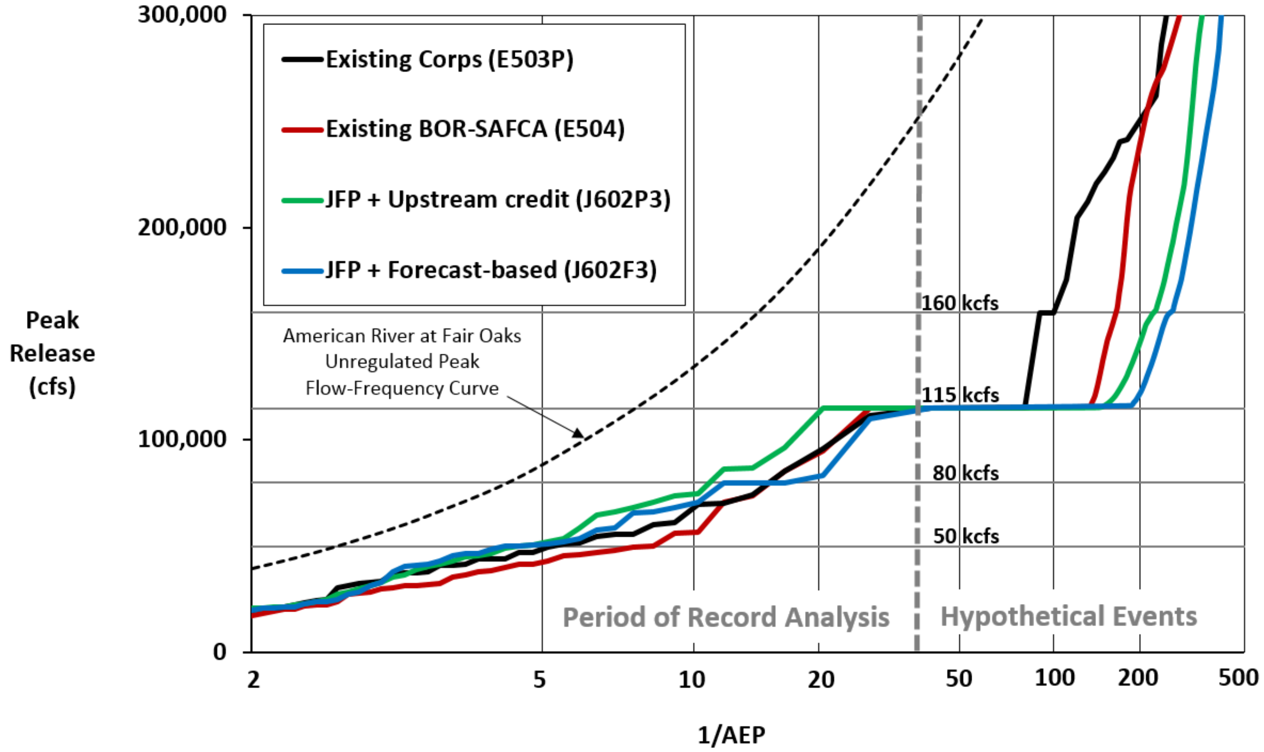


Figure 4-11. Lower American River Flow Frequency Curves of the Operation Scenarios Modeled for the Manual Update.

As shown in Table 4-3, 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.

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.

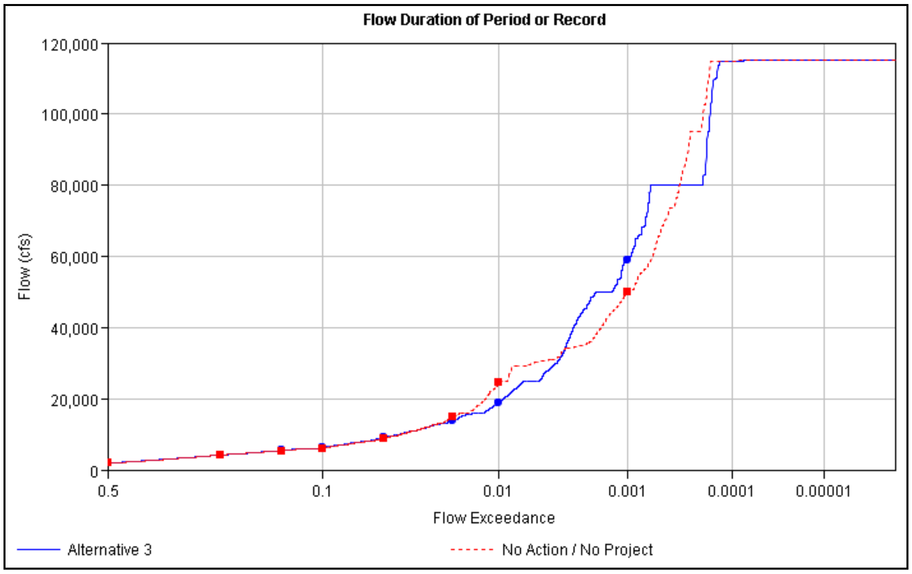


Figure 4-12. Probability of Flow Exceedance for Alternative 2 and No Action/No Project for the 82-year period of record flows in the Lower American River.

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.

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.

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

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.

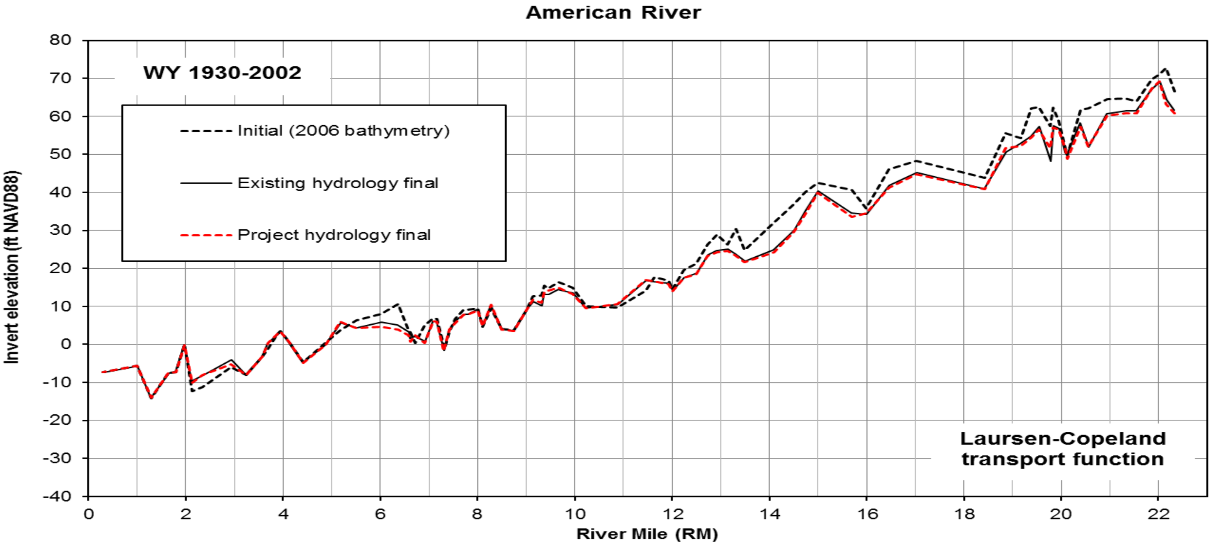


Figure 4-13. Computed change: initial channel invert (2006 bathymetry) to No Action/No Project channel invert and with-project channel invert (82-year period of record).

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.

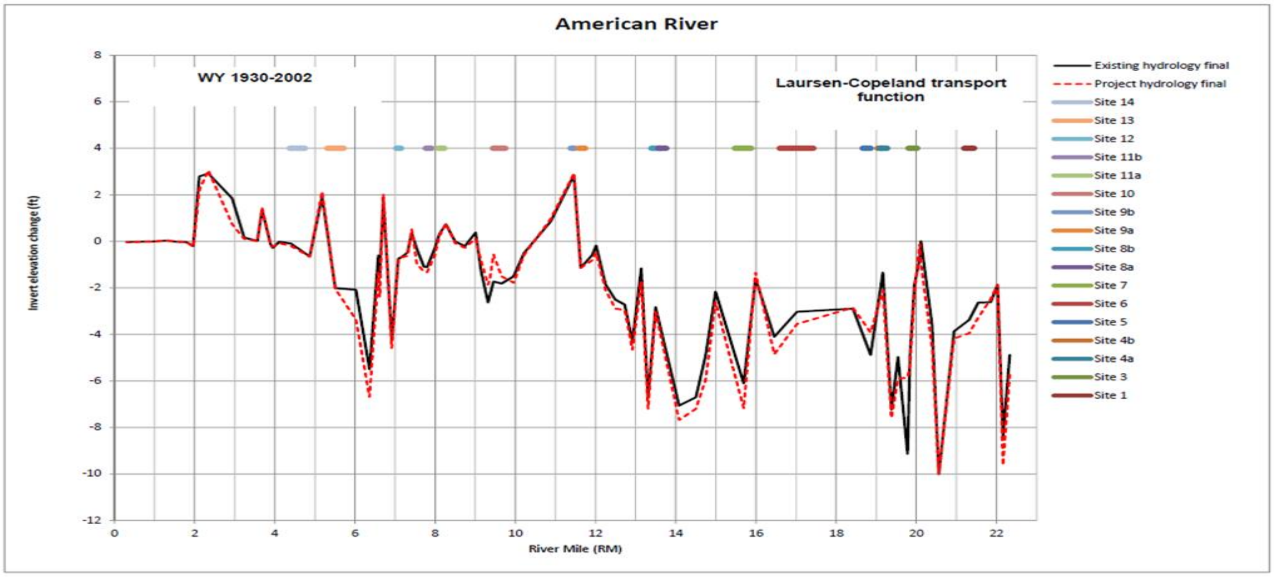


Figure 4-14. HEC-6T Sediment Transport Analysis Computed Net Changes in Invert Elevations in American River (Long-term Simulations, Existing and Project Hydrology) (NHC 2015).

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 2017, 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.

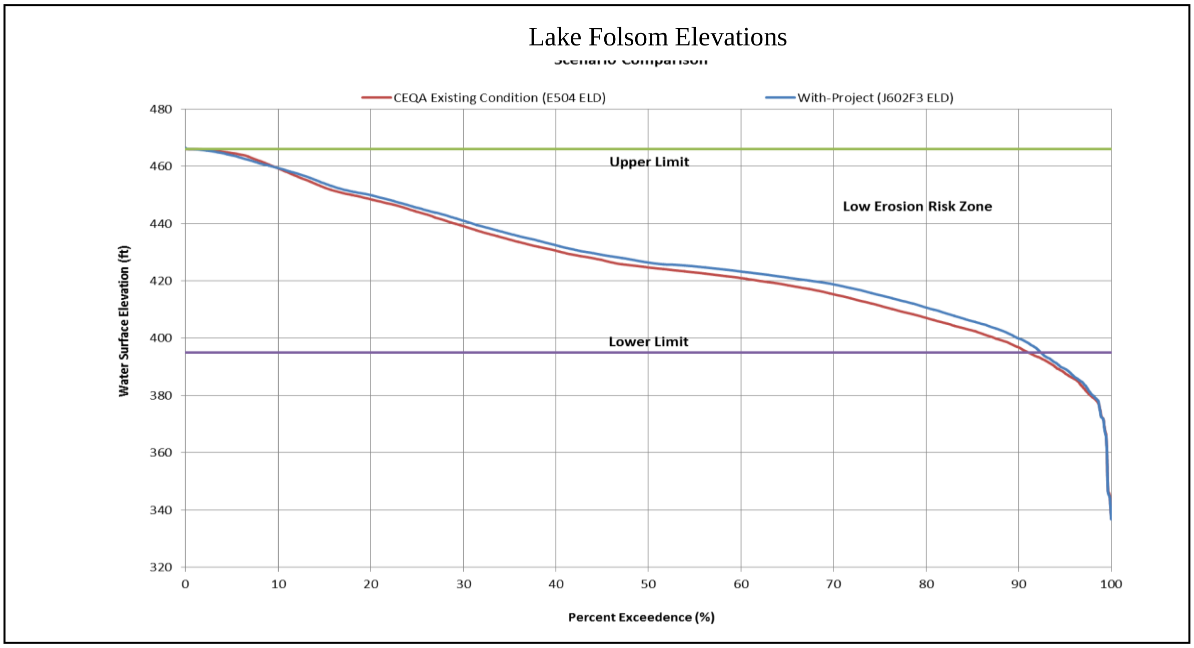


Figure 4-15. Folsom Lake Pool Levels Comparison of No Action/No Project Condition and Alternative 2 - Forecast-informed Operations.

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 affects 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.

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 wuality 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.

D-1641	Water Year Type				
	Wet	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Minimum Number of Days Less than 150 mg/L	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 percent	–1.7 percent	–1.3 percent	–2.0 percent	√
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 percent to +0.9 percent	±1.9 percent	–1.7 percent to +0.8 percent	–1.2 percent to +1.1 percent	–1.0 percent to +4.1 percent	–1.7 percent to +1.0 percent

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 three instances with a greater than or equal to 1 km shift (east): once in March and twice in 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 aone-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 affects were determined, the basis of significance, and the environmental consequences to vegetation and wildlife as a result of the Manual Update.

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 affects 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 affects assessment area 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-proposed, candidate, threatened, or endangered species (listed species) and their associated critical habitat was reviewed for the Rocklin, Pilot Hill, Citrus Heights, Folsom, Clarksville, Sacramento West, Sacramento East, and Carmichael 7.5 Minute USGS Quadrangles (USFWS 2012 and California Natural Diversity Database (CNDDB) 2012).

<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 un-named tributaries to the American River.

Folsom Reservoir and Nimbus Reservoir (Lake Natoma)

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.

Special Status Species

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, 2012.

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*	FT / 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

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.

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.

Lower American River Cottonwood Growth

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 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.

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

Special-Status Plant and Animal Species

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 are 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. Because effects on backwater habitats with the Alternative 2 - Forecast-informed Operations alternative would be negligible, overall 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.

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 depdendent plant species – Boggs Lake hedge-hyssop and Sacramento Orcutt grass. Additionall, 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.

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.

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) 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 1997 Draft 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); and

- 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.

4.5.1 Environmental Setting/Affected Environment

Local Project Area

Lower American River

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.

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-/late fall-run Chinook salmon[a]	Federal species of concern State species of special concern
• Central Valley spring-run Chinook salmon (non-natal rearing only)	Federal and State threatened
• River lamprey	State species of special concern
• Pacific lamprey	Federal species of 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.

Folsom Reservoir and Lake Natoma

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.

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, 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, only a general summary of the regional effects assessment is discussed. See Appendix A and D for a detailed discussion of CalSim II and other 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 this Draft Technical Report 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 4-19).

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.

Spawning Gravel Mobilization

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 affects 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 4-21). 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.

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.

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	-0.7	3.3	0.9
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	-0.6	-2.4	-21.5	-5.6	7.6	5.5	5.4	-1.4	0.1	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

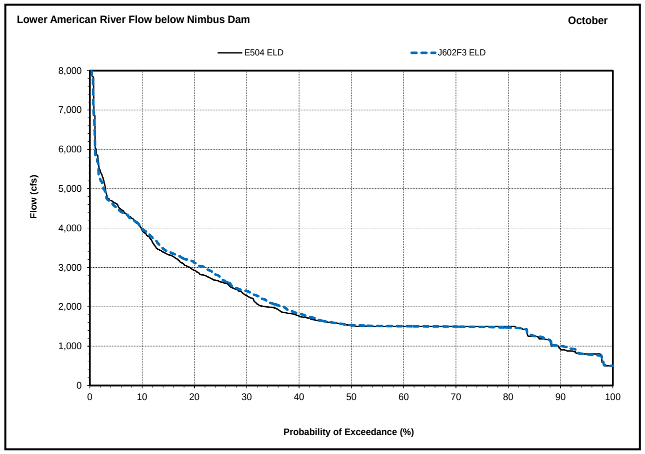


Figure 4-16. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for October under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

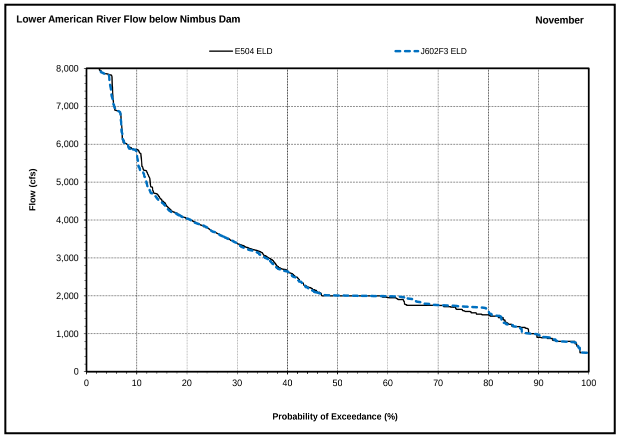


Figure 4-17. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for November under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

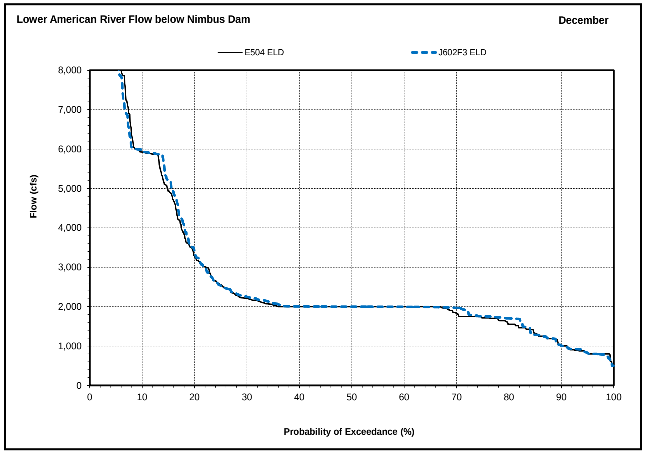


Figure 4-18. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for December under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

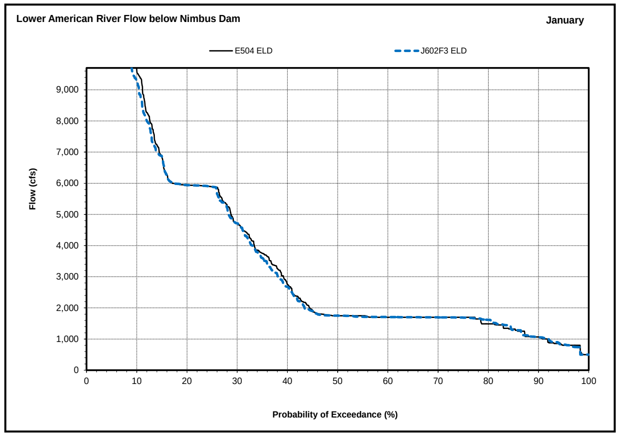


Figure 4-19. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for January under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

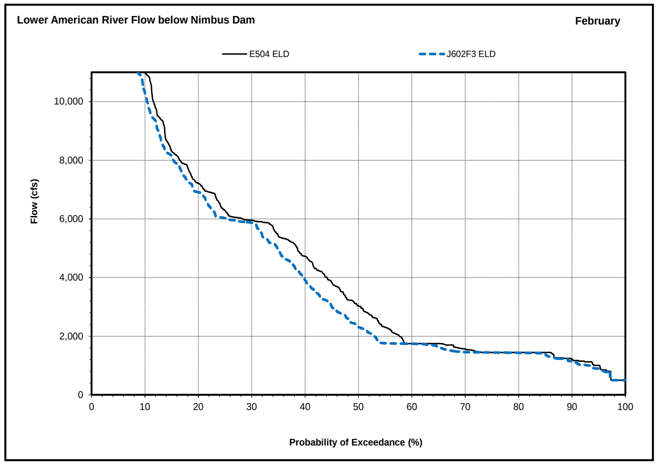


Figure 4-20. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for February under Alternative 2 - Forecast-informed Operations and N Action/No Project Condition.

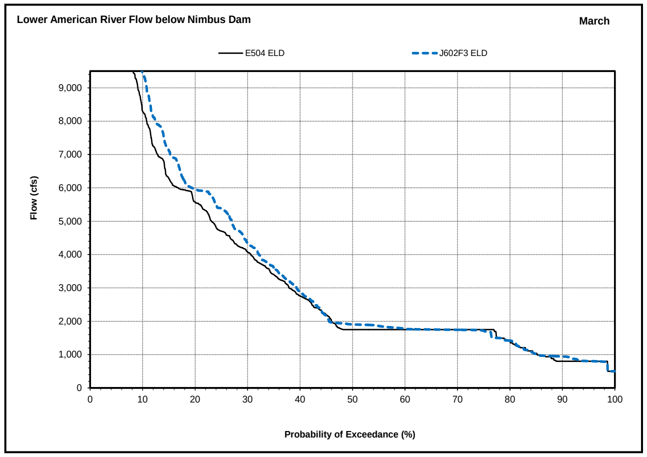


Figure 4-21. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for March under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

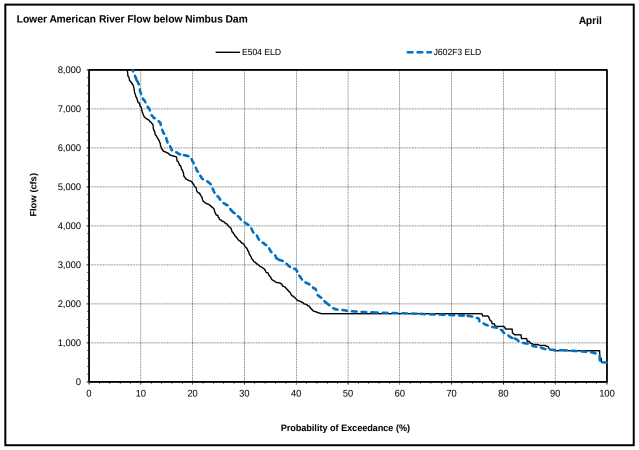


Figure 4-22. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for April under Alternative 2 - Forecast-informed Operations and N Action/No Project Condition.

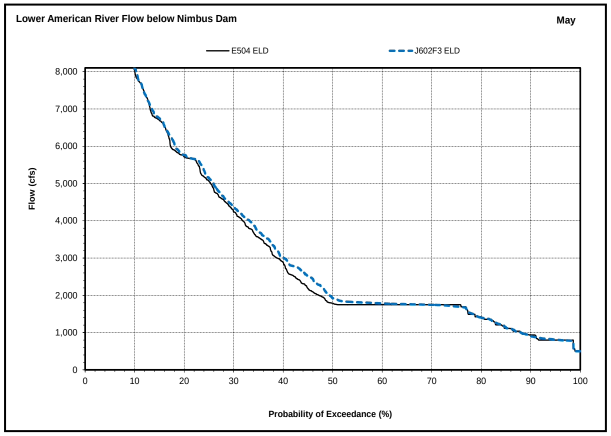


Figure 4-23. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for May under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

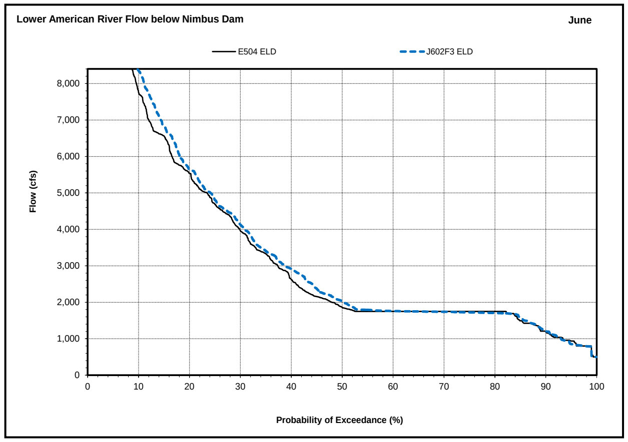


Figure 4-24. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for June under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

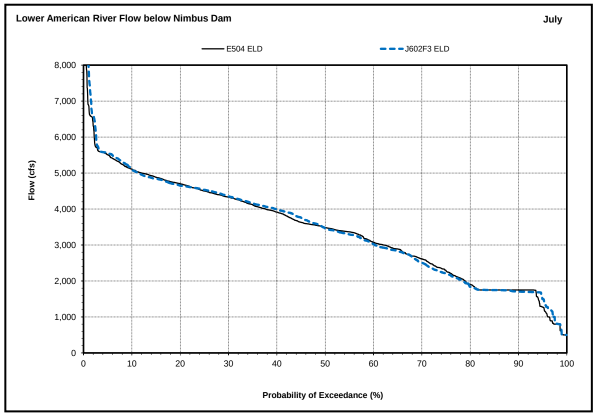


Figure 4-25. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for July under Alternative 2 - Forecast-informed Operations and No Action/N Project Condition.

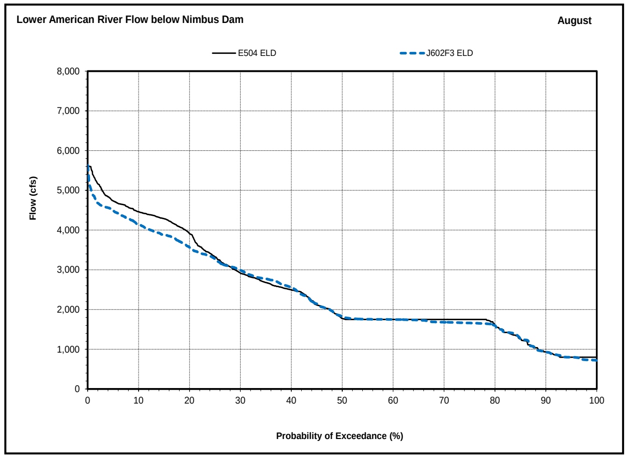


Figure 4-26. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for August under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

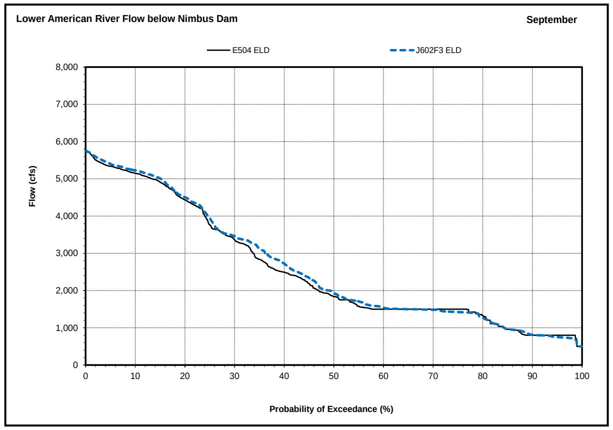


Figure 4-27. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for September under Alternative 2 - Forecast-informed Operations and No Action/No Project Condition.

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 4-22). 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 4-23). 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 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, as shown in Table 4-26 to 4-28.

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, except for May when there is a measurably decrease in water temperature. Mean monthly water temperatures by water year type would be generally similar most of the time, except for measurably cooler water temperatures during May, June, and August of above-normal water years and during May and June of dry water years. Monthly water temperature exceedance probability distributions would be generally similar with slight differences most of the time during all months, but are slightly cooler during May, June, and August, and are warmer during April.

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	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.	**Entire Monthly Exceedance Distributions**
American River below Nimbus Dam		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	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.	Warmest 25 percent of the Monthly Exceedance Distributions
American River below Nimbus Dam		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

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more of the time during May, June, and August, and a net measurably increase would occur over 10 percent or more of the time during April. 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 May through September.

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, but would be measurably cooler during May, June, and August. Monthly water temperatures by water year type would be generally similar most of the time, but would be measurably cooler during May and August of wet water years; May through August of above-normal water years; May through July of below-normal water years; May, June, and August of dry water years; and during March through August of critical years. Monthly water temperature exceedance probability distributions would be generally similar most of the time during all months with some slight differences, but would be cooler during March through September.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more of the time during May through September. Over the warmest 25 percent of the monthly distributions, net measurable decreases in water temperature would occur in over 10 percent or more in the distributions during March through September.

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 most months of the year, and would be measurably cooler during April through September. Monthly water temperatures by water year type would be generally similar most of the time, but would be measurably cooler during March of above-normal and critical water years, April of below-normal and dry water years, May through August of most water year types, and September of critical years. Monthly water temperature exceedance probability distributions would be generally similar during most months of the year, but would be cooler during March through September.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more of the time during March through September. 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 March through September.

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. 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

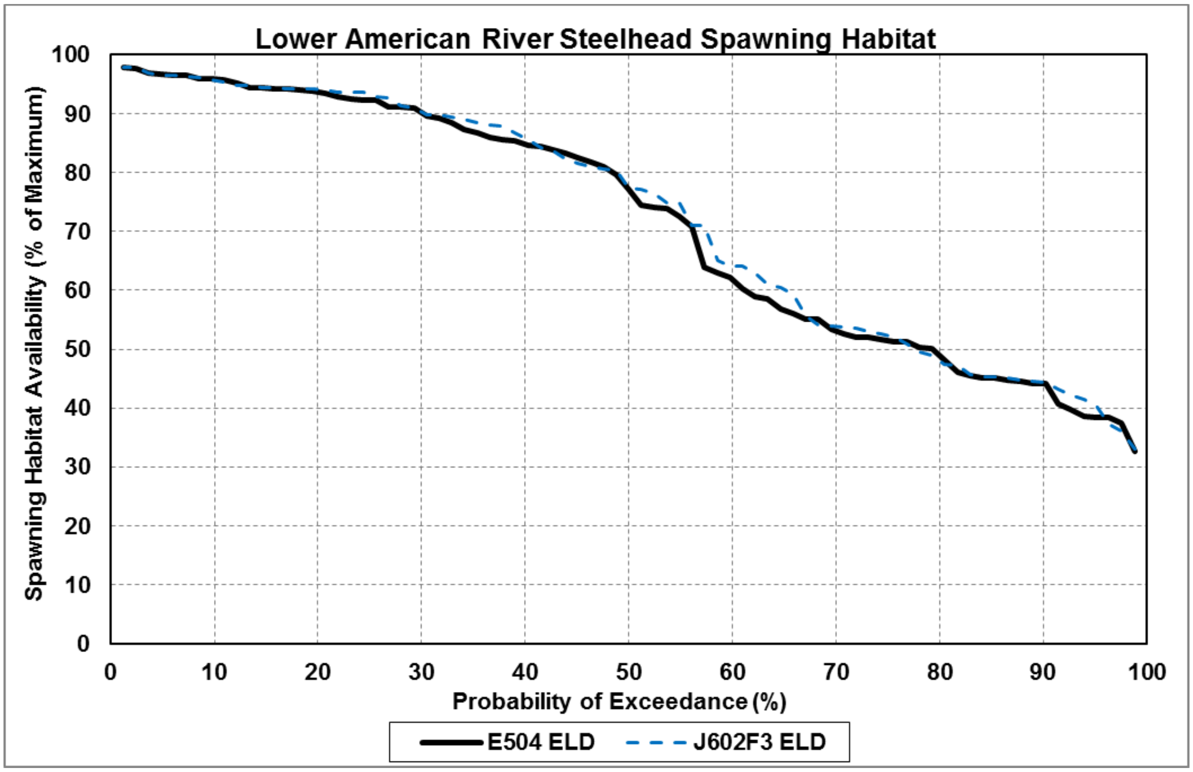


Figure 4-28. Steelhead Spawning WUA Exceedance Distribution Under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

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

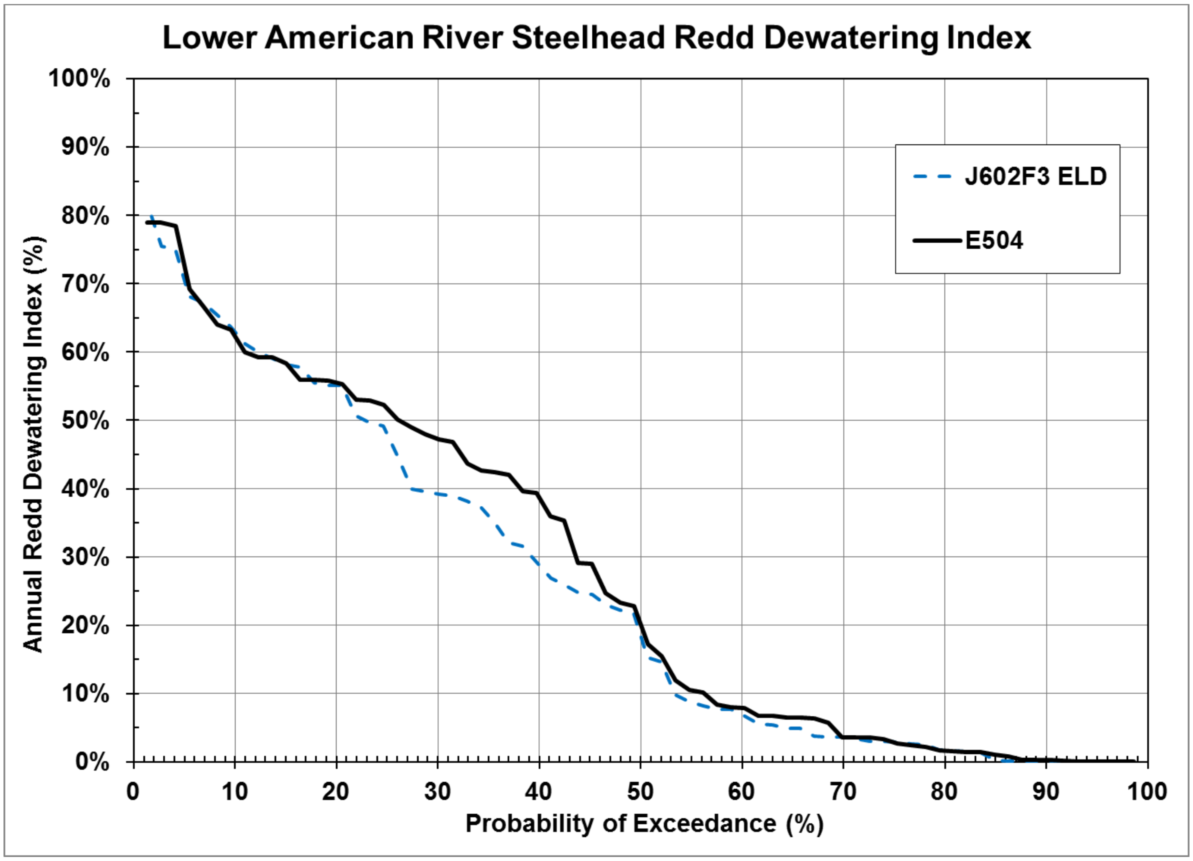


Figure 4-29. Steelhead Redd Dewatering Index Exceedance Distribution Under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

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

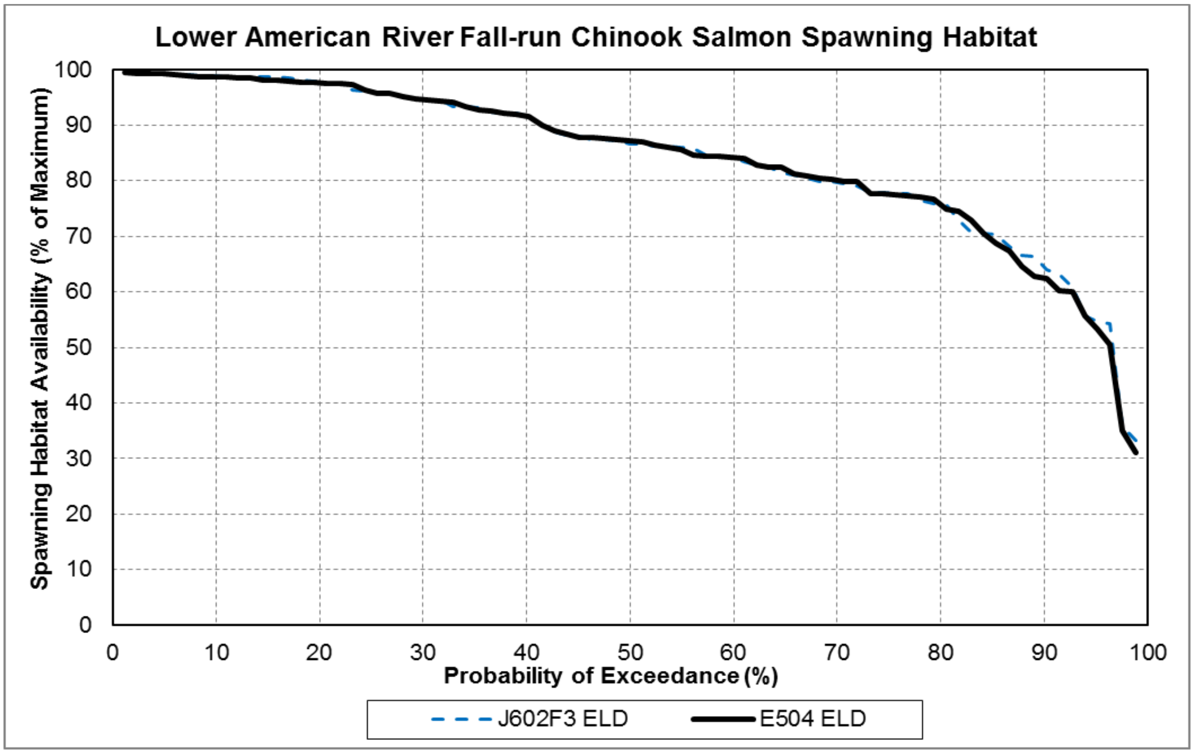


Figure 4-30. Fall-run Chinook Salmon Spawning WUA Exceedance Distribution under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

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

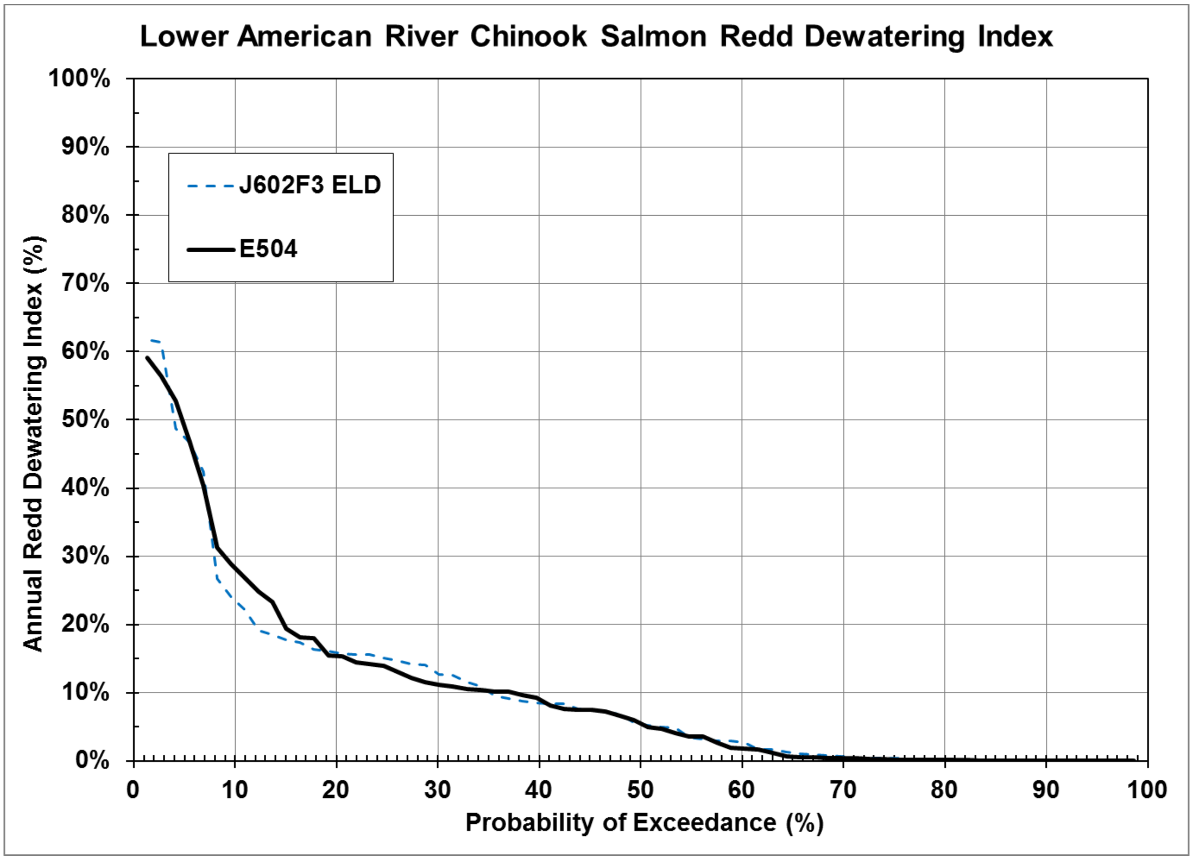


Figure 4-31. Fall-run Chinook Salmon Redd Dewatering Index Exceedance Distribution under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

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

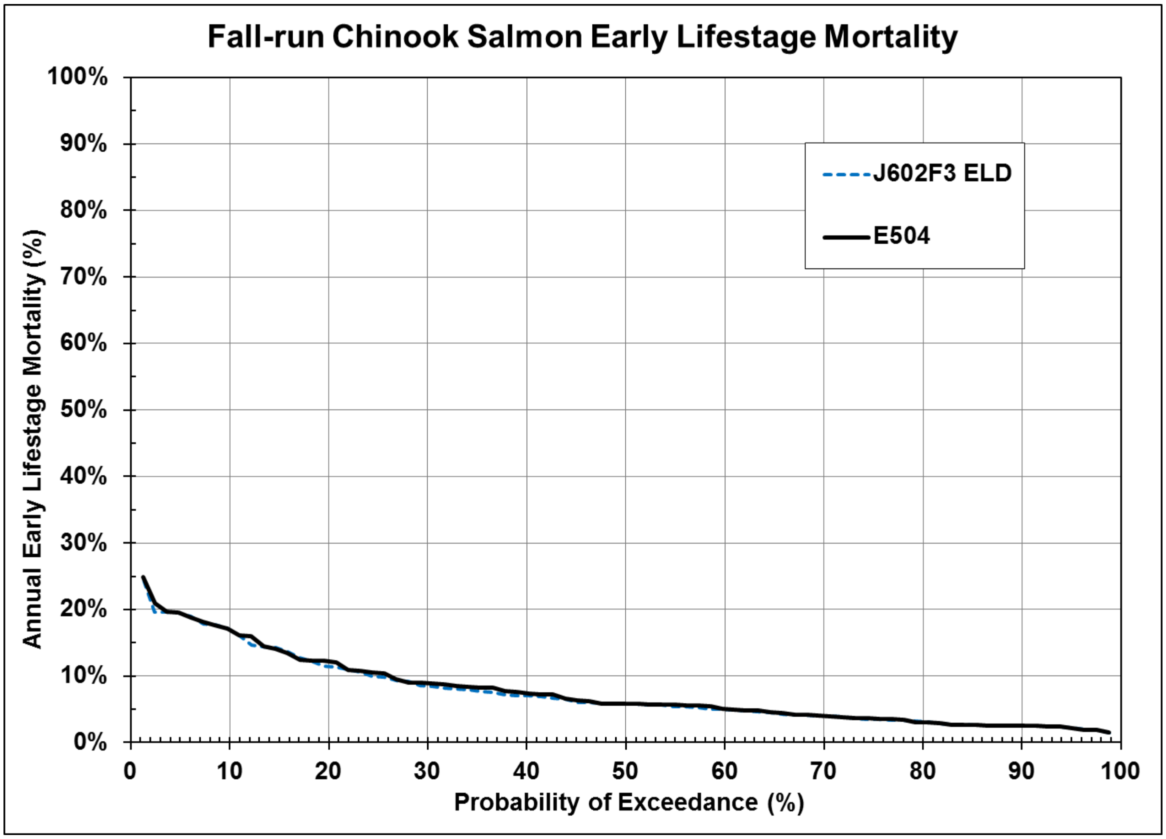


Figure 4-32. Fall-run Chinook Salmon Annual Early Lifestage Mortality Exceedance Distribution under Alternative 2 - Forecast-informed Operations and No Action/No Project Conditions.

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. This is a benefit to Redd survival.

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	May	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 Nimus Dam that averages 6,700 to 9,100CY of bed material annually, and aggradation in the lower subreachs 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.

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 Days	% 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 to 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 (ie. 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.

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.

Evaluation Parameters	**Results**					
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.

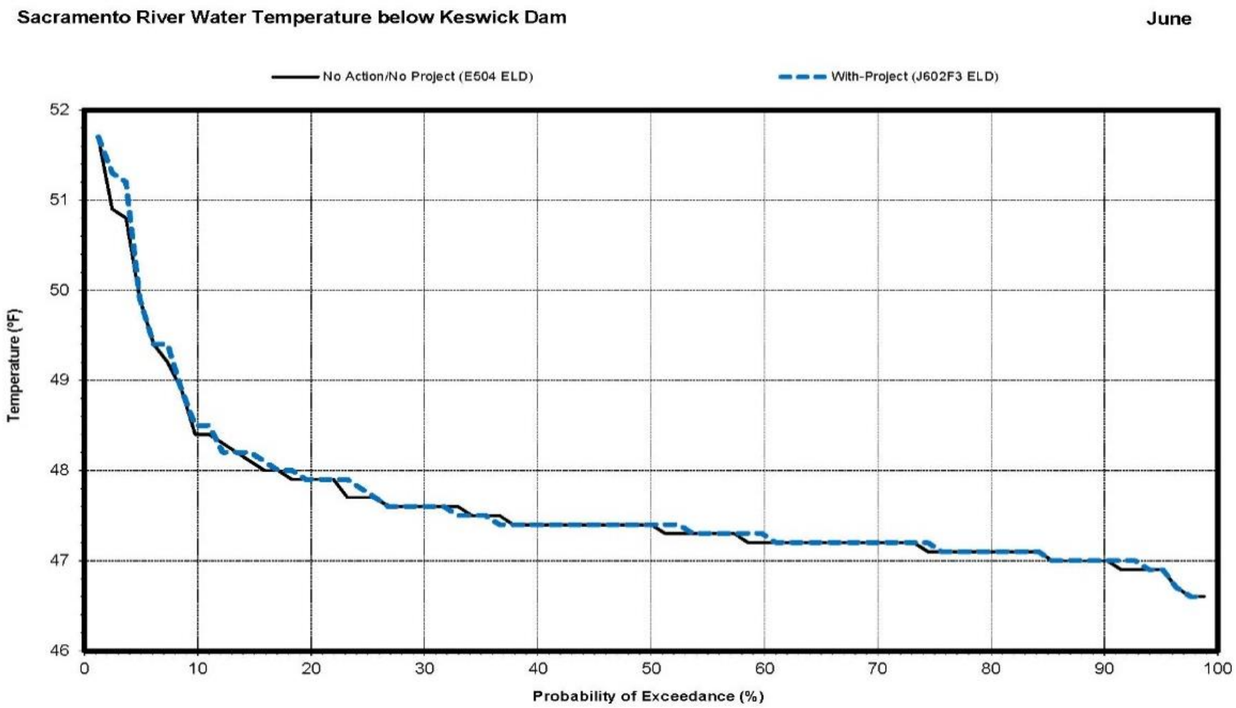


Figure 4-33. Exceedance Probability Plot of June Sacramento River Water Temperature below Keswick Dam – No Action/No Project compared to Alternative 2.

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).

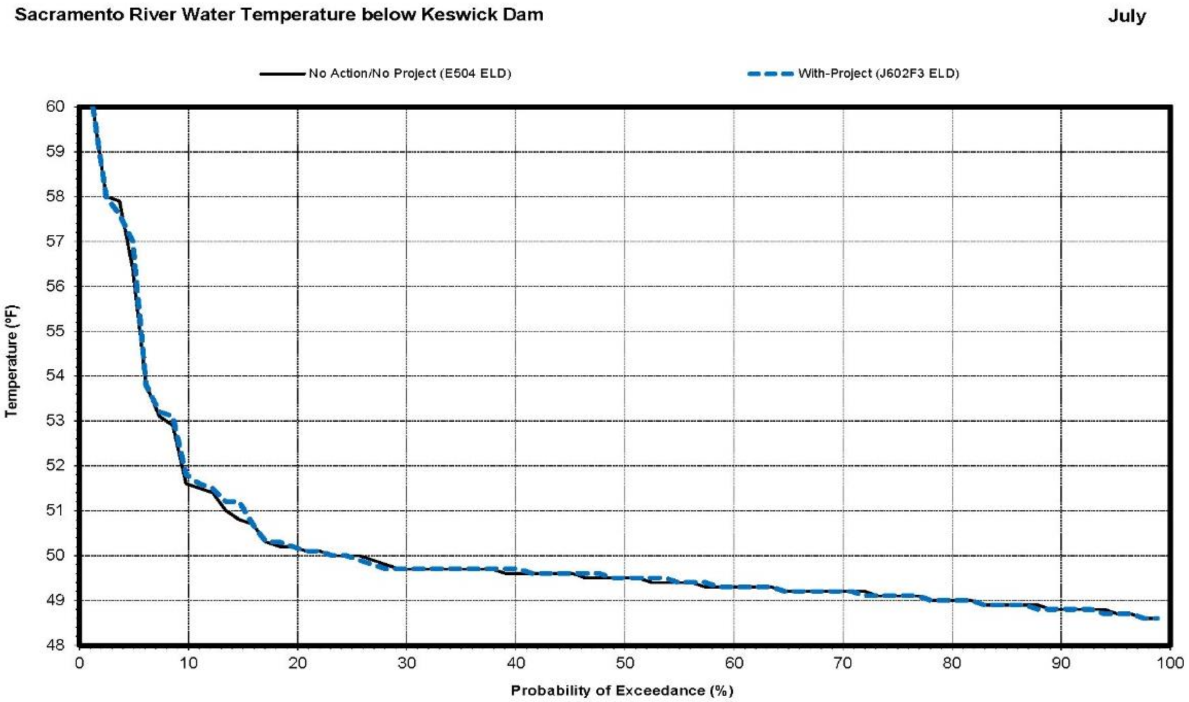


Figure 4-34. Exceedance Probability Plot of July Sacramento River Water Temperature below Keswick Dam – No Action/No Project compared to Alternative 2.

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.

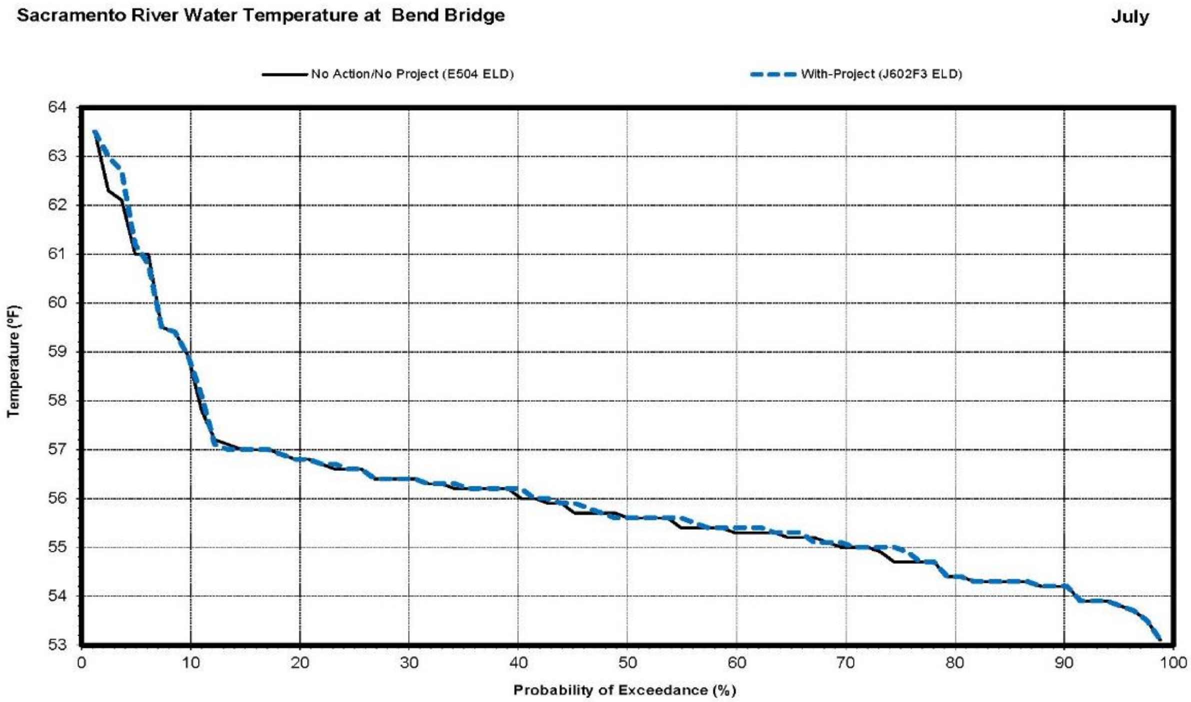


Figure 4-35. Exceedance Probability Plot of July Sacramento River Water Temperature at Bend Bridge – No Action/No Project compared to Alternative 2.

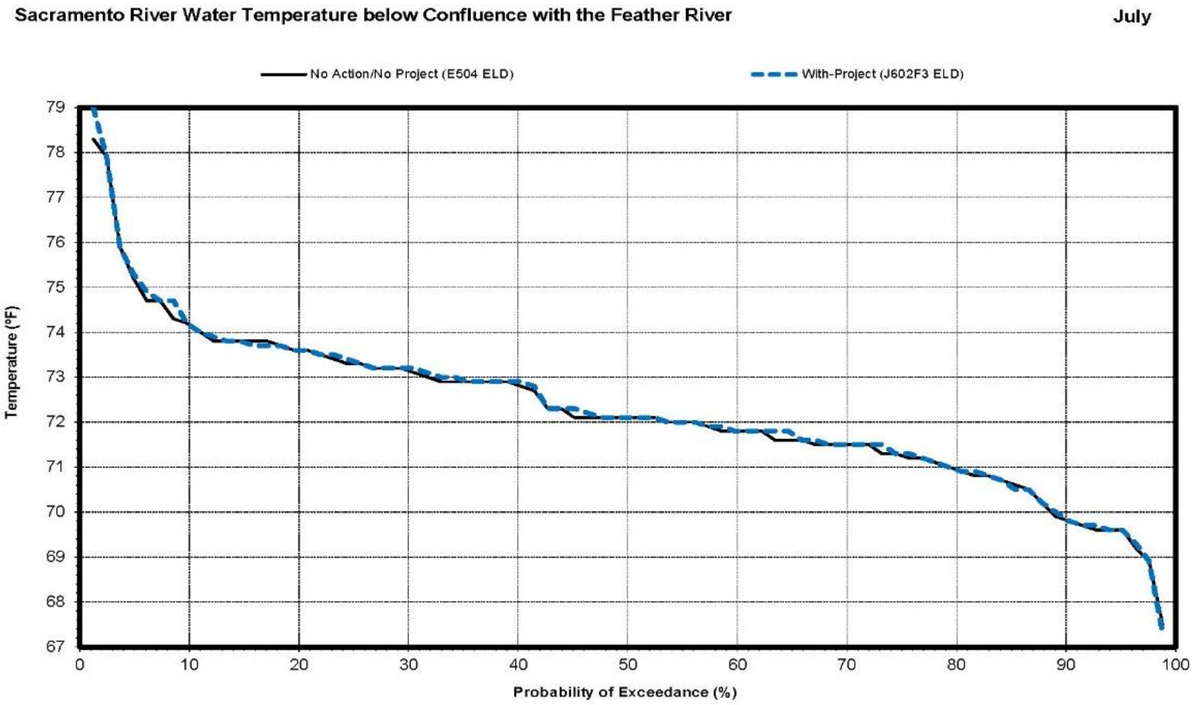


Figure 4-36. Exceedance Probability Plot of July Sacramento River Water Temperature below the Confluence with the Feather River – No Action/No Project compared to Alternative 2.

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 affects 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 affects 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 Affects 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 slight trend of increases

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.

	Average Storage (TAF)											
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)	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.

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 4-40 and 4-41. 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.

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 affects 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 affects 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 CalSimm 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. Maximim 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 is a positive effect on the minimum adequate flow of 1,750 cfs, which ranges from 2.4 to 16.9 percent. The minimum adequate flow is met more frequently under the 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 Threshold Difference between Alternative 2 - Forecast-informed Operations and No Action/No Project.

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 occurances 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 4-44). 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 Reservouir 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

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 also included in the above reports, and drawn from for the following sections.

The histories of Folsom and Sacramento as cities connects back to several broader themes that have been prevalent in California history: mining, railroads, and early farming and agriculture, flooding and management of water. Numerous archaeological investigations have also covered large portions of the project area on the American River (Far Western, 1990; Dames & Moore, 1994; Waechter 1994).

Area of Potential Effects

USACE is in the process of identifying an area of potential effects (APE) that would include two separate areas, 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 Sacrament 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, and 2013 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 Section 106 process of the National Historic Preservation Act. 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. Such eligible resources are called "historic properties". Adverse effects to historic properties, as assessed following the Section 106 process, are considered significant effects for the purposes of this document.

In order for a cultural resource to be considered a historic property it must typically be at least 50 years of age, and must meet at least one of the four criteria of National Register 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:

- That are associated with events that have made a significant contribution to the broad patterns of our history; or
- That are associated with the lives of significant persons in our past; or

- That 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
- That 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.

Initiation of the Section 106 process includes the first step of determining whether the proposed action is a Federal undertaking with the potential to affect historic properties and if so, identifying the appropriate consulting parties. In this case, the project is a Federal undertaking that would alter the frequency of different lake level elevations and of different downstream flows into the American River. These results could potentially effect historic properties if such were present, and is therefore considered an undertaking. USACE has so far identified the California State Historic Preservation Officer, the Shingle Springs Band of Miwok Indians, United Auburn Indian Community, Wilton Rancheria, Buena Vista Rancheria, and the Tsi-Akim Maidu as consulting parties. Other interested groups and individuals are welcome to become consulting parties at any time.

USACE is presently engaged actively in the second step of the process, the identification of historic properties. In this step, the Federal agency, in consultation with the consulting parties, defines the area of potential effects; seeks to identify potential historic properties located within the APE; and using the criteria outlined above, evaluates the historical significance of the resources identified. If USACE, in consultation with the consulting parties, determines that there are no historic properties within the APE, and the SHPO does not object to that finding, the Section 106 process would be complete.

Based on the initial records and literature search of Reclamation records of cultural resources sites and previously conducted archaeological surveys USACE has concluded that there may be potential historic properties within the APE around the Folsom Reservoir. Downstream of Folsom Reservoir, within the APE along the American River, previous records and literature searches conducted within portions of the APE also indicate there may be potential historic properties within the APE. Typically additional identification efforts would include revisiting previously recorded cultural resources in able to determine if they may be eligible as historic properties. Due to the high level of the water, USACE is unable to complete identification efforts prior to approval of the Manual Update.

If historic properties were identified within the APE, USACE would move to the third step to determine if the project would adversely affect those properties. The criteria of adverse effects is as follows “adverse effects occur when an undertaking may directly or indirectly alter characteristics of a historic property that qualify it for inclusion in the Register. Reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative also need to be considered.” USACE is unable to determine if the project may adversely affect historic properties, or if historic properties are within the APE prior to approval of the undertaking (the Manual Update). As a result, and in compliance with the National Historic Preservation Act of 1966, as amended, when effects on historic properties cannot be fully determined prior to approval of an undertaking, a programmatic agreement (PA) may be used in order for the undertaking to be in compliance with the Section 106 process.

USACE is currently developing a PA that would stipulate the steps that would be taken to continue identification of historic properties, evaluation of effects, and provide a resolution to adverse effects (if required) through avoidance, minimization, or mitigation of those effects. The PA shall take effect when executed by USACE, SHPO, signatory parties designated by USACE, and the Advisory Council on Historic Preservation (ACHP) (if they choose to participate).

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.

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 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 cubic feet per second (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 eriosion 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 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. Cultural resource surveys cannot be completed prior to circulation of the document. 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.

Under NEPA adverse effects to historic properties may result due to the action. The determination of effects to historic properties would be made as part of the stipulations in the PA. If effects are determined to be potentially significant and adverse, those effects would be resolved through mitigation. Mitigation would be as a stipulation of the PA.

4.9.3 Mitigation

It is not clear whether mitigation will or will not be required. USACE must complete identification efforts, and as necessary, an assessment of adverse effect. If adverse effects are found, USACE would develop means to resolve those adverse effects through the PA. Execution of a PA will be completed prior to implementing the Manual Update.

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

Consultation is currently ongoing. CAR Recommendations should be available soon and will be incorporated into the final document and proposed alternative at that time.

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 affects assessment area and reduce the chance of emergency releases which could cause extensive damage to the human environment.

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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

Partial Compliance

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.

This document serves as the instrument for NEPA compliance. The project will be in full compliance when a Finding of No Significant Impact is signed by the Commander of the Sacramento District.

6.1.2 National Historic Preservation Act of 1966

Partial 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 is currently under development 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

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

Partial 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 is currently undergoing informal consultation with USFWS and NMFS regarding the Manual Update.

6.1.6 Fish and Wildlife Coordination Act

Partial 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 has initiated coordination with USFWS under the Coordination Act.

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 (ITAs) 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 (ITA) 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

Partial 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 is currently coordinating with the resource agencies regarding the Manual Update's effect on essential fish habitat.

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.

Partial 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 in currently coordinating 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)

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

1.1.1 California Environmental Quality Act

Partial Compliance

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 effects 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 effects;
- 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. This project will be in full compliance with CEQA when the Central Valley Flood Protection Board issues a Notice of Determination following public review of this document.

6.2.1 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.

6.2.2 California Endangered Species Act

Partial 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.

Effects to listed species are evaluated in detail in Chapter 4. Implementation of the Manual Update is not likely to adversely affect any species protected under CESA. Coordination with CDFW is ongoing.

6.2.3 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.

6.2.4 California Water Code

Partial 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. Compliance with the California Water Code will be accomplished by obtaining certifications from the Central Valley RWQCB, if needed.

6.2.5 California Register of Historic Resources

Partial 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 person 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.

Consultation regarding cultural resources for the Manual Update is currently ongoing.

6.2.6 Native American Heritage Commission

Partial 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. Consultation regarding cultural resources for the Manual Update is currently ongoing.

6.2.7 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.

6.2.8 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.

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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
- USBR

7.7 Public Review and Comments on Draft SEA/EIR

Following completion of the Draft SEA/EIR, a USACE and CVFPB will file a Notice of Completion with the State Clearing House to start the 45-day public review period. A Notice of Availabity will be distributed to interested or affected agencies, groups, and individuals. Copies of the Draft SEA/EIR will be furnished to those who specifically request them and to agencies having jurisdictional responsibilities associated with the proposed action or its effects. Copies of the Draft SEA/EIR will also be made available for download at the project website and for review at appropriate public libraries and offices. Following distribution, The Study Partners will hold a series of public meetings within the Folsom Dam and Reservoir area during the 45-day public review of the Draft SEA/EIR, as required by NEPA, CEQA, and other laws and policies. Public notices will be posted identifying the dates, times, and locations of the public meetings. The Study Partners will consolidate public review comments received and process for consideration to incorporate in the Final SEA/EIR. A public review report will be prepared by USACE to document the review process, comments received, and processing of comments for further consideration. The CVFPB will decide whether to certify and approve the document at one of their regularly scheduled montly meetings. At the time the CVFPB certifies a document, they will sign a Notice of Determination (NOD). This 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. Once finalized, the EA/EIR will also be filed with the EPA.

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	

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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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Appendix A: CalSimII Modeling

Table of Contents

1.0 General CalSim II Assumptions

1.1 CalSim II Version

After careful review and comparison of the available CalSim II models, and through coordination with the United States Department of the Interior, Bureau of Reclamation’s (Reclamation) CalSim II modeling team, the U.S. Army Corps of Engineers (USACE) selected the 2013 State Water Project (SWP) Delivery Reliability Report (DRR) (DWR 2013) as the base model for the Folsom Dam Water Control Manual (WCM) Update project. The 2013 DRR versions of CalSim II are the most recent publicly available models from either the California Department of Water Resources (DWR) or Reclamation. Therefore, it was considered the most reasonable base from which to develop the models used for the Folsom Dam WCM Update project.

1.2 System-Wide Assumptions

Table 1-1 summarizes assumptions for the CalSim II models (Existing and Future Condition) developed for the 2013 DRR, which were subsequently modified for use in the Folsom Dam WCM Update EIS/EIR. The assumptions made for the Folsom Dam WCM Update EIS/EIR models are also detailed in Table 1-1 for comparison to the 2013 DRR models.

Table 1-1. CalSim II Modeling Assumptions for DWR 2013 and for Folsom Dam WCM Update Models.

	2013 DRR Existing Condition[1]	**WCM Existing Condition (CEQA)**	**2013 DRR Future Condition[1]**	**WCM Future Condition (NEPA No Action)**
Planning horizon	2013	2014	Interpolation to 2033 future using data from 2013 Future No Climate Change and 2050 Future with Climate Change	Same as 2013 DRR Future Condition except the climate change
Period of simulation	82 years (1922–2003)	Same	Same	Same
HYDROLOGY				
Level of development (land use)	2005 level[2]	Same as 2013 DRR Existing Condition	2030 level[3]	Same as 2013 DRR Future Condition
DEMANDS				
North of Delta (excluding the American River)				
CVP	Land-use based, limited by contract amounts[4]	Same as 2013 DRR Future Condition	Land-use based, full build-out of contract amounts	Same as 2013 DRR Future Condition
SWP (FRSA)	Land-use based, limited by contract amounts,[5] no rice decomposition water demand	Same as 2013 DRR Existing Condition; included about 160 TAF/yr of rice decomposition water demand	Land-use based, limited by contract amounts,[5] no rice decomposition water	Same as 2013 DRR Future Condition; included about 160 TAF/yr of rice decomposition water demand
Non-Project	Land-use based, limited by water rights and SWRCB decisions for existing facilities	Same	Same	Same
Antioch Water Works	Pre-1914 water right	Same	Same	Same

	2013 DRR Existing Condition[1]	**WCM Existing Condition (CEQA)**	**2013 DRR Future Condition[1]**	**WCM Future Condition (NEPA No Action)**
Federal refuges	Recent historical level 2 water needs[6]	Same as 2013 DRR Future Condition	Firm level 2 water needs[6]	Same as 2013 DRR Future Condition
American River Basin				
Water rights	Year 2005[7]	Same as 2013 DRR Existing Condition except Sacramento Suburban Water District's diversion from Folsom PP set to 14.5 TAF/yr, City of Sacramento demand set to 131.5 TAF/yr	Year 2025, full water rights[7]	Same as 2013 DRR Future Condition except City of Sacramento demand set to 311.8 TAF/yr (230 TAF/yr at E. A. Fairbairn WTP), PCWA demand set to 65 TAF/yr.
CVP	2005 level[7]	2005 level[7]; included Freeport Regional Water Project, El Dorado County demands set to 0, EBMUD demands updated as provided by EBMUD	Year 2025, full contracts including Freeport Regional Water Project[7]	Same as 2013 DRR Future Condition except EBMUD demands updated as provided by EBMUD
San Joaquin River Basin[9]				
Friant Unit	Limited by contract amounts, based on current allocation policy	Same	Same	Same
Lower Basin	Land-use based, based on district level operations and constraints	Same	Same	Same
Stanislaus River Basin[10, 19]	Land-use based, based on New Melones Interim Operations Plan, up to full CVP contractor deliveries (155 TAF/yr) depending on New Melones index	Same	Same	Same
South of Delta				
CVP	Demands based on contract amounts[4]	Same	Same	Same
Federal refuges	Recent historical level 2 water needs[6]	Same as 2013 DRR Future Condition	Firm level 2 water needs[6]	Same as 2013 DRR Future Condition
CCWD	195 TAF/yr CVP contract supply and water rights[11]	Same	Same	Same
SWP [5, 12]	Demand based on full Table A amounts (4.13 MAF/year)	Same	Same	Same
Article 56	Based on 2001–2008 contract requests	Same	Same	Same

	2013 DRR Existing Condition[1]	WCM Existing Condition (CEQA)	2013 DRR Future Condition[1]	WCM Future Condition (NEPA No Action)
Article 21	MWD demand up to 200 TAF/month (December–March) subject to conveyance capacity, KCWA demand up to 180 TAF/month, and other contractor demands up to 34 TAF/month, subject to conveyance capacity	Same	Same	Same
North Bay Aqueduct	77 TAF/yr demand under SWP contracts, up to 43.7 cfs of excess flow under Fairfield, Vacaville, and Benicia Settlement Agreement	Same	Same	Same
FACILITIES				
System-wide	Existing facilities	Same	Same	Same
Sacramento Valley				
Shasta Lake	Existing 4,552 TAF capacity	Same	Same	Same
Red Bluff Diversion Dam	Diversion dam operated with gates out all year, NMFS BO (2009) Action I.3.1[19]; assume permanent facilities in place	Same	Same	Same
Colusa Basin	Existing conveyance and storage facilities	Same	Same	Same
Upper American River	PCWA American River pump station	Same	Same	Same
Lower Sacramento River	None	Freeport Regional Water Project for EBMUD diversions only	Freeport Regional Water Project	Same as 2013 Future Condition
Fremont Weir	Existing weir; no notched operation	Same as 2013 Existing Condition	Same as 2013 Existing Condition	BDCP notch operation of Fremont Weir
Delta Export Conveyance				
SWP Banks pumping capacity (South Delta)	Physical capacity is 10,300 cfs, permitted capacity is 6,680 cfs in all months and up to 8,500 cfs during Dec 15th-Mar 15th depending on Vernalis flow conditions[20]; additional capacity of 500 cfs (up to 7,180 cfs) allowed Jul-Sep for reducing impact of NMFS BO (2009) Action IV.2.1[19] on SWP[21]	Same	Same	Same

	2013 DRR Existing Condition[1]	WCM Existing Condition (CEQA)	2013 DRR Future Condition[1]	WCM Future Condition (NEPA No Action)
CVP C.W. "Bill" Jones Pumping Plant (formerly Tracy PP)	Permit capacity is 4,600 cfs in all months (allowed for by the DMC-California Aqueduct Intertie)	Same	Same	Same
Upper DMC capacity	Exports limited to 4,200 cfs plus diversion upstream from DMC constriction plus 400 cfs DMC-California Aqueduct Intertie	Same	Same	Same
Los Vaqueros Reservoir	Enlarged storage capacity (160 TAF), existing pump location, Alternate Intake Project included[14]	Same	Same	Same
San Joaquin River				
Millerton Lake (Friant Dam)	Existing, 520 TAF capacity	Same	Same	Same
Lower San Joaquin River	None	Same as 2013 DRR Future Condition	City of Stockton Delta Water Supply Project, 30 mgd capacity	Same as 2013 DRR Future Condition
South of Delta (CVP/SWP project facilities)				
South Bay Aqueduct	Existing capacity	Same as 2013 DRR Future Condition	SBA rehabilitation, 430 cfs capacity from junction with California Aqueduct to Alameda County FC&WSD Zone 7 point	Same as 2013 DRR Future Condition
California Aqueduct East Branch	Existing capacity	Same	Same	Same
REGULATORY STANDARDS				
Trinity River				
Minimum flow below Lewiston Dam	Trinity Environmental Impact Study Preferred Alternative (369-815 TAF/yr)	Same	Same	Same
Trinity Reservoir end-of-September minimum storage	Trinity Environmental Impact Study Preferred Alternative (600 TAF as able)	Same	Same	Same
Clear Creek				
Minimum flow below Whiskeytown Dam	Downstream water rights, 1963 Reclamation proposal to USFWS and NPS, predetermined Central Valley Protection Improvement Act 3406(b)(2) flows,[22] and NMFS BO (2009) Action I.1.1[19]	Same	Same	Same
Upper Sacramento River				

	2013 DRR Existing Condition[1]	**WCM Existing Condition (CEQA)**	**2013 DRR Future Condition[1]**	**WCM Future Condition (NEPA No Action)**
Shasta Lake end-of-September minimum storage	NMFS 2004 winter-run BO (1900 TAF in non-critical dry years), and NMFS BO (2009) Action I.2.1[19]	Same	Same	Same
Minimum flow below Keswick Dam	Flows for the SWRCB Water Rights Order 90-5, predetermined Central Valley Protection Improvement Act 3406(b)(2) flows, and NMFS BO (2009) Action I.2.2[19]	Same	Same	Same
Feather River				
Minimum flow below Thermalito Diversion Dam	2006 Settlement Agreement (700 / 800 cfs)	Same	Same	Same
Minimum flow below Thermalito Afterbay Outlet	1983 DWR, DFG Agreement (750–1700 cfs)	Same	Same	Same
Yuba River				
Minimum flow below Daguerre Point Dam	D-1644 Operations (Lower Yuba River Accord) [15]	Same	Same	Same
American River				
Minimum flow below Nimbus Dam	American River flow management as required by NMFS BO (2009) Action II.1[19]	Same as 2013 DRR Existing Condition, except CalSim II code was updated to include conference years and off-ramp conditions.	Same as 2013 DRR Existing Condition	Same as WCM Existing Condition, except CalSim II code was updated to include conference years, and off-ramp conditions.
Minimum flow at H Street Bridge	SWRCB D-893	Same	Same	Same
City of Sacramento's diversion restrictions through Fairbairn WTP	None	Hodge Restrictions if river flows are less than Hodge flow criteria	Same as 2013 DRR Existing Condition	Same as WCM Existing Condition
Lower Sacramento River				
Minimum flow near Rio Vista	SWRCB D-1641	Same	Same	Same
Mokelumne River				
Minimum flow below Camanche Dam	FERC 2916-029,[13] 1996 (Joint Settlement Agreement) (100–325 cfs)	Same	Same	Same
Minimum flow below Woodbridge Diversion Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (25–300 cfs)	Same	Same	Same

	2013 DRR Existing Condition[1]	WCM Existing Condition (CEQA)	2013 DRR Future Condition[1]	WCM Future Condition (NEPA No Action)
Stanislaus River				
Minimum flow below Goodwin Dam	1987 Reclamation, DFG agreement, and flows required for NMFS BO (2009) Actions III.1.2 and III.1.3 [19]	Same	Same	Same
Minimum dissolved oxygen	SWRCB D-1422	Same	Same	Same
Merced River				
Minimum flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180–220 cfs, Nov–Mar), and Cowell Agreement	Same	Same	Same
Minimum flow at Shaffer Bridge	FERC 2179 (25-100 cfs)	Same	Same	Same
Tuolumne River				
Minimum flow at Lagrange Bridge	FERC 2299-024, 1995 (Settlement Agreement) (94–301 TAF/yr)	Same	Same	Same
San Joaquin River				
San Joaquin River below Friant Dam/Mendota Pool	Interim San Joaquin River restoration flows	Same as 2013 DRR Existing Condition	Full San Joaquin River restoration flows	Same as 2013 DRR Future Condition
Maximum salinity near Vernalis	SWRCB D-1641	Same	Same	Same
Minimum flow near Vernalis	SWRCB D-1641 but with Vernalis Adaptive Management Plan single-step standard only, per purchase agreement between Reclamation and Merced ID. NMFS BO (2009) Action IV.2.1 Phase II flows not provided because of lack of agreement for purchasing water	Same as 2013 DRR Future Condition	SWRCB D-1641 and Vernalis Adaptive Management Plan per San Joaquin River Agreement.[17] NMFS BO (2009) Action IV.2.1 Phase II flows not provided because of lack of agreement for purchasing water	Same as 2013 DRR Future Condition
Sacramento River-San Joaquin River Delta				
Delta outflow index (flow and salinity)	SWRCB D-1641, USFWS BO (2008), Action 4 [19]	Same	Same	Same
Delta cross channel gate operation	SWRCB D-1641 with additional days closed from Oct 1-Jan 31 based on NMFS BO (2009) Action IV.1.2[19] (closed during flushing flows from Oct 1–Dec 14 unless adverse water quality conditions)	Same	Same	Same

	2013 DRR Existing Condition[1]	**WCM Existing Condition (CEQA)**	**2013 DRR Future Condition[1]**	**WCM Future Condition (NEPA No Action)**
South Delta exports (Jones PP and Banks PP)	SWRCB D-1641 export limits (not including VAMP period export cap under the San Joaquin River Agreement) and Vernalis flow-based export limits in Apr–May as required by NMFS BO (2009) Action IV.2.1 Phase II[19] (additional 500 cfs allowed for Jul-Sep for reducing impact on SWP)[21]	Same	Same	Same
Combined flow in Old and Middle River	USFWS BO (2008), Actions 1–3 and NMFS BO (2009), Action IV.2.3 [19]	Same	Same	Same
OPERATIONS CRITERIA: RIVER-SPECIFIC				
Upper Sacramento River				
Flow objective for navigation (Wilkins Slough)	NMFS BO (2009) Action I.4 [19]; 3,250–5,000 cfs based on CVP water supply condition	Same	Same	Same
American River				
Folsom Dam flood control	Variable 400-670 flood control diagram (without outlet modifications)	Same	Same	Same
Shasta and Folsom Reservoir balancing	Folsom Flood Control Rule for September set to 650 TAF.	Folsom Flood Control Rule for September set to 760 TAF (650 TAF for balancing purposes), releasing more water from Nimbus.	Same as 2013 DRR Existing Condition	Same as WCM Existing Condition
Feather River				
Flow at mouth of Feather River (above Verona)	Maintain the DFG/DWR flow target above Verona or 2800 cfs for April–September dependent on Oroville inflow and FRSA allocation	Same	Same	Same
Stanislaus River				
Flow below Goodwin Dam	Revised Operations Plan and NMFS BO (2009) Actions III.1.2 and III.1.3 [19]	Same	Same	Same
San Joaquin River				
Salinity at Vernalis	Grasslands Bypass Project (partial implementation)	Same as 2013 DRR Future Condition	Grasslands Bypass Project (full implementation)	Same as 2013 DRR Future Condition

	2013 DRR Existing Condition[1]	WCM Existing Condition (CEQA)	2013 DRR Future Condition[1]	WCM Future Condition (NEPA No Action)
OPERATIONS CRITERIA: SYSTEM WIDE				
CVP Water Allocation				
CVP settlement and exchange	100% (75% in Shasta critical years)	Same	Same	Same
CVP refuges	100% (75% in Shasta critical years)	Same	Same	Same
CVP agriculture	100%–0% based on supply; South of Delta allocations are additionally limited because of D-1641, USFWS BO (2008) and NMFS BO (2009) export restrictions[19]	Same	Same	Same
CVP municipal & industrial	100%–50% based on supply; South of Delta allocations are additionally limited because of D-1641, USFWS BO (2008) and NMFS BO (2009) export restrictions[19]	Same	Same	Same
SWP Water Allocation				
North of Delta (FRSA)	Contract specific	Same	Same	Same
South of Delta (including North Bay Aqueduct)	Based on supply; equal prioritization between Ag and M&I based on Monterey Agreement; allocations are limited because of D-1641, USFWS BO (2008), and NMFS BO (2009) export restrictions[19]	Same	Same	Same
CVP/SWP Coordinated Operations				
Sharing of responsibility for in-basin use	1986 Coordinated Operations Agreement (FRWP and EBMUD two-thirds of the North Bay Aqueduct diversions are considered as Delta export; one-third of the North Bay Aqueduct diversion is considered as in-basin use)	Same	Same	Same
Sharing of surplus flows	1986 Coordinated Operations Agreement	Same	Same	Same
Sharing of restricted export capacity for project-specific priority pumping	Equal sharing of export capacity under SWRCB D-1641, USFWS BO (2008) and NMFS BO (2009) export restrictions[19]	Same	Same	Same

	2013 DRR Existing Condition[1]	WCM Existing Condition (CEQA)	2013 DRR Future Condition[1]	WCM Future Condition (NEPA No Action)
Water transfers	Acquisitions by SWP contractors are wheeled at priority in Banks Pumping Plant over non-SWP users; LYRA included for SWP contractors[21]	Same	Same	Same
Sharing of restricted export capacity for lesser priority and wheeling-related pumping	Cross Valley Canal wheeling (maximum of 128 TAF/yr), CALFED ROD defined JPOD	Same	Same	Same
San Luis Reservoir	San Luis Reservoir is allowed to operate to a minimum storage of 100 TAF	Same	Same	Same
CVPIA 3406(b)(2)				
Policy decision	Per May 2003 U.S. Department of the Interior decision	Same	Same	Same
Allocation	800 TAF/yr, 700 TAF/yr in 40-30-30 dry years, and 600 TAF in 40-30-30 critical years	Same	Same	Same
Actions	Predetermined non-discretionary USFWS BO (2008) upstream fish flow objectives (Oct–Jan) for Clear Creek and Keswick Dam, non-discretionary NMFS BO (2009) actions for the American and Stanislaus Rivers, and NMFS BO (2009) actions leading to export restrictions[19]	Same	Same	Same
Accounting adjustments	No discretion assumed under USFWS BO (2008) and NMFS BO (2009),[19] no accounting	Same	Same	Same
WATER MANAGEMENT ACTIONS				
Water Transfer Supplies (long-term programs)				
Lower Yuba River Accord[21]	Yuba River acquisition reducing impact of NMFS BO export restrictions[19] on SWP	Same	Same	Same
Phase 8	None	Same	Same	Same
Water Transfers (short term or temporary programs)				
Sacramento Valley acquisitions conveyed through Banks PP[23]	Post analysis of available capacity	Same	Same	Same

Notes:

[1] These assumptions have been developed under the direction of the DWR and Reclamation management team for the BDCP Habitat Conservation Plan and EIR/EIS. Additional modifications were made by Reclamation for its May 2013 baselines and by DWR for the 2013 DRR.

[2] The Sacramento Valley hydrology used in the Existing Condition CalSim II model reflects nominal 2005 land-use assumptions. The nominal 2005 land use was determined by interpolation between the 1995 and projected 2020 land-use assumptions associated with DWR Bulletin 160-98 (DWR 1998). The San Joaquin Valley hydrology reflects 2005 land-use assumptions developed by Reclamation to support Reclamation studies.

[3] The Sacramento Valley hydrology used in the Future Condition CalSim II model reflects 2020 land-use assumptions associated with DWR Bulletin 160-98 (DWR 1998). The San Joaquin Valley hydrology reflects draft 2030 land-use assumptions developed by Reclamation to support Reclamation studies.

[4] CVP contract amounts have been reviewed and updated according to existing and amended contracts, as appropriate. Assumptions regarding CVP agricultural and M&I service contracts and settlement contract amounts are documented in the delivery specifications attachments to the BDCP CalSim assumptions document.

[5] SWP contract amounts have been updated as appropriate based on recent Table A transfers/agreements. Assumptions regarding SWP agricultural and M&I contract amounts are documented in the delivery specifications attachments to the BDCP CalSim assumptions document.

[6] Water needs for Federal refuges have been reviewed and updated, as appropriate. Assumptions regarding firm level 2 refuge water needs are documented in the delivery specifications attachments to the BDCP CalSim assumptions document. Refuge level 4 (and incremental level 4) water is not included.

[7] Assumptions regarding American River water rights and CVP contracts are documented in the delivery specifications attachments to the BDCP CalSim assumptions document. The Sacramento Area Water Forum Agreement, its dry year diversion reductions, Middle Fork Project operations, and “mitigation” water is not included.

[8] Footnote removed.

[9] The new CalSim II representation of the San Joaquin River has been included in this model package (CalSim II San Joaquin River Model) (Reclamation 2005). Updates to the San Joaquin River have been included since the preliminary model release in August 2005. The model reflects the difficulties of on-going groundwater overdraft problems. The 2030 level of development representation of the San Joaquin River Basin does not make any attempt to offer solutions to groundwater overdraft problems. In addition, a dynamic groundwater simulation is not yet developed for the San Joaquin River Valley. Groundwater extraction/ recharge and stream-groundwater interaction are static assumptions and might not accurately reflect a response to simulated actions. These limitations should be considered in the analysis of result

[10] The CalSim II model representation for the Stanislaus River does not necessarily represent Reclamation’s current or future operational policies. A suitable plan for supporting flows has not been developed for NMFS BO (2009) Action III.1.3.

[11] The actual amount diverted is reduced because of supplies from the Los Vaqueros Project. The existing Los Vaqueros storage capacity is 100 TAF, and future storage capacity is 160 TAF. Associated water rights for Delta excess flows are included.

[12] Under Existing Conditions and the Future No Action baseline, USACE assumes that SWP contractors can take delivery of all Table A allocations and Article 21 supplies. Article 56 provisions are assumed and allow for SWP contractors to manage storage and delivery conditions such that full Table A allocations can be delivered. Article 21 deliveries are limited in wet years under the assumption that demand is decreased in these conditions. Article 21 deliveries for the North Bay Aqueduct are dependent on excess conditions only; all other Article 21 deliveries also require that San Luis Reservoir be at capacity and that Banks PP and the California Aqueduct have available capacity to divert from the Delta for direct delivery.

[13] Mokelumne River flows reflect EBMUD supplies associated with the Freeport Regional Water Project.

[14] The CCWD Alternate Intake Project, an intake at Victoria Canal, operates as an alternate Delta diversion for Los Vaqueros Reservoir.

[15] D-1644 and the Lower Yuba River Accord are assumed to be implemented for Existing Condition and Future No Action baselines. The Yuba River is not dynamically modeled in CalSim II. Yuba River hydrology and availability of water acquisitions under the Lower Yuba River Accord are based on modeling performed and provided by the Lower Yuba River Accord EIS/EIR study team.

[16] Footnote removed.

[17] It is assumed that either VAMP, a functional equivalent, or D-1641 requirements would be in place in 2020.

[18] Footnote removed.

[19] In cooperation with Reclamation, NMFS, USFWS, CDFG, and DWR have developed assumptions for implementation of the USFWS BO (2008) and NMFS BO (2009) in CalSim II.

[20] Current USACE permit for Banks PP allows for an average diversion rate of 6,680 cfs in all months. The diversion rate can increase up to 1/3 of the rate of San Joaquin River flow at Vernalis during Dec 15th to Mar 15th, up to a maximum diversion of 8,500 cfs, if Vernalis flow exceeds 1,000 cfs.

[21] Acquisitions of Component 1 water under the Lower Yuba River Accord, and use of 500 cfs dedicated capacity at Banks PP during Jul–Sep are assumed to be used to reduce as much of the impact of the Apr-May Delta export actions on SWP contractors as possible.

[22] Delta actions, under USFWS discretionary use of CVPIA 3406(b)(2) allocations, are no longer dynamically operated and accounted for in the CalSim II model. The Combined Old and Middle River Flow and Delta export restrictions under the USFWS BO (2008) and the NMFS BO (2009) severely limit any discretion that would have been otherwise assumed in selecting Delta actions under the CVPIA 3406(b)(2) accounting criteria. Therefore, it is anticipated that CVPIA 3406(b)(2) account availability for upstream river flows below Whiskeytown, Keswick, and Nimbus Dams would be very limited. It appears the integration of BO RPA actions will likely exceed the 3406(b)(2) allocation in all water year types. For these baseline simulations, upstream flows on Clear Creek and the Sacramento River are predetermined based on CVPIA 3406(b)(2) operations from the August 2008 BA Study 7.0 and Study 8.0 for Existing Condition and Future No Action baselines, respectively. The procedures for dynamic operation and accounting of CVPIA 3406(b)(2) are not included in the CalSim II model.

[23] Only acquisitions of Lower Yuba River Accord Component 1 water are included.

Key:
Ag = agricultural
BA = Biological Assessment
BO = Biological Opinion
BDCP = Bay-Delta Conservation Plan
CALFED = CALFED Bay-Delta Plan
CCWD = Contra Costa Water District
CEQA = California Environmental Quality Act
cfs = cubic feet per second
CVP = Central Valley Project
CVPIA = Central Valley Project Improvement Act
DFG = California Department of Fish and Game
DMC = Delta-Mendota canal
DRR = Delivery Reliability Report
DWR = California Department of Water Resources
D-xxxx = Water Right Decision
EBMUD = East Bay Municipal Utility District
EIR = Environmental Impact Review
EIS = Environmental Impact Statement
FC&WSD = Flood Control and Water Service District
FERC = Federal Energy Regulatory Commission
FRSA = Feather River Service Area
FRWP = Freeport Regional Water Project
FWS = Fish and Wildlife Service
KCWA = Kern County Water Agency
LYRA = Lower Yuba River Accord
MAF/yr = million acre-feet per year
mgd = million gallons per day
M&I = municipal and industrial
MWD = Metropolitan Water District
NEPA = National Environmental Policy Act
NMFS = National Marine Fisheries Service
NPS = National Park Service
PCWA = Placer County Water Agency
PP = Pumping Plant
Reclamation = United States Department of the Interior, Bureau of Reclamation
ROD = Record of Decision
RPA = Reasonable and Prudent Alternative
SBA = South Bay Aqueduct
SWP = State Water Project
SWRCB = State Water Resources Control Board
TAF = thousand acre-feet
TAF/yr = thousand acre-feet per year
USACE = U.S. Army Corps of Engineers
USFWS = United States Fish and Wildlife ServiceVAMP = Vernalis Adaptive Management Plan
WCM = Folsom Dam Water Control Manual
WTP = Water Treatment Plant
yr = year

2.0 WCM Updates to CalSim II

The following is a summary of the changes made to CalSim II to adapt the model for the Folsom Dam WCM Update EIS/EIR Existing Condition and Future Condition.

2.1 Update of American River Flow Management Standard Implementation

The American River Flow Management Standard (FMS) was implemented in the 2013 DRR model; however, USACE refined its implementation to be more in line with the 2008 Lower American River Flow Management Standard Technical Report (2008 FMS Report) (Water Forum 2008).

2.1.1 Flow Management Standard

The minimum flow requirements are the cornerstone of the FMS. The FMS minimum flow requirements are comprised of the downstream compliance flows (DCF) measured at the mouth of the American River and the minimum release requirements (MRR) measured at Nimbus Dam. The minimum flow requirements do not preclude Reclamation from making higher releases at Nimbus Dam, and minimum flow requirements vary throughout the year in response to the hydrology of the Sacramento and American River basins.

To align the CalSim II code with the 2008 FMS Report, the flow trigger for the March-September MRR was corrected. USACE also refined the coding for the prescriptive adjustments to more-accurately reflect the defined criteria. In addition, USACE added conference year definitions and off-ramps to the code. The Water Resource Simulation Language (WRESL) code for the FMS implementation is shown in detail in Attachment A.1.

2.1.1.1 Downstream compliance flows

According to the State Water Resources Control Board (SWRCB) Decision 893, Reclamation will operate Folsom and Nimbus Dams and Reservoirs to provide the following minimum DCF between Nimbus Dam and the mouth of the American River:

- 250 cubic feet per second (cfs) from January 1 through September 15
- 500 cfs from September 16 through December 31

The DCF were implemented in the 2013 DWR CalSim models; however, USACE made changes to the way the minimum flows are coded in the WCM models. USACE edited the definition for the minimum flow at the mouth of the American River in the *HSt_base.wresl* file by using a value from the lookup table, *HSt_base.table*, based on maintaining flow above 250 cfs in all years to be consistent with the 2008 FMS Report.

2.1.1.2 Minimum Release Requirements

The MRR are based on a sequence of determinations. Three water availability indices are applied during different times of the year, which provides adaptive flexibility in response to changing hydrological and operational conditions: the Four Reservoir Index (FRI), the Sacramento River Index (SRI), and the Impaired Folsom Inflow Index (IFII). The FRI is calculated as the combined end-of-September storage in four reservoirs – Folsom, French Meadows, Union Valley, and Hell Hole reservoirs. The SRI is an index of forecasted water year runoff for the Sacramento River Basin. The IFII is the predicted inflow to Folsom Reservoir. These indices are used as triggers to determine minimum flows, also known as index flows, for the lower American River.

The index flow is initially determined through the appropriate water availability index. During some months, prescriptive adjustments might modify the index flow to determine the final MRR. Without a prescriptive adjustment, the MRR is equal to the index flow.

According to the 2008 FMS Report, discretionary adjustments for water conservation or fish protection may be applied from June through October. If discretionary adjustments are applied, resulting flows are referred to as the adjusted minimum release requirement (adjusted MMR). Discretionary releases are not modeled in CalSim II, but are an integral part of the FMS and, therefore, are acknowledged here.

The MRR and adjusted MRR may be suspended, and the only required flows on the American River would be the DCF during extremely dry condition exceptions. Extremely dry condition exceptions, as defined in the 2008 FMS Report, occur in conference years or off-ramp condition and are described in sections 2.1.5 and 2.1.4, respectively.

The WRESL code and WCM-related modifications implementing the FMS is presented in Attachment A.1. A full discussion of the water availability indices, index flows, prescriptive adjustments, MRR, discretionary adjustments, and adjusted MRR are presented in the 2008 FMS Report.

2.1.2 FMS Implementation Curve

The 2013 DRR implementation of FMS used forecasted impaired inflow to Nimbus as a trigger for the March-September MRR. USACE changed the trigger so that it uses impaired inflow to Folsom (per 2006 FMS) rather than impaired Nimbus inflow. This coding is discussed in Attachment A.1.1.1. The FMS implementation curves are described in detail in the 2008 FMS Report.

2.1.3 Prescriptive Adjustments

USACE revised the coding of prescriptive adjustments to better represent FMS criteria. Prescriptive adjustments for storage operations as described in the 2008 FMS Report: a key revision was an update of the methodology for forecasting end-of-May and end-of-September storage to better implement prescriptive adjustments related to forecasted storage. The coding for this update is discussed in Attachment A.1.2.

2.1.4 Off-Ramp Criteria

According to the FMS, off-ramp criteria, used to reduce flows in the lower American River, are triggered if Folsom Reservoir storage is forecasted to fall below 200 thousand acre-feet (TAF) in the subsequent 12 months. If Folsom Reservoir storage is forecasted to drop below 200 TAF, the MRR are reduced to 250 cfs from January 1 through September 15, and 500 cfs from September 16 through December 31.

The 12-month Folsom Reservoir storage forecast can only be calculated within the current water year (October–September), it cannot be calculated easily across a water year; therefore, USACE was able to partially implement this off-ramp in the FMS code in CalSim II. The WRESL code is presented in Attachment A.1.3.

2.1.5 Conference Year Criteria

Conference years occur when the projected March through November unimpaired inflow to Folsom Reservoir (UIFR) is less than 400 TAF. USACE added an off-ramp for conference years in the WCM CalSim II model. To add the off-ramp, USACE assumed a reasonable forecast for the March through November UIFR would be available in February of each year. If the forecasted UIFR was low enough and a conference year was warranted, USACE assumed a group of American River fisheries and municipal interests would meet with Reclamation to discuss the declaration of conference year. The conference year off-ramp was added to the FMS code starting in February and continuing until the following January. The code for these criteria is detailed in Attachment A.1.4.

2.1.6 Folsom Area-Capacity Curve

USACE updated the area-capacity curve for Folsom Reservoir by editing the lookup table *res_info.table* according to the data provided by Reclamation (2005) and included in Attachment A.1.5.

2.2 Update of Hodge Criteria

The City of Sacramento (City) provides water supply within the City limits and to a small area outside the City limits in the Fruitridge area. The City has existing diversion, treatment, storage, and pumping facilities on the Sacramento and American Rivers. The Sacramento River plant is located just downstream of the confluence with the American River. The E. A. Fairbairn Water Treatment Plant (FWTP) is located near Howe Avenue, about 16 miles downstream from Nimbus Dam.

2.2.1 Hodge Flow Criteria

The Hodge flow criteria are constraints for City diversions based on water year type and flow bypassing the FWTP on the American River. The Hodge flow criteria go into effect when flow in the American River drops below a pre-defined flow called the Hodge flow trigger

The Hodge flow trigger is defined as average monthly flows:

October 15 through February	2,000 cfs
March through June	3,000 cfs
July through October 14	1,750 cfs

When the American River flows bypassing the FWTP are below the Hodge flow trigger, the Hodge flow criteria is implemented. Diversion flows from the FWTP can not exceed the following criteria during the designated months:

January through May	120 cfs
June through August	155 cfs
September	120 cfs
October through December	100 cfs

For example, if flows are below 3,000 cfs in April of any year, the City can not divert more than 120 cfs from the American River at the FWTP.

The City also operates according to additional restrictions on the use of FWTP diversion capacity. In extremely dry years (i.e., years in which unimpaired flow into Folsom Reservoir is less than 400,000 acre-feet), the City will limit its diversions at the FWTP to no greater than 155 cfs and no more than 50,000 acre-feet per water year. Any additional water needs are met by diversions at other locations and/or other sources. This constraint is known as the Hodge year limitation and is only in effect in the future level of demand modeling, since demand is not high enough to warrant this limitation in the existing level of demand.

2.2.2 Implementation

The flow in the lower American River is used as a trigger to implement the Hodge flow restrictions in CalSim II. If the flow in the lower American River is below the Hodge flow trigger, Hodge flow restrictions are activated and FWTP diversions are reduced. In response to this reduction in diversion on the American River, the City diversion on the Sacramento River would increase diversions by the same amount as the American River diversion decrease. The WRESL code for this implementation is explained in more detailed in Attachment A.2.

2.3 Coordinated Operating Agreement Adjustments

2.3.1 Coordinated Operating Agreement

In 1986 the Coordinated Operating Agreement between the U.S. Government and the State of California determined the respective water supplies of the Central Valley Project (CVP) and the SWP while allowing for a negotiated sharing of Sacramento-San Joaquin Delta excess outflows and the fulfillment of in-basin obligations between the two projects.

2.3.2 Feather River Rice Decomposition

Rice farmers divert water from the Thermalito Afterbay for rice straw decomposition, in addition to irrigation. The flows from this diversion return to the Sacramento River above Verona. The rice decomposition water was not included in prior DWR CalSim II releases (2011 or 2013 DRR). This water diversion is about 160 TAF/year, delivered between October and January. Since it is a relatively large diversion and it affects CVP/SWP Coordinated Operating Agreement balance, USACE added it to the WCM CalSim II model.

A diversion node and a return flow node were created, and the continuity equations were updated to maintain the basin water balance. WRESL code was added to describe the timing and volume of the rice decomposition water, as well as the storage changes resulting from the movement of this water. The WRESL code for this implementation is explained in Attachment A.5.

2.4 Balancing of Shasta and Folsom Reservoirs

2.4.1 The Purpose of Balancing

Shasta Reservoir and Folsom Reservoir are operated in tandem to meet mutual objectives in the Delta, such as flow requirements, water quality requirements, and export demands along with their individual responsibilities of meeting water supply demands, minimum flow requirements, and temperature objectives on the Sacramento and American Rivers. CalSim II simulates releases from these reservoirs using a system of weights and priorities to balance the draw down of both reservoirs to meet all the needs of the system but without excessively reducing storage in one at the expense of the other.

2.4.2 Modification to Navigation Control Point Weight

Historical commerce on the Sacramento River resulted in the requirement to maintain a minimum flow in the Sacramento River; while there is no longer any commercial traffic on the Sacramento River, Sacramento River diverters set their pump intakes based on the historical minimum flow, and the CVP continues to maintain 5,000 cfs at the navigation control point, Wilkins Slough, to facilitate diversions. In CalSim II, the file called *ncp_relax.wresl* is used to balance the draw down in Shasta and Folsom Reservoirs. A penalty is put on the variable C129_EXC when Shasta storage is greater than 1,900 TAF. This is designed to shift releases for Delta requirements to Folsom when Shasta is low because Folsom has greater refill capacity. However, water year 1992 in the 2013 DRR CalSim II model, Folsom Reservoir storage is drawn down too far (almost to dead pool) when Shasta Reservoir storage is 1,429 TAF. USACE and Reclamation determined this imbalance in storage was too extreme and the reservoir balancing needed adjustment. USACE, in consultation with Reclamation, changed the penalty on the variable C129_EXC from 10 to 3, to create a more-reasonable reservoir storage balance. This change does not notably affect any other year within the period of record.

2.5 Modifications to S8Level5

S8Level5 is a state variable that defines a regulatory or operational (rather than physical) maximum end-of-month storage for Folsom Reservoir. S8Level5 varies monthly and is defined in the input DSS file. CalSim II always releases adequate flow to ensure storage does not exceed that month's S8Level5 volume.

2.5.1 The Role of S8Level5

From October through May, S8Level5 represents the end-of-month flood reservation for Folsom Reservoir. During those months, reservoir storage is not allowed to exceed the volume identified in S8Level5 time series.

2.5.2 Modification of September values

USACE changed the end-of-September value of S8Level5 from 650 TAF to 760 TAF. The 2013 DRR version of CalSim II used a September value of 650 TAF. This caused a large release from Folsom Reservoir that could be used to improve fisheries (spawning) flows in the fall. With a September

S8Level5 value of 760 TAF (shown in Figure 2-1), there is a gradual increase in fall releases (as demonstrated in Figure 2-2) compared to a large fluctuation between September and October (also seen in Figure 2-2) resulting from a S8Level5 version of 650 TAF. This gradual increase in fall flows creates a more favorable condition for the fishery. With the new value in September, lower American River flows are less variable in the late summer.

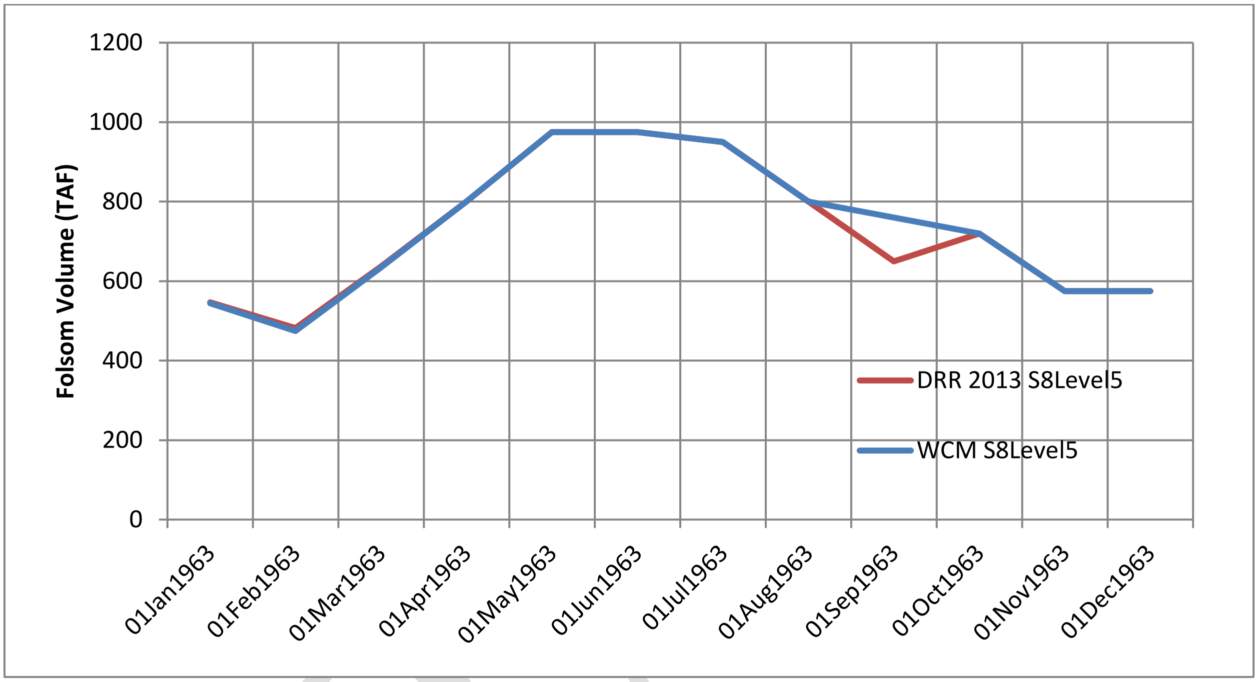


Figure 2-1. Comparison of Folsom Reservoir End-of-Month Flood Reservation Curve Volumes for the 2013 DRR and the Water Control Manual CalSim II Simulations.

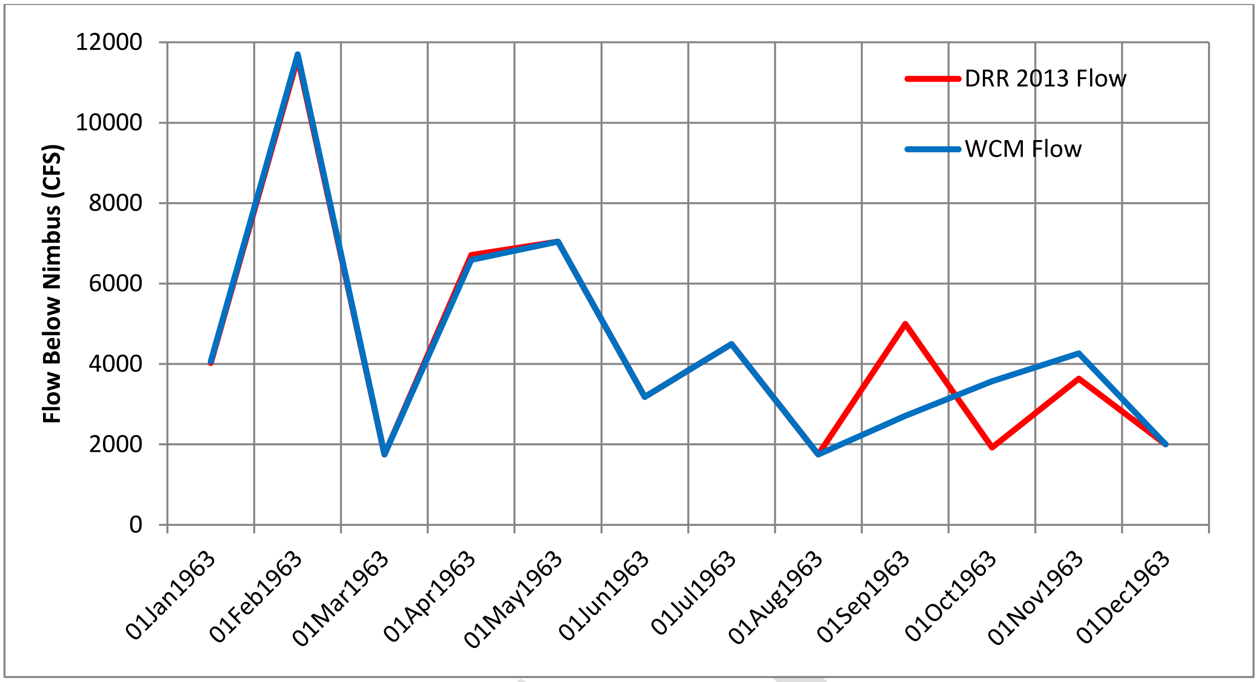


Figure 2-2. Simulated American River flow below Nimbus Dam demonstrating the effect of the end-of-September S8Level5 value between the Water Control Manual and 2013 DRR CalSim II Simulations.

2.6 EBMUD Demands

2.6.1 EBMUD Diversion at Freeport

The East Bay Municipal Utility District (EBMUD) has a water service contract with the CVP. The contracted water is available when storage in EBMUD's Mokelumne River system is less than an agreed-upon volume. CVP water supplies are delivered to EBMUD at the Freeport Regional Water Project (FRWP) with a 155 cfs maximum EBMUD diversion capacity. The CVP-EBMUD contract includes a three-year delivery cap of 165 TAF and a maximum single-year delivery of 133 TAF.

2.6.2 Modification of Freeport demands

The 2013 DRR version of CalSim II contained a node from which to deliver water to EBMUD; however, no deliveries were being made in the existing level of demand. USACE added a time series of diversions provided by EBMUD, so EBMUD diversions from FRWP were consistent with other EBMUD analyses.

2.7 American River Demands

USACE discovered an error in the representation of the City demands in the 2013 DRR. The demand time series was updated; however, the demand patterns remained the same as those in the 2013 DRR CalSim model. Table 1-1 provides a comparison between the water demands in 2013 DRR and the 2006 FMS, the Water Forum's Existing Condition.

2.7.1 Description of representation all American River Purveyor Demands

Table 2-1 shows the American River purveyor demands in the 2013 DRR and WCM CalSim II models.

Table 2-1. Comparison of Annual American River Purveyor Demands in the 2013 DRR Build and Water Control Manual Builds

Description	CalSim II Node	2013 DRR Existing Condition	Water Control Manual Existing Condition	2013 DRR Future Condition	WCM Future Condition
UPSTREAM OF FOLSOM RESERVOIR					
Placer County Water Agency (Middle Fork Project)	D300	35,500 AF	Same as 2013 DRR Existing Condition	35,500 AF	65,000 AF
FROM FOLSOM RESERVOIR					
Sacramento Suburban Water District (Placer County Water Agency water right)	D8A	17,000 AF	14,500 AF	29,000 AF	0 AF
City of Folsom	D8B	34,000 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
Water rights		27,000 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
CVP contract		7,000 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
Folsom State Prison	D8C	2,000 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
San Juan Water District (Placer County)	D8D	17,000 AF	Same as 2013 DRR Existing Condition	24,000 AF	25,000 AF
San Juan Water District (Sacramento County)	D8E	44,200 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
Water rights		33,000 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
CVP contract		11,200 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
El Dorado County Water Agency	D8I	4,000 AF	0 AF	15,000 AF	Same as 2013 DRR Future Condition
El Dorado Irrigation District	D8F	7,550 AF	Same as 2013 DRR Existing Condition	24,550 AF	Same as 2013 DRR Future Condition
Water rights		0 AF	Same as 2013 DRR Existing Condition	17,000 AF	Same as 2013 DRR Future Condition
CVP contract		7,550 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
City of Roseville	D8G	37,000 AF	Same as 2013 DRR Existing Condition	62,000 AF	Same as 2013 DRR Future Condition
Water rights		5,000 AF	Same as 2013 DRR Existing Condition	30,000 AF	Same as 2013 DRR Future Condition
CVP contract		32,000 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
Placer County Water Agency (CVP contract)	D8H	0 AF	Same as 2013 DRR Existing Condition	35,000 AF	Same as 2013 DRR Future Condition
FROM FOLSOM SOUTH CANAL					
Southern California Water Co.	D9AA	5,000 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
California Parks and Recreation	D9AB	1,000 AF	Same as 2013 DRR Existing Condition	5,000 AF	Same as 2013 DRR Future Condition
Sacramento Municipal Utility District (SMUD)	D9B	20,000 AF	Same as 2013 DRR Existing Condition	45,000 AF	Same as 2013 DRR Future Condition

Description	CalSim II Node	2013 DRR Existing Condition	Water Control Manual Existing Condition	2013 DRR Future Condition	WCM Future Condition
Water rights		15,000 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
CVP contract		5,000 AF	Same as 2013 DRR Existing Condition	30,000 AF	Same as 2013 DRR Future Condition
FROM BELOW NIMBUS DAM TO H STREET					
Sacramento Suburban Water District	D302B	0 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
Carmichael Water District	D302C	12,000 AF	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition	Same as 2013 DRR Existing Condition
City of Sacramento	D302A	58,000 AF	69,200 AF	230,000 AF	Same as 2013 DRR Future Condition
SACRAMENTO RIVER BELOW THE AMERICAN RIVER CONFLUENCE					
City of Sacramento	D167A	62,300 AF	131,500 AF	230,000 AF	311,800 AF
Sacramento County Water Agency					
City of Sacramento Sacramento River diversion	D167B	15,000 AF	Same as 2013 DRR Existing Condition	30,000 AF	Same as 2013 DRR Future Condition
Freeport CVP contract	D168C	0 AF	Same as 2013 DRR Existing Condition	varied	Same as 2013 DRR Future Condition
Other water rights[2]	D168C	0 AF	Same as 2013 DRR Existing Condition	varied	Same as 2013 DRR Future Condition
EBMUD[3]	ALLOC_D168B_EBMUD	0 AF	varied	varied	varied

1. Sacramento Suburban Water District receives 964 AF from the City of Sacramento. This water is included in the total City demand.

2. "Other" water, derived from transfers and/or other appropriated water, averaging 14,800 AF annually, but varying according to remaining unmet demand.

3. EBMUD demand is a dry year supply only. A maximum of 133,000 AF and a three-year maximum of 165,000 AF with a 155 cfs diversion capacity limitation at FRWP.

2.7.2 Placer County Water Agency

The demand for Placer County Water Agency (PCWA) increases from 35.5 TAF to 65 TAF in the WCM Future Condition scenario. This increased demand accounts for the addition of Sacramento Suburban Water District's (SSWD) demand of 29 TAF at PCWA's American River pump station (node D300), which is discussed in Section 2.7.3.

2.7.3 Sacramento Suburban Water District Demands

SSWD demand was changed from 29 TAF in the 2013 DRR Future Condition to zero in the WCM Future Condition scenario. This demand was moved to the PCWA pump station (D300) to account for the entire PCWA Middle Fork Project water volume of 120 TAF (as agreed upon between PCWA and Reclamation) because SSWD does not have a long-term Warren Act contract with Reclamation to receive this water from Folsom Reservoir.

SSWD's diversion from Folsom Reservoir in the WCM Existing Condition scenario is 14.5 TAF per year in accordance with SSWD's current Warren Act contract. This was reduced from 17 TAF that was included in the 2013 DRR Existing Condition.

2.7.4 San Juan Water District

The demand for the San Juan Water District (SJWD) was increased from 24 TAF to 25 TAF in the WCM Future Condition to reflect the delivery agreed upon in their Warren Act contract with Reclamation. SJWD's Warren Act contract provides them 25 TAF of water from PCWA's Middle Fork Project.

2.7.5 City of Sacramento Demands

The 2013 DRR Existing Condition scenario included explicit demand time series for the City's diversion facilities on the American and Sacramento Rivers, the FWTP, and the City's Sacramento River Diversion (Sac River Diversion), respectively. The 2013 DRR Future Condition included a coding revision, further described in Attachment A.2, to better simulate coordinated operations between the two diversions. The revised diversion logic was copied into the WCM Existing Condition scenario and the demand representation was modified.

The revised coding in the 2013 DRR Future Condition model allowed the Fairbairn demand volume to be combined with the Sac River Diversion volume. The revised Sac River Diversion volume in the input time series was increased by the Fairbairn demand volume, and the revised code directed the Sacramento River Plant to divert the difference between the combined demand and the Fairbairn diversion. This allowed for any shortages in Fairbairn diversions, due to Hodge criteria restrictions or otherwise, to be diverted at the Sac River Plant.

The WCM modeling also included updated demand volumes for the City to reflect a better representation of their anticipated demand.

2.7.6 El Dorado County

El Dorado County's CVP municipal and industrial demands were reduced to zero in WCM Existing Condition because the demand was incorrect. In the WCM Future Condition, their demand is 15 TAF to reflect their Warren Act contract that is expected to be finalized by that time.

2.8 Other Demands

2.8.1 CVP North of Delta Contractor Demands

The North-of-Delta CVP contractor demands from the 2013 DRR Future Condition were implemented in the WCM Update existing and future level of development models to reflect recent requests for their full contract amounts.

2.8.2 CVP Refuge Demands

The CVP refuge demands from the 2013 DRR Future Condition were implemented in the WCM existing and future level of development models to reflect recent requests for their full amounts.

2.9 VAMP Modification

The Vernalis Adaptive Management Program (VAMP) is a large-scale, long-term (12-year) management program designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Sacramento-San Joaquin Delta by setting minimum flow standards. It is also a scientific experimental program to determine how salmon survival rates change in response to alterations in San Joaquin River flows and Delta exports. VAMP was introduced in 2000 as part of the SWRCB Decision 1641 and is guided by the framework provided in the San Joaquin River Agreement and recognition of the hydrologic conditions within the watershed.

The VAMP provides for a 31-day pulse flow on the San Joaquin River during the months of April and May, along with a corresponding reduction in SWP and CVP Sacramento-San Joaquin Delta exports. The VAMP pulse flow and reduced Delta export are determined based on a forecast of the San Joaquin River flow that would occur during in the spring if the VAMP were not in place. Based upon hydrologic conditions, the target flow in a given year could either be increased to the next higher value (double-step) or the supplemental water requirement could be eliminated entirely (sequential dry-year relaxation). (San Joaquin River Group Authority 2013)

2013 DRR Existing Condition CalSim II model employs a double-step flow standard in place of the previously used single-step standard. This double-step standard was carried forward in the WCM Update model as well.

A double-step flow year occurs when the sum of the numerical indicators (Table 2-2) for the previous year's year-type and current year's forecasted 90 percent exceedance year-type is seven or greater. A sum of seven represents a general recognition of either abundant reservoir storage levels or a high probability of ample runoff. A sequential dry-year relaxation year occurs when the sum of the numerical indicators for the two previous years' year types and the current year's forecasted 90 percent exceedance year-type is four or less, an indication of extended drought conditions.

Under the San Joaquin River Agreement, the maximum amount of supplemental water to be provided to meet VAMP target flows in any given year was 110,000 acre-feet. In a double-step year, the quantity of supplemental water required can be as high as 157,000 acre-feet.

Table 2-2. San Joaquin Valley Water-Year Hydrologic Classification Numerical Indicators Used in VAMP

Water Year Hydrologic Classification	VAMP Numerical Indicator
Wet	5
Below Normal	4
Critical	3
Above Normal	2
Dry	1

2.10 Addition of CVP/SWP Facilities

Four pieces of infrastructure were added to CalSim II for the WCM project. They are described in the following sections.

2.10.1 Delta Water Supply Project

The WCM model includes the new intake and pump station that will divert water from the San Joaquin River through miles of underground pipeline to the City of Stockton's 30 million gallons per day (mgd) water treatment plant. Code for the Delta Water Supply Project existed in the 2013 DRR CalSim II model but was not yet turned on. USACE switched the code on in the WCM modeling by including the WRESL files containing the Delta Water Supply Project code and excluding the WRESL files that do not contain the Delta Water Supply Project code.

2.10.2 South Bay Aqueduct Enlargement Project

The South Bay Aqueduct was the first water delivery system completed under the SWP and has been conveying water to Alameda County since 1962 and to Santa Clara County since 1965. It was designed for a capacity of 300 cfs. Recent flow tests and studies have shown that the actual capacity is 270 cfs. The South Bay Aqueduct Enlargement Project purpose is to increase the capacity of the South Bay Aqueduct to 430 cfs to meet future water demands and provide operational flexibility to reduce State Water Project peak power consumption (DWR 2014). USACE implemented the capacity increase in CalSim II by changing transfer capacity limits in the *common/System/SystemTables_All/Channel_Table.wresl* file and the *common/ReOperations/Transfers/Transfers_Capacity_Limits.wresl* file in both Existing and Future Condition models.

2.10.3 Freeport Regional Water Project

The water intake facility and pumping plant for the FRWP are located on the Sacramento River, upstream of the town of Freeport, and will divert water and pump it through pipelines to other FRWP facilities. Water from the FRWP will go to Sacramento County Water District, Contra Costa Water District, and EBMUD. In the 2013 DRR CalSim II model for Existing and Future Condition, the demand for Contra Costa Water District is set to zero. The total CVP demand for Sacramento County Water District is delivered at FRWP, as well as some Fazio water if it cannot be delivered at the Sac River Plant. EBMUD will use 100 mgd of water from the FRWP as a supplemental water source in dry years. EBMUD has an adequate water supply during normal and wet years, but must ration water during dry years. The supplemental water source from the FRWP will help EBMUD reduce rationing during dry years.

In the WCM Update CalSim II model, demands for EBMUD and Sacramento County Water District are met at the node (D168) that represents the FRWP. The EBMUD demands have been updated according to data provided by EBMUD.

2.10.4 Fremont Weir Notch

The Freemont Weir controls the release of water into the Yolo Bypass which is about seven feet high and a mile long. The Bay-Delta Conservation Plan includes modifications of the Freemont Weir, including the creation of a gated channel to control the timing, frequency, and duration of Yolo Bypass inundation from the Fremont Weir.

The 2013 DRR CalSim II models do not include the notch in the Fremont Weir. However, because implementation of the Fremont Weir project is expected to be after 2016, it was included in the Future Condition but not the Existing Condition.

In CalSim II, *gate11flow* is the variable that represents the flow through this notch in the weir. USACE added the minimum flow through the notch by commenting out the definition of *gate11flow* in the *common\hydrology\WEIRS\ weir_steps_dailyops.wresl* file to the Future Condition model. Furthermore, USACE added the file *common\hydrology\WEIRS\weir_steps_monthops.wresl* to add the proposed notch operation of Fremont Weir into the Future Condition of the WCM model. Lastly, the lookup table, *CONV\Run\Lookup\FRENotch_OnOff.table*, determines whether or not the proposed Bay-Delta Conservation Plan notch operations are turned on or off for each day of a year. The switches are turned on for the daily operation of the Bay-Delta Conservation Plan notch between December and April of each year in the Future Condition of the WCM model.

3.0 WCM Modifications for WCM Alternatives

USACE is evaluating scenarios with three different water control diagrams (WCD) for this project.

1. Fixed-400 water control diagram developed by USACE and published in the December 1987 Water Control Manual for the Folsom Dam (USACE 1987), as shown in Figure A.6-1.
2. Variable 400-670 water control diagram developed by the Sacramento Area Flood Control Agency (SAFCA) and published in the 1994 SAFCA Folsom Dam Interim Reoperation EIR/Environmental Assessment (SAFCA and U.S. Bureau of Reclamation 1994) and currently being used for flood operation of the Folsom Lake, shown in Figure A.6-2.
3. Variable 400-600 water control diagram currently under development by USACE.

3.1 CEQA Existing Condition (E504) and NEPA No Action (J604)

The WCM Existing Condition CalSim II run represents the WCM Alternative E504, the California Environmental Quality Act (CEQA) Existing Condition. The WCM Future Condition CalSim II run represents the WCM Alternative J604, the National Environmental Policy Act (NEPA) No Action Alternative. The differences between the two runs are described in earlier sections of this report. Both the Existing Condition and No Action Alternative are based on the SAFCA's 400-670 WCD.

3.2 Modifications for Fixed-400 Run

3.2.1 How S8level Values Were Determined

USACE computed Folsom Lake top-of-conservation-pool storage volume using the Fixed-400 WCD (see Figure A.6-1). The fixed-400 WCD specifies flood control reservation in the reservoir for each month from October through May. For the months of October through January and for May, the flood control reservation is same for each year. For February, March, and April, flood control reservation varies from year to year depending on the basin wetness index.

The basin wetness index is effectively the cumulative basin average precipitation, with a built-in decay factor as described in the manual. The basin precipitation is weighted based on measurements at four precipitation gages. USACE has computed the index since water year 1989, when it came into use. For this project, basin wetness series was extended back to 1922. For periods in which the original four gages were not available, USACE adjusted the weighting scheme to allow computation of the basin wetness series using suitable replacement gages as follows:

1922 - 1954: Four gages (Auburn, Gold Run, Placerville, and Twin Lakes) were used to calculate the index using the current method (BNAP/STAP * Total Precipitation + 0.97 * previous day's parameter). For the period of overlap with the archived index, a regression was calculated between the substitute and the current index. By applying the slope and intercept to the surrogate index, current index using a different set of gages was estimated.

1954 - 1979: For this period, three of the gages (Blue Canyon, Georgetown, and Pacific House) specified in the current water control manual are available. These three were used, and the current formula was adjusted to make up for the unavailable data for the fourth site (Sly Park).

1980 - 1988: All four of the gages currently used for calculating the index are available, so current snap values were used, and the index was calculated. The archive does not include the parameter for this period.

1989 - Current: Beginning in water year 1989, the flood control parameter is available in the archive database.

Since the CalSim model has a monthly time-step, only the values at the end-of-month were used for computing S8level5. Required flood control space in Folsom was computed by HDR using USACE' top-of-conservation-pool storage values. This required flood control space was further subtracted from 975 TAF of maximum Folsom storage in CalSim to come up with the S8level5. Values for S8level4 were adjusted to match S8level5 for the months of November through March and also not to exceed S8level5 for rest of the months. Table 3-1 presents the data used in the Fixed-400 runs. In Addition, there were instances where S8level2 was dropping below 350 TAF in the CEQA/NEPA models whenever S8level5 was dropping below 350 TAF. For the fixed-400 runs, S8level5 does not drop below 350 TAF, so values for S8level2 were updated to 350 TAF for those instances.

Table 3-1. S8level5 and S8level4 Values Used in Fixed-400 Runs

Month	S8level5 from CEQA/NEPA runs	S8level5 used for Fixed-400 runs	S8level4 from CEQA/NEPA runs	S8level4 used for Fixed-400 runs
Oct	720	712	600	unchanged
Nov	Varies from 405 to 575	575	Same as S8level5 for CEQA-NEPA runs	Same as S8level5 for Fixed-400 runs
Dec	Varies from 305 to 575	575		
Jan	Varies from 318 to 575	575		
Feb	Varies from 352 to 575	Varies from 575 to 623		
Mar	Varies from 570 to 675	Varies from 636 to 700		
Apr	800	803	800	unchanged
May	975	974.77	975	974.77
Jun	975	975	600	unchanged
Jul	950	950	600	unchanged
Aug	800	800	600	unchanged
Sep	760	760	600	unchanged

3.3 Modifications for 400-600 Run

3.3.1 How Storage Credit Ratio was Determined

SAFCA's 400-670 WCD (See Figure A.6-2) defines the required flood control reservation in the Folsom Reservoir for the months of October through May. This flood control reservation varies from 400 TAF to 670 TAF, based on available space in the upstream reservoirs (French Meadows, Hell Hole, and Union Valley). The 400-670 WCD assumes that the total creditable flood control transfer space available in the upstream reservoirs can be translated 1:1 to the total creditable control transfer space variable at the Folsom Reservoir. USACE did extensive analysis of the validity of this ratio and found that a ratio of 1:0.905 of upstream credit to Folsom credit was more reasonable in representing this relationship. USACE recommends using this storage credit ratio for the 400-600 WCD.

Table 3-2. Creditable space for 400-600 Runs

Upstream Creditable Space (TAF)	Folsom Credited Space (TAF)	Folsom Total Flood Space (TAF)
0	0	600
221	200	400
Resulting "ratio" is 200/221 = about 0.905.		

3.3.2 How S8level Values were Determined

The S8level5 inputs for the 400-600 runs were developed using the upstream reservoirs' storages derived from the UARM time series in CalSim II and the HEC-ResSim US storage distribution, along with the 1.0:0.905 crediting scheme 400/600 WCD that USACE had developed.

The individual upstream reservoir storages were calculated using the UARM time series from the NEPA No Action CalSim II Model and ratio of upstream reservoirs storages from the J604 HEC-ResSim model. For the water year 2003 when HEC-ResSim upstream reservoir storages were not available, a water-year-type average of all years' storages were computed and used for 2003.

Space available in the upstream reservoir at the end of each month is compared against the maximum creditable space to come up with creditable flood control transfer space in each upstream reservoir. The storage credit ratio of 0.905 is then applied to the total upstream creditable flood control transfer space to compute the flood control transfer space at the Folsom Reservoir. For each of the values in the 82-years series, the flood control reservation is computed by interpolating the values in the 400-600 WCD. The required reservoir storage or the S8level5 is then computed by subtracting this flood control reservation from the 975 TAF of maximum Folsom Reservoir storage in CalSim. A sample calculation is provided in Table 3-3. The 400-600 WCD as developed by USACE is presented in Table 3-4.

In Addition, S8level4 and S8level2 values were also modified in a similar fashion as Fixed-400 WCD runs.

Table 3-3. Sample Calculation of Required Reservoir Storage from 400/600 Water Control Diagram

Reservoir	**Storage on Jan 1 (TAF)**	**Storage at Spillway Crest (TAF)**	**Space Available (TAF)**	**Maximum Creditable Space (TAF)**	**Creditable Flood Control Transfer (TAF)**
French Meadows	41.605	111.605	70	55	55
Hell Hole	82.590	207.590	125	91	91
Union Valley	144.985	224.985	80	75	75
Total creditable **Upstream** flood control transfer space (TAF)					221
Folsom flood control transfer space (TAF)					200
Flood control reservation at Folsom Lake (TAF)					400
Required reservoir storage at Folsom Lake (TAF)					575

Table 3-4. 400-600 WCD Based on 1:0.905 Upstream Credit Ratio

Upstream Credit	0	33,150	110,500	165,750	193,375	221,000
Credit at Folsom Lake	0	30,000	100,000	150,000	175,000	200,000
1-Jan	366,934	396,823	466,823	516,823	541,823	566,934
1-Mar	366,934	396,823	466,823	516,823	541,823	566,934
21-Apr	741,779	741,779	741,779	741,779	741,779	741,779
1-Jun	966,934	966,934	966,934	966,934	966,934	966,934
1-Oct	966,934	966,934	966,934	966,934	966,934	966,934
18-Nov	491,050	514,300	566,800	566,800	566,800	566,800
23-Nov	437,193	466,293	524,293	566,793	566,793	566,793
26-Nov	404,097	433,797	501,797	544,297	566,797	566,797
30-Nov	366,934	396,823	466,823	516,823	541,823	566,934
31-Dec	366,934	396,823	466,823	516,823	541,823	566,934

Note: This WCD presents Folsom Reservoir storage in acre-feet (AF).

ATTACHMENT 1

A.1 Flow Management Standard Implementation

The American River Flow Management Standard (FMS) was updated in the Folsom Dam Water Control Manual (WCM) Update CalSim II models to more accurately reflect the description of the FMS. A number of coding changes were implemented identically in both Existing and Future Condition scenarios; any differences between the Existing and Future Condition model are identified as such. Improvements from the 2013 Delivery Reliability Report (DRR) models include both the interpretation of the Impaired Folsom Inflow Index (IFII) and the prescriptive adjustments. Both were updated to adhere to the Lower American River Flow Management Standard Technical Report (Water Forum 2008). Additionally, the FMS Off-ramp and the Conference Year designation were implemented into the FMS code. These modeling improvements are detailed in the Sections that follow.

A.1.1 Implementation Curves

According to the FMS (Water Forum 2008), index flows, the initial flows below Nimbus Dam are determined by the application of three water availability indices: the Four Reservoir Index (FRI), the Sacramento River Index (SRI), and the IFII. The FRI is calculated as the combined end-of-September storage in four reservoirs – Folsom, French Meadows, Union Valley, and Hell Hole Reservoirs. The SRI is an index of forecasted water year runoff for the Sacramento River Basin. The IFII is the predicted inflow to Folsom Reservoir. USACE made no changes to the FRI or SRI calculations, but the forecasting methodology for the IFII was improved for the WCM models.

A.1.1.1 Impaired Folsom Inflow Index

March through Labor Day index flows are based upon the IFII. The IFII is an index of the forecasted volume of flow into Folsom Reservoir from May through September and is calculated using the U.S. Department of the Interior, Bureau of Reclamation’s (Reclamation) 90 percent exceedance water operations forecast for Folsom Reservoir inflow.

The IFII was selected as the index for the determination of minimum flows for March through September since it is a reasonable surrogate for available water supply and can be reasonably calculated in March.

Figure A.1-1 depicts the IFII implementation curve. If the IFII is greater than or equal to 550 thousand acre-feet (TAF), the index flow will be 1,750 cubic feet per second (cfs). If the IFII is between 375 and 550 TAF, the index flow will be between 800 and 1,750 cfs, proportional to the value of the IFII. If the IFII is less than or equal to 375 TAF, the index flow will be 800 cfs (Water Forum 2008).

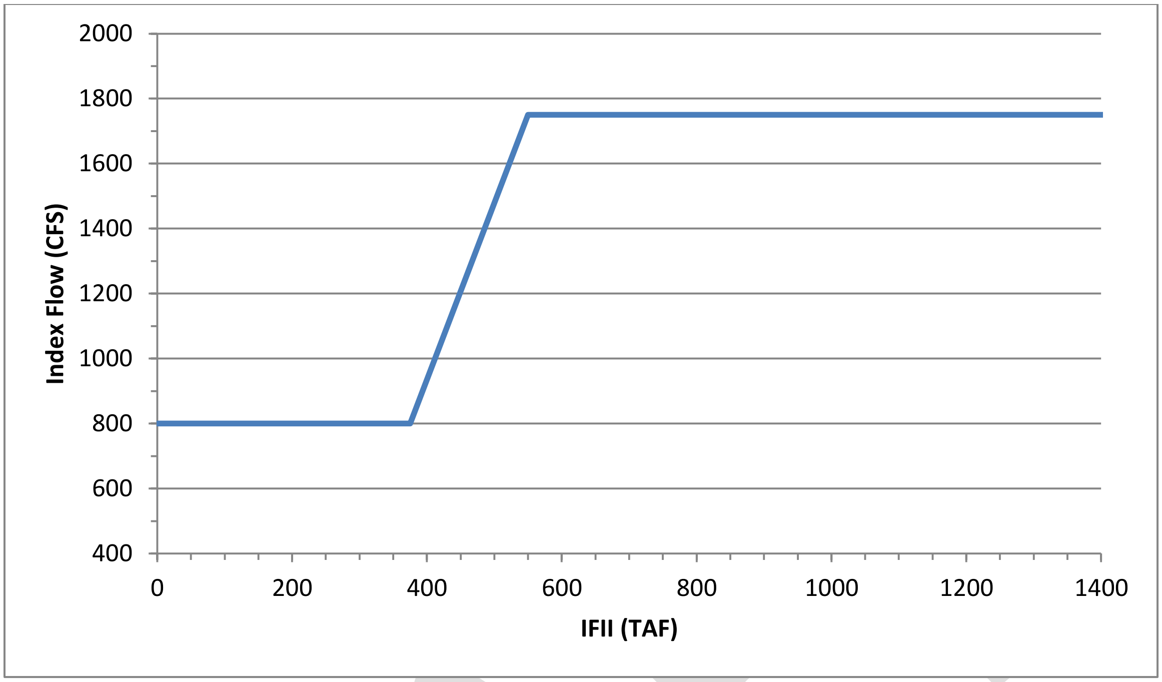


Figure A.1-1. Impaired Folsom Inflow Index Flow for March through Labor Day

The common\NorthOfDelta\American\FMStandard.wresl file contains the code to implement the FMS. In it, the variable *amerFMPTriger*, shown in box A.1.1-1, defines the trigger used to select the index flow. In October though December the trigger is defined by the FRI and is calculated as the Folsom Reservoir storage in the previous September plus the total of up-stream reservoir storage, *UARM*. In January and February, the SRI year type defines the trigger; however, *S8*, Folsom Reservoir storage, is used as a surrogate here but never used to define the index flow for the FMS. In March through September the trigger is defined by the IFII. The definition for the IFII was corrected in the WCM models to be equal to the forecasted inflow to Folsom Reservoir only. The Lake Natoma evaporation and diversions that were included in the calculation of the IFII for the 2013 DRR CalSim II model were removed.

```
                                                                     (A.1.1-1)
define amerFMPTrigger {
  case OctDec {
       condition        month>=OCT .and. month<=DEC
        value           S8(prevSEP) + UARM(prevSEP) }  ! Computes Four Reservoir Index

  case JanFeb {
       condition        month>=JAN .and. month<=FEB
       value            S8(-1) }   ! No need for a trigger in Jan-Feb since SRI year type determines
                                   standard (see code below)
  case MarSep {
       condition        always
        value           AmerFrcstInflow}   ! Computes Impaired Folsom Inflow Index
```

The sum of the inflows arcs I8 and I300 is used to forecast the impaired inflow to Folsom Reservoir for the IFII, as shown in box A.1.1-2, during the months of March through September. Every other month of the year, the IFII is equal to zero.

```
                                                                  (A.1.1-2)
define AmerFrcstInflow {
  case MAR_SEP {
            condition      month >= MAR .and. month <= SEP
            sum(i=-(month-MAY),SEP-month)  I8(i)*cfs_ (i) + I300(i)*cfs_taf(i) }
  case other {
     condition      always
     value          0.0   }
}
```

A.1.1.2. Index Curve "Trigger" Table

The implementation of the index flows is accomplished through the use of a lookup table called FMPTrigger.table (trigger table). All three implementation curves are represented in the trigger table, Table A.1-1, in the months in which they are applied in the FMS. Water years, rather than calendar years, are used in CalSim II: month 1 is October. In the WCM CalSim II models, the trigger table was updated in two ways: 1) the D-893 basement was excluded because D-893 requirement was separately added to the models in the HSt_base.wresl file; and 2) the IFII index triggers (March to September, water year months 6 to 12) were updated so that they represented the correct IFII implementation curves for the FMS. These changes are shown in Table A.1-1 where the trigger tables from 2013 DRR and WCM are shown side by side.

Table A.1-1. Comparison of the Trigger Table from 2013 DRR and the Same Table from WCM Update

2013 DRR Trigger Table			WCM Updated Trigger Table		
Month	Trigger	FMPFlow	Month	Trigger	FMPFlow
1	0	500	1	0	800
1	300	500	1	600	800
1	301	800	1	746	1750
1	600	800	1	796	1750
1	746	1750	1	848	2000
1	796	1750	1	9000	2000
1	848	2000			
1	9000	2000			
2	0	500	2	0	800
2	300	500	2	600	800
2	301	800	2	746	1750
2	600	800	2	796	1750
2	746	1750	2	848	2000
2	796	1750	2	9000	2000
2	848	2000			
2	9000	2000			
3	0	500	3	0	800
3	300	500	3	600	800
3	301	800	3	746	1750
3	600	800	3	796	1750
3	746	1750	3	848	2000

2013 DRR Trigger Table				WCM Updated Trigger Table		
3	796	1750		3	9000	2000
3	848	2000				
3	9000	2000				
4	0	250		4	0	800
4	250	800		4	514	800
4	514	800		4	714	1750
4	714	1750		4	1000	2500
4	1000	2500		4	1770	99999
4	1770	99999				
5	0	250		5	0	800
5	250	800		5	454	800
5	454	800		5	814	1750
5	814	1750		5	1000	2500
5	1000	2500		5	1770	99999
5	1770	99999				
6	0	250		6	0	800
6	100	250		6	375	800
6	101	800		6	550	1750
6	200	800		6	9000	1750
6	400	1750				
6	9000	1750				
7	0	250		7	0	800
7	100	250		7	375	800
7	101	800		7	550	1750
7	200	800		7	9000	1750
7	400	1750				
7	9000	1750				
8	0	250		8	0	800
8	100	250		8	375	800
8	101	800		8	550	1750
8	200	800		8	9000	1750
8	400	1750				
8	9000	1750				
9	0	250		9	0	800
9	100	250		9	375	800
9	101	800		9	550	1750
9	200	800		9	9000	1750
9	400	1750				
9	9000	1750				
10	0	250		10	0	800
10	100	250		10	375	800
10	101	800		10	550	1750
10	200	800		10	9000	1750
10	400	1750				
10	9000	1750				
11	0	250		11	0	800
11	100	250		11	375	800
11	101	800		11	550	1750
11	200	800		11	9000	1750
11	400	1750				
11	9000	1750				

2013 DRR Trigger Table			WCM Updated Trigger Table		
12	0	375	12	0	800
12	100	375	12	375	800
12	101	800	12	550	1750
12	200	800	12	9000	1750
12	400	1750			
12	9000	1750			

A.1.2 Determination of the Final MRR

The index flows are calculated as described in Section A.1.1 and the resultant variable, a temporary minimum release requirement (MRR) is called *minFMPAmerTmp*. The prescriptive adjustments are applied to the temporary MRR to create the final MRR in a multi-case definition for the variable *minflowFMPAmer* in the file FMStandard.WRESL. At the end of the file, the minimum in-stream flow below Nimbus is set equal to *minflowFMPAmer*. The cases that define the conference years, off-ramp and prescriptive adjustments are described in the following text and equations.

The CalSim II definition of *minflowFMPAmer*, the final MRR, begins by implementing, if applicable, the conference year and the off-ramp. These cases are shown in box A.1.2-1. If the unimpaired inflow to Folsom Reservoir from March to November (*UIFR_Yr*) is less than 400 TAF, then a conference year is implemented and flows are equal to D893 minimum flows (further described in Section A.1.3). If Folsom Reservoir storage (*S8min*) is forecast to be equal to or below 200 TAF in any of the forthcoming 12 months, an off-ramp is implemented and flows are equal to D893 minimum flows (further described in Section A.1.4).

(A.1.2-1)

```
define minflowFMPAmer {
        case confyr {
                condition   UIFR_Yr <= 400
                value       D893min  }
        case offRamp {
                condition   S8min <= 200.0
                value       D893min }
```

The FMS implementation begins in October, the first month of the water year. WRESL code is interpreted within CalSim II in the order it is written, so the MRR for October maximum flows is introduced after the determination of both conference and off-ramp years. When the FRI-based index flows (*minFMPAmerTmp*) for October are higher than 1,500 cfs, the MRR is capped at 1,500 cfs, as shown in box A.1.2-2.

(A.1.2-2)

```
    case OctMax {
            condition   month==OCT .and. minFMPAmerTmp > 1500.
            value       1500. }}
```

Spawning Flow Progression Prescriptive Adjustment

As part of the FMS, a prescriptive adjustment to the FRI-based index flows, referred to as the Chinook salmon spawning flow progression, is implemented during November, if the October through December FRI-based index flows are higher than 1,500 cfs.

The Chinook salmon spawning flow progression consists of two incremental step increases in flows. The first step (scheduled to occur on November 2) increases lower American River flows from 1,500 cfs up to the index flow minus 250 cfs. Therefore, the first-step increase will not occur unless the index flow is greater than 1,750 cfs. The second-step increase in flow occurs seven days after the first step and increases lower American River flows to the index flow.

If the index flow is 1,500 cfs or less, no spawning flow prescriptive adjustment is implemented, and the MRR is equal to the index flow and will be implemented from October 1 through December 31.

If a spawning flow progression prescriptive adjustment is implemented, then the MRR is equal to the FRI-based index flow for October, the spawning flow progression-adjusted index flows for November, and the FRI-based index flow for December (Water Forum 2008).

The equation in box A.1.2-3 shows the November maximum MRR. If the index flow (*minFMPAmerTmp)* is greater than or equal to 2,000 cfs, the spawning flow progression is implemented to bring the flows up to 2,000 cfs. Since CalSim II is a monthly time step, USACE used an average of all the daily flows during the spawning flow progression.

```
                                                                  (A.1.2-3)
case NovMax {
        condition   month==NOV .and. minFMPAmerTmp >= 2000.
        value       ((1500.*1.) + (1750.*7.) + (2000.*22.))/30. }
```

If the index flow is less than or equal to 1,500 cfs in October, then the MRR is equal to the FRI-based index flow as shown in box A.1.2-4.

```
                                                                  (A.1.2-4)
case OctMin {
        condition   month>=OCT .and. month<=DEC .and. minFMPAmerTmp <= 1500.
        value       (minFMPAmerTmp) }
```

The MRR is the index flow in December, if the index flow is greater than 1,500 cfs, as shown in box A.1.2-5.

```
                                                                    (A.1.2-5)
   case DecOther {
                condition    month==DEC .and. minFMPAmerTmp > 1500.
                value        max(minFMPAmerTmp, 1500.)}
```

If the index flow is greater than 1,500 cfs in November, the spawning flow progression prescriptive adjustment would be in effect. Since CalSim II operates in a monthly time step, an average of the daily flows is used during the spawning flow progression, as shown in box A.1.2-6. The spawning flow progression starts on the second day of November; therefore, there is one day with a flow of 1,500 cfs. For the next 7 days, the flows are either the index flow (*minFMPAmerTmp*) minus 250 cfs or 1,500 cfs, whichever is higher. Finally, for the remaining 22 days of the month, flows are either the index flows or 1,500 cfs, whichever is higher.

```
                                                                    (A.1.2-6)
    case NovOther {
                condition    month==NOV .and. minFMPAmerTmp > 1500.
                value        ((1500.*1.) + (max(minFMPAmerTmp - 250., 1500.)* 7.) +
                             (max(minFMPAmerTmp, 1500.)*22.)) / 30. }
```

January and February FMS flows, shown in box A.1.2-7, are based on the SRI. If the SRI in January indicates a critically dry year and the December MRR is greater than 800 cfs, then the January MRR is 85 percent of the December MRR. In February, the same condition applies; if the SRI is critical and the January MRR was greater than or equal to 800 cfs, then the February MRR is 85 percent of the January MRR.

```
                                                                    (A.1.2-7)
    case JanFebC {
        condition      month>=JAN .and. month<=FEB .and. sri_ytp == 5 .and. C9_fmp_mif(-1) >= 800.
        value          max(800., min(1750., (0.85 * C9_fmp_mif(-1)))) }
```

Box A.1.2-8 continues to describe the FMS for January. If the SRI indicates a below normal or dry year, and December's Folsom Reservoir storage was greater than 300 TAF, then the MRR is December's MRR; however, it cannot be greater than 1,750 cfs. If January's SRI is above normal or wet, the MRR is 1,750 cfs.

```
                                                            (A.1.2-8)
      case JanDBN {
             condition     month==JAN .and. S8(-1)>=300. .and. sri_ytp >= 3
             value         max(800., min(1750.,C9_fmp_mif(-1))) }
      case JanANW {
             condition     month==JAN .and. S8(-1)>=300.  .and. sri_ytp <= 2
             value         1750.}
```

Box A.1.2-9 describes the FMS for February. If the SRI indicates a below normal or dry year, and January's Folsom Reservoir storage was greater than 350 TAF, then the MRR is January's MRR; however, it cannot be greater than 1,750 cfs. If February's SRI is above normal or wet, the MRR is 1,750 cfs.

```
                                                            (A.1.2-9)
      case FebDBN {
             condition     month==FEB .and. S8(-1)>=350. .and. sri_ytp >= 3
             value         max(800., min(1750.,C9_fmp_mif(-1))) }
      case FebANW {
             condition     month==FEB .and. S8(-1)>=350. .and. sri_ytp <= 2
             value         1750.}
```

Prescriptive Adjustments Based on End-of-Month Folsom Reservoir Storages

In addition to the SRI index flows, the January and February MRR can be modified by prescriptive adjustments based on Folsom Reservoir storage at the end of the previous month.

If the end-of-December storage is less than 300 TAF, then the January MRR is 85 percent of the December MRR, or 800 CFS, whichever is higher. Similarly, if the end-of-January Folsom Reservoir storage is less than 350 TAF, then the February MRR is 85 percent of the January MRR, or 800 CFS, whichever is higher. If an end-of-month (December or January) Folsom Reservoir storage-based prescriptive adjustment is implemented, then the MRR are equal to the resultant flows based on this adjustment.

The flood control curve can, on a rare occasion, require that more than 625 TAF of flood control space be maintained in Folsom Reservoir. Therefore, in the equations in boxes A.1.2-10 and A.1.2-11 S8Level5 is used as a constraint. In addition, 0.00001 was added to *S8(-1)* (Folsom Reservoir storage in the previous time step) to ensure January and February flows were correct even under flood control operations in case of rounding errors relating S8Level5 and S8.

```
                                                            (A.1.2-10)
      case JanLoSto {
             condition     month==JAN .and. S8(-1) < 300. .and. S8Level5(-1) > S8(-1) + 0.00001
             value         max(800., min(1750.,0.85 * C9_fmp_mif(-1))) }
```

```
                                                                          (A.1.2-11)
        case FebLoSto {
                condition     month==FEB .and. S8(-1) < 350. .and. S8(-1) + 0.00001 < S8Level5(-1)
                value         max(800., min(1750.,0.85 * C9_fmp_mif(-1))) }
```

Prescriptive Adjustments Based on End-of-May Folsom Reservoir Storage

The FMS includes an end-of-May storage prescriptive adjustment, applied during the March through May period of projected dry hydrologic conditions. The prescriptive adjustment is intended to prevent an end-of-May Folsom Reservoir storage less than 700 TAF.

If an end-of-May Folsom Reservoir storage-based prescriptive adjustment is implemented, then the MRR is equal to the resultant flows based on this adjustment, and the MRR remains the same from March to May.

Equations A.1.2-16 through A.1.2-18 show the implementation of the prescriptive adjustments based on end-of-May Folsom Reservoir storage. The end-of-May Folsom Reservoir storage is forecast using the code in box A.1.2-12, and it is calculated only once, in March. The code uses the reservoir storage of the previous time step (February), adds the forecasted water balance in Folsom Reservoir (*AmerFrcstSpring*), and subtracts the forecast FMS flows below Nimbus Dam (*FMPfrcstMarMay*) for March through May. The variable *AmerFrcstSpring* is the water balance for Folsom from March to May and is shown in box A.1.2-13. It adds the inflows, diversions, and evaporation from Folsom Reservoir. Evaporation (*Evap_Folsm_MarMay)* was calculated for March through May, so it is divided by three in the *AmerFrcstSpring* definition for March.

```
                                                                  (A.1.2-12)
define EOMayForecast {
        case MarForecast {
                condition     month == MAR
                 value        min(975., S8(-1)+AmerFrcstSpring-FMPfrcstMarMay) }
        case other {
                 condition    always
                value         0.   } }
```

```
                                                                  (A.1.2-13)
define AmerFrcstSpring {
  case MARforecast{
         condition     month == MAR
         sum(i=-(month-MAR),MAY-month) I8(i)*cfs_taf(i) + I300(i)*cfs_taf(i)
        - min(dem_D8b_pmi_ann(i), dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol(i)
        - min(dem_D8e_pmi_ann(i), dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS(i)
        - min(dem_D8f_pmi_ann(i), dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor(i)
        - min(dem_D8g_pmi_ann(i), dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose(i)
        - min(dem_D8h_pmi_ann(i), dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa(i)
        - min(dem_D8i_pmi_ann(i), dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo(i)
        - min(dem_D9ab_pmi_ann(i), dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec(i)
        - min(dem_D9b_pmi_ann(i), dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD(i)
```

```
                - min(dem_D300_pmi_ann(i), dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA(i)
                - dem_D8a_wr_ann(i) * perdem_70NRWD(i)
                - dem_D8b_wr_ann(i) * perdem_70Fol(i)
                - dem_D8c_wr_ann(i) * perdem_70FolP(i)
                - dem_D8d_wr_ann(i) * perdem_70SJWDP(i)
                - dem_D8e_wr_ann(i) * perdem_70SJWDS(i)
                - dem_D8f_wr_ann(i) * perdem_70ElDor(i)
                - dem_D8g_wr_ann(i) * perdem_70Rose(i)
                - dem_D9b_wr_ann(i) * perdem_70SMUD(i)
                - dem_D9aa_wr_ann(i) * perdem_70SCWC(i)
                - dem_D300_wr_ann(i) * perdem_70PCWA(i)
                - dem_D9a_pls(i) * cfs_taf(i)
                - (Evap_Folsom_MarMay / 3.)}
    case other {
        condition       always
        value           0.0   }}
```

The equation is box A.1.2-13 assumes perfect foresight for inflows, and diversions will be according to water right demands and CVP allocations. The demands and delivery patterns used in the calculation of *AmerFrctSummer* are listed in the Tables A.1-2 and A.1-3 for reference.

In equation A.1.2-13, the state variable *dem_D300_pmi_ann* is commented out in the Future Condition scenario of the WCM Update model. This variable represents the Folsom Lake demand node for Placer County Water Agency (PCWA). There is currently no intake and there are no plans for an intake to be built; therefore, the Future Condition of 2013 DRR CalSim II commented out this term and USACE similarly removed it for the WCM Update model.

Table A.1-2. Monthly Delivery Pattern for Each Water Purveyor

Delivery Pattern Name in CalSim	Water Purveyor
perdem_70smud	Sacramento Municipal Utility District Folsom South Canal
perdem_70Sac	City of Sacramento
perdem_70Fol	Folsom City
perdem_70SJWDS	San Juan Water District (Sac County)
perdem_70SJWDP	San Juan Water District (Placer County)
perdem_70Rose	Roseville City
perdem_70ArcWD	Arcade Water District
perdem_70NRWD	Northridge Water District
perdem_70Carm	Carmichael Water District
perdem_70PCWA	Placer County Water Agency
perdem_70FolP	Folsom Prison
perdem_70ElDor	El Dorado Irrigation District
perdem_70ElDorCo	El Dorado County Water Agency
perdem_70CARec	CA Parks & Recreation

Delivery Pattern Name in CalSim	Water Purveyor
perdem_70SCWC	SCWC/ACWC
perdem_70SCWA	Sac County Water Agency

Table A.1-3. Annual Demands on the American River

Annual Demand Name in CalSim	Water Purveyor
dem_D300_pmi_ann { 'TAF'}	PCWA (American Pump Station above Folsom)
dem_D300_wr_ann { 'TAF'}	PCWA (American Pump Station above Folsom)
dem_D8a_wr_ann {TAF'}	Sac Suburban (American)
dem_D8b_pmi_ann {'TAF'}	Folsom City
dem_D8b_wr_ann {TAF'}	Folsom City
dem_D8c_wr_ann {TAF'}	Folsom Prison
dem_D8d_wr_ann {TAF'}	San Juan Water District (Placer County)
dem_D8e_pmi_ann {'TAF'}	San Juan Water District (Sac County)
dem_D8e_wr_ann {TAF'}	San Juan Water District (Sac County)
dem_D8f_pmi_ann {'TAF'}	El Dorado Irrigation District
dem_D8f_wr_ann {TAF'}	El Dorado Irrigation District
dem_D8g_pmi_ann {TAF'}	Roseville City (American)
dem_D8g_wr_ann {TAF'}	Roseville City (American)
dem_D8h_pmi_ann { 'TAF'}	PCWA at Folsom
dem_D8i_pmi_ann { 'TAF'}	El Dorado County PL 101514
dem_D9aa_wr_ann { TAF'}	SCWC/ACWC
dem_D9ab_pmi_ann s {'TAF'}	Cal Parks & Recreation
dem_D9b_pmi_ann {'TAF'}	Sacramento Municipal Utility District Folsom South Canal
dem_D9b_wr_ann {'TAF'}	Sacramento Municipal Utility District Folsom South Canal

Note: demands with “pmi” in the name are Central Valley Project demands whereas demands with “wr” in the name are water right demands.

The forecast MRR from March to May, *FMPfrcstMarMay*, uses the FMS index flows to predict the MRR in order to forecast storage in Folsom Reservoir in the equation in box A.1.2-12. As shown in box A.1.2-14, *FMPfrcstMarMay* is multiplied by 92 to reflect the 92 days between March 1 and May 31 and the MRR forecast is converted from cfs to TAF.

```
                                                            A.1.2-14
define FMPfrcstMarMay {
             value         minFMPAmerTmp*(92.*1.9835/1000.)}
```

Folsom evaporation is estimated in the equation in box A.1.2-15 and used to forecast storage in Folsom Reservoir in the equation in box A.1.2-12. This definition was carried forward from the 2013 DRR CalSim II models. The evaporation forecast is based on average relations between storage in a prior month and evaporation. The forecast was generated using CalSim II output.

```
                                                                    A.1.2-15
define Evap_Folsm_MarMay {
        case MAR {
                condition       month == MAR
                value           0.026 * S8(-1)}
        case other {
                condition       always
                value           0.0   }
}
```

Before the end-of-May Folsom Reservoir storage prescriptive adjustment is implemented, USACE included code to discontinue the off-ramp (see Section A.1.3) in March by setting flows to the previous month's MRR or the index flow for the current time step, whichever is higher, if the previous month's flow was equal to the required D893 flows. Without this adjustment, it is possible that the off-ramp flows would be continued without off-ramp conditions.

```
                                                                    (A.1.2-16)
        case MarLowNoOffRamp{
                condition       month==MAR .and.  EOMayForecast < 700. .and.
                                C9_fmp_mif(-1) == D893min
                value           max(C9_fmp_mif(-1), minFMPAmerTmp)}
```

In the calculation of the March MRR, the end-of-May Folsom Reservoir storage prescriptive adjustment takes place if the end-of-May Folsom Reservoir storage forecast, *EOMayForecast*, (box A.1.2-14) is less than 700 TAF. When Folsom Reservoir storage is forecast to be less than 700 TAF at the end of May, then either the IFII-based index flow or the MRR from the previous time step, whichever is less, is used as the MRR in March (A.1.2-17).

```
                                                                    (A.1.2-17)
        case MarLow {
                condition       month==MAR .and.  EOMayForecast < 700.
                value           min(minFMPAmerTmp, C9_fmp_mif(-1)) }
```

If the end-of-May Folsom Reservoir storage forecast is greater than or equal to 700 TAF, the March MRR is equal to the index flow (the IFFI-based index flow) as shown in box A.1.2-18.

```
                                                                    (A.1.2-18)
        case MarOther {
                condition       month==MAR .and. EOMayForecast >= 700.
                value           minFMPAmerTmp }
```

Before the April and May MRR are calculated, USACE included code to discontinue the off-ramp (see Section A.1.3) in April and May, by setting flows to the previous month's MRR or the index flow for the current time step, whichever is higher, if the previous month's flow was equal to the required D893 flows (A.1.2-19).

```
                                                                        (A.1.2-19)
        case AprMayNoOffRamp{
                condition     month>=APR .and. month<=MAY .and. C9_fmp_mif(-1) == D893min
                value         max(C9_fmp_mif(-1), minFMPAmerTmp)}
```

In April and May, USACE used the flow that was determined for March, whether it was the IFII-based index flow or the end-of-May Folsom Reservoir storage prescriptive adjustment. The code, as shown in A.1.2-20, calls the MRR in the previous time so that the March flows are repeated for both April and May.

```
                                                                        (A.1.2-20)
        case APRMay {
                condition     month>=APR .and. month<=MAY
                value        C9_fmp_mif(-1)}
```

PRESCRIPTIVE ADJUSTMENT BASED ON END-OF-SEPTEMBER FOLSOM RESERVOIR STORAGE

The FMS includes an end-of-September storage prescriptive adjustment that is applied to releases in June through September when hydrologic conditions are predicted to be exceptionally dry and Folsom Reservoir storage is predicted to drop below 300 TAF. This adjustment is intended to avoid storage and cold water pool depletion in Folsom Reservoir and have adequate water supply to meet summer and fall lower American River flow requirements and water temperature objectives. The end-of-September storage forecast for Folsom Reservoir is a key component of the implementation of this prescriptive adjustment as it determines whether or not this prescriptive adjustment is applied.

Reclamation forecasts the end-of-September storage in Folsom Reservoir by June 1 of each year. This determines whether the original IFII index flow, or a June through September storage-based flow is applied to the June through September period. The June through September storage-based flow is the flow for each month that would result in an end-of-September storage of 300 TAF in Folsom Reservoir.

The June through September storage-based flow is calculated by taking into account: (1) Folsom Reservoir end-of-May storage; (2) the forecasted June through September Folsom Reservoir inflow, diversions, and evaporation; (3) the forecasted June through September Folsom South Canal diversions; and (4) the forecasted MRR from Nimbus Dam.

The volume of the forecasted FMS flows for June through September are calculated in CalSim II using the code shown in box A.1.2-21 where minFMPAmerTemp is the Index Flow.

```
                                                                    (A.1.2-21)
define FMPfrcstJunSep {
            value minFMPAmerTmp*(122.*1.9835/1000.)}
```

The inflow, diversions, and evaporation from Folsom Reservoir are represented by the variable *AmerFrctSummer*, which is calculated by the code shown below in box A.1.2-22. It computes the forecasted Folsom inflow minus the diversions from Folsom Reservoir and Folsom South Canal and the evaporation from Folsom Lake during June through September of each year.

In equation A.1.2-22, the state variable *dem_D300_pmi_ann* is commented out in the Future Condition of the WCM Update CalSim II model. This is a Folsom Lake demand node for PCWA. There is currently no intake and there are no plans for an intake to be built; therefore, the Future Condition of 2013 DRR CalSim II commented out this term and USACE carried it through to the WCM Update model.

```
                                                                    (A.1.2-22)
define AmerFrcstSummer {
  case JUN_SEP {
        condition     month == JUN
        sum(i=-(month-JUN),SEP-month) I8(i)*cfs_taf(i) + I300(i)*cfs_taf(i)
       - min(dem_D8b_pmi_ann(i), dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol(i)
       - min(dem_D8e_pmi_ann(i), dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS(i)
       - min(dem_D8f_pmi_ann(i), dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor(i)
       - min(dem_D8g_pmi_ann(i), dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose(i)
       - min(dem_D8h_pmi_ann(i), dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa(i)
       - min(dem_D8i_pmi_ann(i), dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo(i)
       - min(dem_D9ab_pmi_ann(i), dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec(i)
       - min(dem_D9b_pmi_ann(i), dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD(i)
       - min(dem_D300_pmi_ann(i), dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA(i)
       - dem_D8a_wr_ann(i) * perdem_70NRWD(i)
       - dem_D8b_wr_ann(i) * perdem_70Fol(i)
       - dem_D8c_wr_ann(i) * perdem_70FolP(i)
       - dem_D8d_wr_ann(i) * perdem_70SJWDP(i)
       - dem_D8e_wr_ann(i) * perdem_70SJWDS(i)
       - dem_D8f_wr_ann(i) * perdem_70ElDor(i)
       - dem_D8g_wr_ann(i) * perdem_70Rose(i)
       - dem_D9b_wr_ann(i) * perdem_70SMUD(i)
       - dem_D9aa_wr_ann(i) * perdem_70SCWC(i)
       - dem_D300_wr_ann(i) * perdem_70PCWA(i)
       - dem_D9a_pls(i) * cfs_taf(i)
       - (Evap_Folsm_JuneSept / 4)}
  case other {
    condition     always
    value        0.0   }}
```

This equation assumes perfect foresight for inflows and that diversions will be according to water rights and CVP allocations. The water purveyors and the delivery patterns used in the calculation of *AmerFrctSummer* are identified in the Tables A.1-2 and A.1-3.

To implement this end-of-September storage prescriptive adjustment in CalSim II, each item listed above is calculated and added up, as shown in box A.1.2-23 for the end-of-September Folsom (EOSepFolFrcst) storage forecast. If the EOSepFolFrcst is forecasted to be less than 300 TAF in June, then MRR is reduced to a flow that would result in Folsom Reservoir reaching 300 TAF at the end of September, as long as that storage-based flow was not less than the D893 required flow of 250 cfs. If the EOSepFolFrcst is projected to be greater than 300 TAF, the IFII-based index flow is used as shown in box A.1.2-24.

```
                                                                         (A.1.2-23)
define EOSepFolFrcst {
   case JunForecast {
      condition      month>=JUN .and. month<=SEP
      value         min(650., S8(prevMAY)+ AmerFrcstSummer - FMPfrcstJunSep) }
   case other {
      condition      always
      value         0.   }
 }
```

Of the three parameters used to forecast the end-of-September storage, only the *AmerFrcstSummer* variable is subject to variability; diversion quantities, particularly according to water rights, are computed by CalSim II each month and may not match the forecast values. Similarly, simulated evaporation is based on reservoir storage and releases from Folsom Reservoir and may not match with the forecasted evaporation.

The prescriptive adjustment for end-of-September Folsom Reservoir storage is first implemented in June a shown in the equation in box A.1.2-24. When the *EOSepFolFrcst* is forecasted to be less than 300 TAF, then MRR is reduced to a flow that would cause Folsom Reservoir storage to reach 300 TAF by September, but not less than 250 cfs, which is the D-893 required flow. If the *EOSepFolFrcs*t is projected to be greater than 300 TAF, the IFII-based index flow is used as the MRR.

```
                                                               (A.1.2-24)
     case JunMin {
            condition      month==JUN .and. EOSepFolFrcst < 300.
            value         min(1750., minFMPAmerTmp, (max(250.,minFMPAmerTmp-
                          (300.- EOSepFolFrcst)*1000./(1.9835*122.))))}
     case Junother {
            condition      month==Jun .and. EOSepFolFrcst >= 300.
            value         minFMPAmerTmp }
```

The June and July MRR is shown in box A.1.2-25. The code discontinues the off-ramp (Section A.1.3) in those months, if it was previously effective, by setting flows to the MRR for May or the index flow for the current time step, whichever is less, if the previous month’s flow was equal to the required D893 flows.

```
                                                                    (A.1.2-25)
    case JunJulNoOffRamp{
            condition     month>=JUN .and. month<=JUL .and. C9_fmp_mif(-1) == D893min
            value         max(C9_fmp_mif(-1), minFMPAmerTmp)}
```

MRR determination in July and August uses the flow determined for June, whether it was the IFII-based index flow or the end-of-September Folsom Reservoir storage prescriptive adjustment. The code calls the MRR in the previous time step so that the June flows are repeated for both July and August as shown in box A.1.2-26.

```
                                                                    (A.1.2-26)
    case JulAug {
            condition     month>=JUL .and. month<=AUG
            value         C9_fmp_mif(-1)}
```

In September, if the end-of-September Folsom Reservoir storage forecast was less than 300 TAF, the MRR continues to be the same as it was in July, as shown in A.1.2-27.

```
                                                                    (A.1.2-27)
    case SepMin {
            condition     month==SEP .and. EOSepFolFrcstdv(prevJUN) < 300.
            value         C9_fmp_mif(-1)}
```

Post-Labor Day through September Index Flows (Based on IFII)

The post-Labor Day through September 30 index flow will be between 800 and 1,500 cfs. For an IFII greater than or equal to 504 TAF, the index flow is 1,500 cfs. For an IFII between 375 TAF and 504 TAF, the index flow is proportional to the IFII and ranges between 800 cfs and 1,500 cfs. For an IFII less than or equal to 375 TAF, the index flow is 800 CFS as shown in Figure A.1-2. (Water Forum 2008)

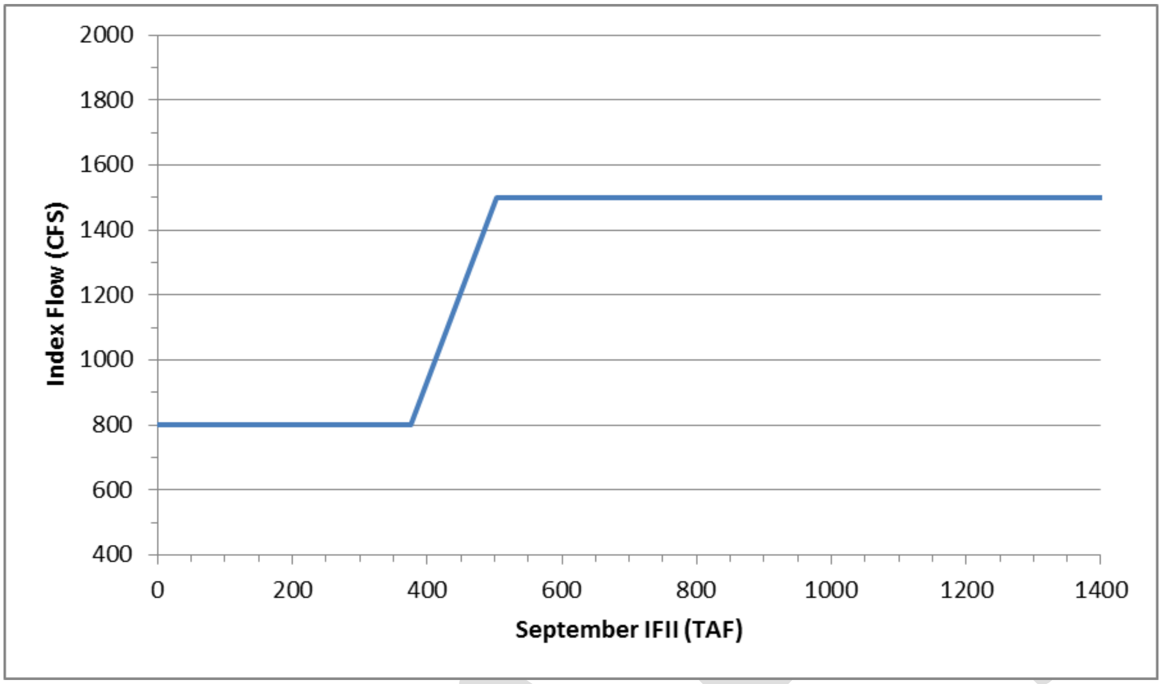


Figure A.1-2. Flow Management Standard Index Flow for Post-Labor Day through September

The September index flow uses the same index flow as March through August; however, the maximum MRR is 1,500 cfs rather than 1,750 cfs. To apply this maximum in CalSim II, USACE did not change the trigger table, *FMP_Trigger.table*, rather, it used the WRESL code to install a maximum flow of 1,500 cfs as shown in boxes A.1.2-28 and A.1.2-29.

The first case in the September WRESL code, as shown in box A.1.2-28, discontinues the off-ramp (Section A.1.3) by setting flows to the September MRR if the previous month's flow was equal to the required D893 flows.

```
                                                                   (A.1.2-28)
case SeptNoOffRamp{
        condition     month==SEP .and. EOSepFolFrcstdv(prevJUN) >= 300. .and.
                      C9_fmp_mif(-1) == D893min
        value        (((minFMPAmerTmp * 4.) + (min(minFMPAmerTmp, 1500.) * 11.) +
                     (max(500., (min(minFMPAmerTmp, 1500.))) * 15. ))/ 30.)}
```

The second case in September implements the same code as the equation A.1.2-28 but it is meant for non-off-ramp years. If the end-of-September Folsom Reservoir storage forecast (*EOSepFolFrcstdv*) is less than 300 TAF, no prescriptive adjustments are in place and the index flows (*minFMPAmerTmp*) will be the MRR. However, the first four days in September would continue to use the index flow previously applied for March through August. The next 11 days use the same index flow but cap the MRR at 1,500 cfs. In the second half of the month, the MRR is equal to the index flow but it is required to be between 500 cfs and 1,500 cfs. These daily flows are averaged out over the month to reflect CalSim II's monthly time step.

Instead of calling the variable for the index flow (*minFMPAmerTmp*), equation A.1.2-29 uses the MRR from the last time step (*C9_fmp_mif(-1)*). The resulting number will be the same because index flows are identical during March through August.

```
                                                                  (A.1.2-29)
      case Sept {
              condition    month==SEP .and. EOSepFolFrcstdv(prevJUN) >= 300.
              value        (((C9_fmp_mif(-1) * 4.) + (min(C9_fmp_mif(-1), 1500.) * 11.) +
                           (max(500., (min(C9_fmp_mif(-1), 1500.))) * 15. ))/ 30.) }
```

If there are no new index flows or prescriptive adjustments, the flows below Nimbus Dam will always be the MRR from the previous time step, as shown in box A.1.2-30. This case "other" with a condition of "always" was required to close the equation that defines the MRR.

```
                                                                  (A.1.2-30)
      case other {
              condition    always
              value        C9_fmp_mif(-1)}}
```

A.1.3 Off-Ramp Condition

The FMS includes an Off-ramp Condition when Folsom Reservoir storage is predicted to be less than 200 TAF in any of the following 12 months. This year-round, Off-ramp Condition is reassessed each month but continues in effect until Folsom Reservoir storage exceeds 200 TAF and is predicted to remain above 200 TAF for the following 12 months (Water Forum 2008). In CalSim II, the Off-ramp Condition cannot be forecasted year-round because CalSim II operates in water years (October to September) rather than in calendar years, and delivery allocations and other operations cannot always be forecasted for the following 12 months. Since forecasted releases use CVP water supply allocations determined by contract year (March through February), Folsom Reservoir storage can be forecast using a multi-month approach from March through September but requires a month-by-month approach from October through February. The code in box A.1.3-1 includes the code for calculating the Off-ramp Condition.

Since it is possible to forecast the deliveries and MRR from the beginning of the contract year to the end of the water year, March through September, USACE added the ability for CalSim II to forecast end-of-month Folsom Reservoir storage for each month between March and September, assuming perfect foresight for inflows. The code computes total inflow volume for the current month through each month between the current month and September, and subtracts total volume of releases, diversions, and evaporation for the current month through each month between the current month and September from the previous month's storage. Using this methodology, the end-of-month storage is computed for each month between the current month and September. For example, in March, the end-of-month storage is computed for March, April, May, June, July, August, and September. In April, the end-of-month storage is computed for April, May, June, July, August, and September. The process is further repeated for May, June, July, August, and September.

To implement the off-ramp condition in October through February, the end-of-month storage for each month is forecast in lieu of a multi-month forecast using a similar methodology as the multi-month forecast described above, but only considers the current month of simulation.

The off-ramp Condition is triggered if storage forecast drops below 200 TAF in any month from the current month's forecast up to the September forecast.

```
                                                                     (A.1.3-1)

define S8_Sep_Init {                          !Compute the end-of-Folsom storage for September
  case MAR_SEP {
    condition      month >= MAR .and. month <= SEP
        sum(i=0,SEP-month) I8(i)*cfs_taf(i) + I300(i)*cfs_taf(i) + I9(i)*cfs_taf(i)
       - min(dem_D8b_pmi_ann(i), dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol(i)
       - min(dem_D8e_pmi_ann(i), dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS(i)
       - min(dem_D8f_pmi_ann(i), dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor(i)
       - min(dem_D8g_pmi_ann(i), dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose(i)
       - min(dem_D8h_pmi_ann(i), dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa(i)
       - min(dem_D8i_pmi_ann(i), dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo(i)
       - min(dem_D9ab_pmi_ann(i), dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec(i)
       - min(dem_D9b_pmi_ann(i), dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD(i)
       - min(dem_D300_pmi_ann(i), dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA(i)
       - dem_D8a_wr_ann(i) * perdem_70NRWD(i)
       - dem_D8b_wr_ann(i) * perdem_70Fol(i)
       - dem_D8c_wr_ann(i) * perdem_70FolP(i)
       - dem_D8d_wr_ann(i) * perdem_70SJWDP(i)
       - dem_D8e_wr_ann(i) * perdem_70SJWDS(i)
       - dem_D8f_wr_ann(i) * perdem_70ElDor(i)
       - dem_D8g_wr_ann(i) * perdem_70Rose(i)
       - dem_D9b_wr_ann(i) * perdem_70SMUD(i)
       - dem_D9aa_wr_ann(i) * perdem_70SCWC(i)
       - dem_D300_wr_ann(i) * perdem_70PCWA(i)
       - dem_D9a_pls(i) * cfs_taf(i)
       - minFMPAmerTmp * cfs_taf(i)
       - 6.0 } ! Evaporation estimate 6.0 TAF per month
       case other {
              condition         always
              value             950.0}
}

Define S8_Sep {
       case MAR_SEP {
              condition         month >=MAR .and. month <=SEP
              value max(90., min(S8(-1) + S8_Sep_Init,S8level5(SEP-month))) }
       case other {
              condition         always
              value             950.0}
```

```
}

define S8_Aug_init {
   case MAR_AUG {
      condition      month >= MAR .and. month <= AUG
            sum(i=0,AUG-month) I8(i)*cfs_taf(i) + I300(i)*cfs_taf(i) + I9(i)*cfs_taf(i)
          - min(dem_D8b_pmi_ann(i), dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol(i)
          - min(dem_D8e_pmi_ann(i), dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS(i)
          - min(dem_D8f_pmi_ann(i), dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor(i)
          - min(dem_D8g_pmi_ann(i), dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose(i)
          - min(dem_D8h_pmi_ann(i), dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa(i)
          - min(dem_D8i_pmi_ann(i), dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo(i)
          - min(dem_D9ab_pmi_ann(i), dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec(i)
          - min(dem_D9b_pmi_ann(i), dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD(i)
          - min(dem_D300_pmi_ann(i), dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA(i)
          - dem_D8a_wr_ann(i) * perdem_70NRWD(i)
          - dem_D8b_wr_ann(i) * perdem_70Fol(i)
          - dem_D8c_wr_ann(i) * perdem_70FolP(i)
          - dem_D8d_wr_ann(i) * perdem_70SJWDP(i)
          - dem_D8e_wr_ann(i) * perdem_70SJWDS(i)
          - dem_D8f_wr_ann(i) * perdem_70ElDor(i)
          - dem_D8g_wr_ann(i) * perdem_70Rose(i)
          - dem_D9b_wr_ann(i) * perdem_70SMUD(i)
          - dem_D9aa_wr_ann(i) * perdem_70SCWC(i)
          - dem_D300_wr_ann(i) * perdem_70PCWA(i)
          - dem_D9a_pls(i) * cfs_taf(i)
           - minFMPAmerTmp * cfs_taf(i)
          - 6.0 } ! Evaporation estimate 6.0 TAF per month
          case other {
                    condition           always
                    value               950.0}
          }

Define S8_Aug {
          case MAR_AUG {
      condition      month >= MAR .and. month <= AUG
                    value max(90., min(S8(-1) + S8_Aug_Init,S8Level5(AUG-month))) }
          case other {
                    condition           always
                    value               950.0}
          }

define S8_Jul_init {
   case MAR_Jul {
      condition      month >= MAR .and. month <= JUL
            sum(i=0,Jul-month) I8(i)*cfs_taf(i) + I300(i)*cfs_taf(i) + I9(i)*cfs_taf(i)
          - min(dem_D8b_pmi_ann(i), dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol(i)
          - min(dem_D8e_pmi_ann(i), dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS(i)
          - min(dem_D8f_pmi_ann(i), dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor(i)
          - min(dem_D8g_pmi_ann(i), dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose(i)
          - min(dem_D8h_pmi_ann(i), dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa(i)
          - min(dem_D8i_pmi_ann(i), dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo(i)
          - min(dem_D9ab_pmi_ann(i), dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec(i)
          - min(dem_D9b_pmi_ann(i), dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD(i)
```

```
            - min(dem_D300_pmi_ann(i), dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA(i)
            - dem_D8a_wr_ann(i) * perdem_70NRWD(i)
            - dem_D8b_wr_ann(i) * perdem_70Fol(i)
            - dem_D8c_wr_ann(i) * perdem_70FolP(i)
            - dem_D8d_wr_ann(i) * perdem_70SJWDP(i)
            - dem_D8e_wr_ann(i) * perdem_70SJWDS(i)
            - dem_D8f_wr_ann(i) * perdem_70ElDor(i)
            - dem_D8g_wr_ann(i) * perdem_70Rose(i)
            - dem_D9b_wr_ann(i) * perdem_70SMUD(i)
            - dem_D9aa_wr_ann(i) * perdem_70SCWC(i)
            - dem_D300_wr_ann(i) * perdem_70PCWA(i)
            - dem_D9a_pls(i) * cfs_taf(i)
            - minFMPAmerTmp * cfs_taf(i)
            - 6.0 }! Evaporation estimate 6.0 TAF per month
            case other {
                        condition           always
                        value               950.0}
}
Define S8_Jul {
            case MAR_Jul {
      condition       month >= MAR .and. month <= JUL
                        value max  (90., min(S8(-1) + S8_Jul_Init,S8Level5(JUL-month))) }
            case other {
                        condition           always
                        value               950.0}
}

define S8_Jun_init {
   case MAR_Jun {
      condition       month >= MAR .and. month <= JUN
             sum(i=0,JUN-month) I8(i)*cfs_taf(i) + I300(i)*cfs_taf(i) + I9(i)*cfs_taf(i)
            - min(dem_D8b_pmi_ann(i), dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol(i)
            - min(dem_D8e_pmi_ann(i), dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS(i)
            - min(dem_D8f_pmi_ann(i), dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor(i)
            - min(dem_D8g_pmi_ann(i), dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose(i)
            - min(dem_D8h_pmi_ann(i), dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa(i)
            - min(dem_D8i_pmi_ann(i), dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo(i)
            - min(dem_D9ab_pmi_ann(i), dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec(i)
            - min(dem_D9b_pmi_ann(i), dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD(i)
            - min(dem_D300_pmi_ann(i), dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA(i)
            - dem_D8a_wr_ann(i) * perdem_70NRWD(i)
            - dem_D8b_wr_ann(i) * perdem_70Fol(i)
            - dem_D8c_wr_ann(i) * perdem_70FolP(i)
            - dem_D8d_wr_ann(i) * perdem_70SJWDP(i)
            - dem_D8e_wr_ann(i) * perdem_70SJWDS(i)
            - dem_D8f_wr_ann(i) * perdem_70ElDor(i)
            - dem_D8g_wr_ann(i) * perdem_70Rose(i)
            - dem_D9b_wr_ann(i) * perdem_70SMUD(i)
            - dem_D9aa_wr_ann(i) * perdem_70SCWC(i)
            - dem_D300_wr_ann(i) * perdem_70PCWA(i)
            - dem_D9a_pls(i) * cfs_taf(i)
            - minFMPAmerTmp * cfs_taf(i)
            - 6.0 }! Evaporation estimate 6.0 TAF per month
            case other {
```

```
                    condition           always
                    value               950.0}
}
Define S8_Jun {
          case MAR_Jun {
     condition        month >= MAR .and. month <= JUN
                    value max(90.,min(S8(-1) + S8_Jun_Init,S8Level5(JUN-month))) }
          case other {
                    condition           always
                    value               950.0}
}

define S8_May_Init {
   case MAR_May {
     condition        month >= MAR .and. month <= MAY
           sum(i=0,MAY-month) I8(i)*cfs_taf(i) + I300(i)*cfs_taf(i) + I9(i)*cfs_taf(i)
          - min(dem_D8b_pmi_ann(i), dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol(i)
          - min(dem_D8e_pmi_ann(i), dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS(i)
          - min(dem_D8f_pmi_ann(i), dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor(i)
          - min(dem_D8g_pmi_ann(i), dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose(i)
          - min(dem_D8h_pmi_ann(i), dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa(i)
          - min(dem_D8i_pmi_ann(i), dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo(i)
          - min(dem_D9ab_pmi_ann(i), dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec(i)
          - min(dem_D9b_pmi_ann(i), dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD(i)
          - min(dem_D300_pmi_ann(i), dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA(i)
          - dem_D8a_wr_ann(i) * perdem_70NRWD(i)
          - dem_D8b_wr_ann(i) * perdem_70Fol(i)
          - dem_D8c_wr_ann(i) * perdem_70FolP(i)
          - dem_D8d_wr_ann(i) * perdem_70SJWDP(i)
          - dem_D8e_wr_ann(i) * perdem_70SJWDS(i)
          - dem_D8f_wr_ann(i) * perdem_70ElDor(i)
          - dem_D8g_wr_ann(i) * perdem_70Rose(i)
          - dem_D9b_wr_ann(i) * perdem_70SMUD(i)
          - dem_D9aa_wr_ann(i) * perdem_70SCWC(i)
          - dem_D300_wr_ann(i) * perdem_70PCWA(i)
          - dem_D9a_pls(i) * cfs_taf(i)
          - minFMPAmerTmp * cfs_taf(i)
          - 6.0 }! Evaporation estimate 6.0 TAF per month
          case other {
                    condition           always
                    value               950.0}
}

Define S8_May {
          case MAR_May {
     condition        month >= MAR .and. month <= MAY
                    value max(90.,min(S8(-1) + S8_May_Init,S8Level5(MAY-month))) }
          case other {
                    condition           always
                    value               950.0}
}

define S8_APR_Init {
   case MAR_APR {
```

```
        condition       month >= MAR .and. month <= APR
              sum(i=0,APR-month) I8(i)*cfs_taf(i) + I300(i)*cfs_taf(i) + I9(i)*cfs_taf(i)
            - min(dem_D8b_pmi_ann(i), dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol(i)
            - min(dem_D8e_pmi_ann(i), dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS(i)
            - min(dem_D8f_pmi_ann(i), dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor(i)
            - min(dem_D8g_pmi_ann(i), dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose(i)
            - min(dem_D8h_pmi_ann(i), dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa(i)
            - min(dem_D8i_pmi_ann(i), dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo(i)
            - min(dem_D9ab_pmi_ann(i), dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec(i)
            - min(dem_D9b_pmi_ann(i), dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD(i)
            - min(dem_D300_pmi_ann(i), dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA(i)
            - dem_D8a_wr_ann(i) * perdem_70NRWD(i)
            - dem_D8b_wr_ann(i) * perdem_70Fol(i)
            - dem_D8c_wr_ann(i) * perdem_70FolP(i)
            - dem_D8d_wr_ann(i) * perdem_70SJWDP(i)
            - dem_D8e_wr_ann(i) * perdem_70SJWDS(i)
            - dem_D8f_wr_ann(i) * perdem_70ElDor(i)
            - dem_D8g_wr_ann(i) * perdem_70Rose(i)
            - dem_D9b_wr_ann(i) * perdem_70SMUD(i)
            - dem_D9aa_wr_ann(i) * perdem_70SCWC(i)
            - dem_D300_wr_ann(i) * perdem_70PCWA(i)
            - dem_D9a_pls(i) * cfs_taf(i)
            - minFMPAmerTmp * cfs_taf(i)
            - 6.0 } ! Evaporation estimate 6.0 TAF per month
            case other {
                    condition           always
                    value               950.0}
}
Define S8_Apr {
            case MAR_APR {
        condition       month >= MAR .and. month <= APR
                    value max(90., min(S8(-1) + S8_Apr_Init,S8Level5(APR-month))) }
            case other {
                    condition           always
                    value               950.0}
}

define S8_MAR {
    case MAR {
        condition      month == MAR
        value max(90., min(I8*cfs_taf + I300*cfs_taf + I9*cfs_taf
            - min(dem_D8b_pmi_ann, dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol
            - min(dem_D8e_pmi_ann, dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS
            - min(dem_D8f_pmi_ann, dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor
            - min(dem_D8g_pmi_ann, dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose
            - min(dem_D8h_pmi_ann, dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa
            - min(dem_D8i_pmi_ann, dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo
            - min(dem_D9ab_pmi_ann, dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec
            - min(dem_D9b_pmi_ann, dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD
            - min(dem_D300_pmi_ann, dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA
            - dem_D8a_wr_ann * perdem_70NRWD
            - dem_D8b_wr_ann * perdem_70Fol
            - dem_D8c_wr_ann * perdem_70FolP
            - dem_D8d_wr_ann * perdem_70SJWDP
```

```
              - dem_D8e_wr_ann * perdem_70SJWDS
              - dem_D8f_wr_ann * perdem_70ElDor
              - dem_D8g_wr_ann * perdem_70Rose
              - dem_D9b_wr_ann * perdem_70SMUD
              - dem_D9aa_wr_ann * perdem_70SCWC
              - dem_D300_wr_ann * perdem_70PCWA
              - dem_D9a_pls * cfs_taf
              - minFMPAmerTmp * cfs_taf
              - 6.0 ,S8Level5(MAR)))! Evaporation estimate 6.0 TAF per month
                                + S8(-1)}
              case other {
                         condition          always
                         value              950.0}
}

! -- For other months (October through February), forecast each month's end-of-month storage in lieu of a
longer forecast
define S8_OctFeb {
   case OctFeb {
      condition      month >= OCT .and. month <= FEB
      value I8*cfs_taf + I300*cfs_taf + I9*cfs_taf
              - min(dem_D8b_pmi_ann, dem1_D8b_pmi_a * perdel_cvpmi_sys) * perdem_70Fol
              - min(dem_D8e_pmi_ann, dem1_D8e_pmi_a * perdel_cvpmi_sys) * perdem_70SJWDS
              - min(dem_D8f_pmi_ann, dem1_D8f_pmi_a * perdel_cvpmi_sys) * perdem_70ElDor
              - min(dem_D8g_pmi_ann, dem1_D8g_pmi_a * perdel_cvpmi_sys) * perdem_70Rose
              - min(dem_D8h_pmi_ann, dem1_D8h_pmi_a * perdel_cvpmi_sys) * perdem_70pcwa
              - min(dem_D8i_pmi_ann, dem1_D8i_pmi_a * perdel_cvpmi_sys) * perdem_70ElDorCo
              - min(dem_D9ab_pmi_ann, dem1_D9ab_pmi_a * perdel_cvpmi_sys) * perdem_70CARec
              - min(dem_D9b_pmi_ann, dem1_D9b_pmi_a * perdel_cvpmi_sys) * perdem_70SMUD
              - min(dem_D300_pmi_ann, dem1_D300_pmi_a * perdel_cvpmi_sys) * perdem_70PCWA
              - dem_D8a_wr_ann * perdem_70NRWD
              - dem_D8b_wr_ann * perdem_70Fol
              - dem_D8c_wr_ann * perdem_70FolP
              - dem_D8d_wr_ann * perdem_70SJWDP
              - dem_D8e_wr_ann * perdem_70SJWDS
              - dem_D8f_wr_ann * perdem_70ElDor
              - dem_D8g_wr_ann * perdem_70Rose
              - dem_D9b_wr_ann * perdem_70SMUD
              - dem_D9aa_wr_ann * perdem_70SCWC
              - dem_D300_wr_ann * perdem_70PCWA
              - dem_D9a_pls * cfs_taf
              - minFMPAmerTmp * cfs_taf
              - 6.0 ! Evaporation estimate 6.0 TAF per month
                                + S8(-1)}
              case other {
                         condition          always
                         value              950.0}
}

define S8min { value min(950., S8_OctFeb, S8_Mar, S8_Apr, S8_May, S8_Jun, S8_Jul, S8_Aug, S8_Sep)}
```

This equation assumes perfect foresight for inflows and that diversions will be according to water rights and CVP allocations. The demands and delivery patterns used in the calculation of *S8_Sep_Init* are listed in Tables A.1-2 and A.1-3.

In equation box A.1.3-1 the state variable *dem_D300_pmi_ann* is commented out in the Future Condition of the WCM Update model. This is a Folsom Lake demand node for PCWA. There is currently no intake and there are no plans for an intake to be built; therefore, the Future Condition of 2013 DRR CalSim II commented out this term and USACE maintained its elimination for the WCM Update model.

The last variable in box A.1.3-1 is *S8min*. This variable will change every month according to the forecast storage in Folsom Reservoir. *S8min* is used to define the MRR below Nimbus Dam during Off-ramp Condition, as shown in box A.1.3-1.

The off-ramp condition affects 2 years out of the 82-year CalSim hydrologic record in the Existing Condition: 1991 and 1993. It affects 6 years in the Future Condition and 7 years in each Action Alternative, as shown in Table A.1-4.

Table A.1-4. Model Years During Which the Off-Ramp is Implemented

Scenario	Scenario Description	Number of Years Off Ramp is Implemented	Off Ramp Condition Active (Water Years)
E504	Existing Condition	2	1991, 1993
J604	Future Condition	6	1929, 1961, 1962, 1991, 1992, 1993
J602	Future Condition 400-600 Flood Control Curve	7	1929, 1934, 1961,1962, 1991, 1992, 1993
J603	Future Condition Fixed 400 Flood Control Curve	7	1929, 1934, 1961,1962, 1991, 1992, 1993

A.1.4 Conference Year

A conference year is designated when the forecast March through November unimpaired inflow to Folsom Reservoir (UIFR) is less than 400 TAF. The conference year designation is reassessed each month and is continued unless one of the following occurs.

- The forecast March though November UIFR exceeds 400 TAF
- The FRI is higher than 300 TAF
- Folsom Reservoir releases are made for flood control purposes
- The SRI is higher than or equal to 15.7 million acre-feet (MAF), indicating an above normal or wet year
- The IFII is higher than 205 TAF (Water Forum 2008)

USACE implemented the conference year in CalSim II with two steps: 1) defining the UIFR; and 2) adding code to the MRR calculation (as presented earlier in box A.1.2-1) to limit releases to D893 when a conference year is indicated.

To define the UIFR, a lookup table that returns the UIFR for March through November for each year was added to the models. A UIFR_YR is defined as a year that starts in February and ends in January of the following year as shown in box A.1.4-1. CalSim forecasts a conference year in February, a month in which the UIFR designation is reasonably foreseeable.

The definition of the D893 flow criteria is in box A.1.4-2. CalSim contains a lookup table called HSt_base.table that returns the minimum flow required at the mouth of the lower American River (LAR) for a given month.

The Conference Year Minimum Flow Requirements are as follows:

- From January 1 through September 15, no less than 250 cfs between Nimbus Dam and the mouth of the American River
- From September 16 through December 31, no less than 500 cfs between Nimbus Dam and the mouth of the American River (Water Forum 2008)

These flows replace the MRR below Nimbus when the UIFR is less than 400 TAF. The code used to implement D893 flows as the MRR was presented earlier in box A.1.2-1.

(A.1.4-1)

```
define UIFR_YR {
        case after_October {
            condition month >= OCT .and. month < FEB
                  select UIFR
                  from UIFR
                  where year = Wateryear - 1.}
        case rest {
            condition always
                  select UIFR
                  from UIFR
                  where year = Wateryear}
}
```

(A.1.4-2)

```
define D893min {select HStmin
        from   HSt_base
        where  month=month, AmerD893=1
}
```

Two years within the CalSim II 82-year period of record are designated as conference years: 1924 and 1977.

A.2 Folsom Area Capacity Curve

The reservoir area-capacity curve provided by Reclamation in 2005 is presented in Table A.2-1. This data, in this format, was inserted into CalSim II in the res_info.table file to replace the Folsom Lake data that had previously been used but has been superseded with newer data. The data was published in a technical report by Reclamation (U.S. Department of the Interior, Bureau of Reclamation 2005) called Folsom Lake, Area and Capacity Tables.

Table A.2-1. Folsom Reservoir Area-Capacity Table

Reservoir Number	Storage (AF)	Area (Acres)	Discharge (CFS)	Elevation (FT)
8	0	0	0	0
8	11	2	0	210
8	48449	1304	16800	305
8	93378	2090	28090	332
8	140856	2940	29930	351
8	188313	3914	31170	365
8	236442	4799	32130	376
8	282681	5466	32850	385
8	379578	6652	34130	401
8	668532	9375	132770	437
8	966823	11140	466690	466

A.3 Hodge Criteria

The WRESL code for the implementation of the Hodge criteria, shown in box A.3-1, first defines the demands at the Sacramento River water treatment plant (WTP) (node 167a) and the Fairbairn WTP on the American River (node 302a). Next, it defines the Hodge flow criteria (flows below which the Hodge limitation comes into effect) as a variable called *Hodge_Thresh*. The subsequent definition for the variable *Hodge_div_limit* contains the diversion limitations at the American River WTP if the flows in the American River at its mouth, represented with node 302, are less than the variable *Hodge_thresh*. The code is located in the *common/hydrology/demands70.wresl* file. The last two lines of code in box A.3-1 transfer the demands into new variables.

```
                                                                                  (A.3-1)
define dem_D167a_wr  {value dem_D167a_wr_ann * perdem_70Sac * taf_cfs}  ! full City of Sac
entitlement
define dem_D302a_wr  {value dem_D302a_wr_ann * perdem_70Sac * taf_cfs}  ! City of Sac water right at
Fairbairn

! trigger is the hodge flow criteria for flow past Fairbairn
define Hodge_thresh {
      case OCT     { condition month == OCT          value     1879.0 }
      case NOV_FEB { condition range(month,nov,feb)   value     2000.0 }
      case MAR_JUN { condition range(month,mar,jun)   value     3000.0 }
```

```
      case JUL_SEP { condition always              value     1750.0 }
}
! If flow at 302 is below threshold, diversion limited to these values
define Hodge_div_limit {
      case OCT_DEC     { condition range(month,oct,dec) value     100.0 }
      case JUN_AUG     { condition range(month,jun,aug) value     155.0 }
      case JAN_MAY_SEP { condition always              value     120.0 }
}

define dem_d302a_wf {value dem_d302a_wr }
define dem_d167a_wf  {value dem_d167a_wr}
```

The section of code shown in box A.3-2 sets up a binary system to determine the condition for limiting diversions to the City of Sacramento (City) and determines the allocation of deliveries between the American River and Sacramento River WTPs. When flows are above the Hodge criteria (represented by the variable *Hodge_thresh* as defined in box A-2) the limitation is off and the variable *int_Hst_abv* is set to “1”. When the limitations are in effect, and flows in the LAR at the American River WTP are below the Hodge Criteria, the variable *int_Hst_blw* is set to “1”. If either variable is set to “1,” the other would be set to “0.”

Since the demand at node 167a represents the full demand for the City, delivery is limited to the full demand less whatever is diverted at Fairbairn WTP on the American River (D302A). The American River demand is lower than the Hodge limit if the Hodge criteria is controlling.

```
                                                                              (A.3-2)
define Hst_max {value 99999.*taf_cfs}
define int_Hst_abv {INTEGER std kind 'INTEGER' units 'NONE'}           ! 1 if C302 > threshold
define int_Hst_blw {alias 1. - int_Hst_abv kind 'INTEGER'units 'NONE'}  ! 1 if C302 < threshold
define Hst_above {std kind 'FLOW-HST-ABV' units 'CFS'}
define Hst_below {std kind 'FLOW-HST-BLW' units 'CFS'}
goal Hst_flow {Hst_above - Hst_below = C302 - Hodge_thresh}
goal Hst_abv_force {Hst_above < int_Hst_abv*Hst_max}
goal Hst_blw_force {Hst_below < int_Hst_blw*Hst_max}
```

In the first goal in box A.3-3, the diversion at the American River WTP is limited to either the original demand or the Hodge criteria limit. In the second goal, the same diversion is limited to the demand only, for the potential case that the demand is lower than the Hodge limit if the Hodge criteria is controlling.

```
                                                                              (A.3-3)
goal limit_d302a_np1  {d302a_np < int_Hst_abv*dem_D302a_wf + int_Hst_blw*Hodge_div_limit}
goal limit_d302a_np2  {d302a_np < dem_D302a_wf}
```

The code in box A.3-4 is the final Hodge criteria implementation. If flow in the lower American River is less than specified threshold levels, limits are placed on American River diversion to the City of Sacramento (D302A) and the balance would be moved to the Sacramento River diversion point (D167A).

(A.3-4)

```
define dem_D167a_base {value max(0., dem_d167a_wr - dem_d302a_wr)} ! this is the remainder of the entitlement
define Hodge_cut  {std kind 'reduction-cfs' units 'cfs'}

goal setHodge_cut {Hodge_cut = int_Hst_blw * max(0., dem_d302a_wr - Hodge_div_limit)}  ! how much of the demand cannot be taken at 302

goal limit_d167a_np  {d167a_np < dem_D167a_wf - d302a_np}

goal limit_d167a_np2 {
   lhs D167a_np
   rhs dem_D167a_base + Hodge_cut
   lhs<rhs penalty 50 }
```

A.4 Sacramento River Gains Node D168A

The code is intended to limit the Sacramento River diversions at node 168A to the available river gains. Prior to the implementation of this code, any water that was conserved in the LAR was often shifted into D168A, making the conservation of LAR water much less effective. Equation A.4-1 is located in the common/hydrology/demand70.wresl file.

(A.4-1)

```
goal limitD168a {D168A < I9 + I302 + I166}
```

A.5 Feather River Rice Decomposition

Rice farmers divert water from the Thermalito Afterbay for rice straw decomposition, in addition to irrigation. This rice straw decomposition water diversion and its return flows were added to CalSim II by Reclamation and the logic was provided to USACE for inclusion in the WCM Update. A diversion node and a return flow node were created for the rice decomposition water and the continuity equations along both the Feather River and Sacramento River were updated to maintain the basin water balance as shown in boxes A.5-1 through A.5-5.

The delivery node for the rice decomposition water was added to the CalSim II weight table, CONV\Run\System\SystemTables_ALL\weight_table.wresl, and given a weight of 5000 as shown in box A.5-1.

(A.5-1)

```
[D7C, 5000]
```

The return flow from the rice decomposition deliveries in the Feather River service area was defined in the common\System\SystemTables_ALL\return-table.wresl file as shown in box A.5-2

```
                                                                    (A.5-2)
define R135C_dcmp {std kind 'RETURN-FLOW' units 'CFS'}
```

The delivery of rice straw decomposition water is about 160 TAF/year, delivered between October and January. The code in box A.5-3 was added to the file common\hydrology\DEMANDS\demands_69.wresl to describe the timing and volume of the rice decomposition water. The percent of decomposition water to be delivered is based on end-of-September storage in Oroville Reservoir (*S6*). The intent of releasing a percent of the demand, *dem_D7C_DCMP*, is to avoid drawing Oroville below 850 TAF. If the end-of-September Oroville Reservoir storage is greater than 1,200 TAF, all of the rice decomposition water is delivered. If the end-of-September Oroville Reservoir storage is greater than 1,100 TAF, 75 percent of the rice decomposition water is delivered; if storage is greater than 1,000 TAF, 50 percent of the rice decomposition water is delivered; if storage is greater than 900 TAF, 25 percent of the rice decomposition water is delivered; and if storage is less than 900 TAF, no rice decomposition water is delivered.

```
                                                                    (A.5-3)
define decomp_allocdv {std kind 'Decomp-Alloc' units 'None'}

define decomp_alloc {
        case Oro_high {
                condition        month==OCT .and. S6(-1) > 1200.
                value            1.0        }
        case Oro_1100 {
                condition        month==Oct .and. S6(-1) > 1100.
                value            0.75       }
        case Oro_1000 {
                condition        month==Oct .and. S6(-1) > 1000.
                value            0.5        }
        case Oro_900 {
                condition        month==Oct .and. S6(-1) > 900.
                value            0.25       }
        case Oro_low {
                condition        month==Oct .and. S6(-1) <= 900.
                value            0.0        }
        case other {
                condition        always
                value            decomp_allocdv(-1)          }
}

goal setdecomp_alloc {decomp_allocdv = decomp_alloc}

goal set_D7C {D7C < dem_D7C_DCMP*taf_cfs*decomp_alloc}
```

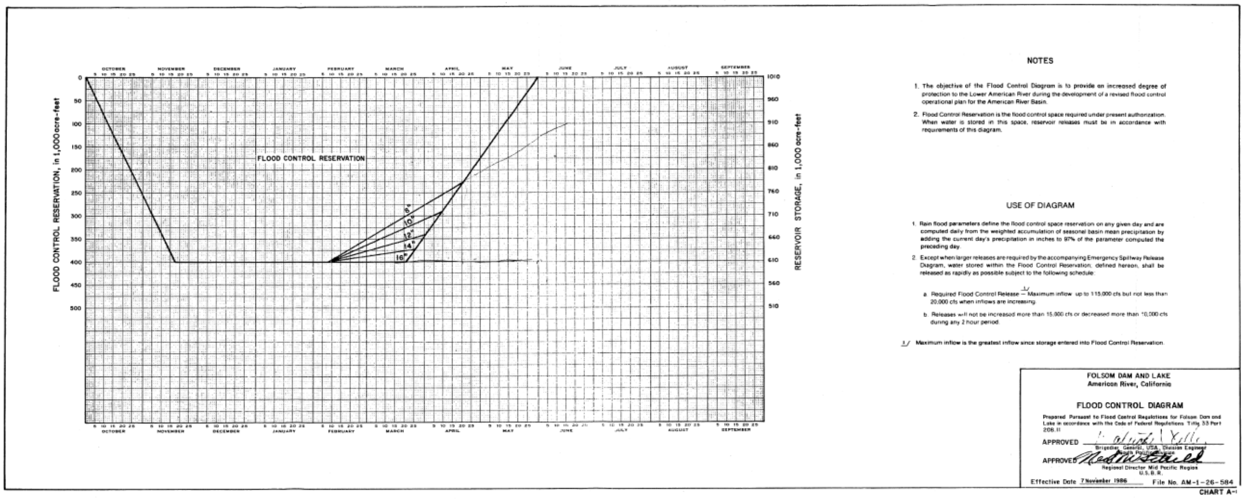
The return flow from the Feather River service area rice decomposition diversion is defined in the file common\hydrology\RETURNS\returns_nod.wresl and shown in box A.5-4. The maximum return flow, *R135C_DCMP_MAX*, is defined with the assumption that 100 percent of the *D7C* demand will be returned through node *R135C_dcmp*. The monthly demand is calculated as well as the actual deliveries. The proportion of deliveries to demand is then multiplied by the maximum return flow to determine the amount of water flowing through the return node, *R135C_dcmp*.

(A.5-4)

```
define R135C_DCMP_MAX {timeseries kind 'RETURN-FLOW' units 'taf'}

define decomp_del {
          case February {
                    condition           month==FEB
                    value               D7C(-1)*cfs_taf(-1)+D7C(-2)*cfs_taf(-2)+D7C(-3)*cfs_taf(-3)+
                                        D7C(-4)*cfs_taf(-4)}
          case other {
                    condition           always
                    value               0.0         }}

define decomp_deldv {alias decomp_del kind 'DECOMP-DELIVERY' units 'taf'}

define decomp_dem {
          case February {
                    condition month==FEB
                    value (dem_D7C_DCMP(-1)+dem_D7C_DCMP(-2)+dem_D7C_DCMP(-
3)+dem_D7C_DCMP(-4))}
          case other{
                    condition always
                    value 1.0            }}

define decomp_per {
          case February {
                    condition month==FEB
                    value decomp_del/decomp_dem}
          case other {
                    condition always
                    value 0.}}

goal set_r135C_dcmp {r135c_dcmp = r135c_dcmp_max*decomp_per*taf_cfs}
```

A.6 Water Control Diagrams

1987 water control manuals' fixed-400 water control diagram is shown in Figure A.6-1.



NOTES

1. The objective of the Flood Control Diagram is to provide an increased degree of protection to the Lower American River during the development of a revised flood control operational plan for the American River Basin.
2. Flood Control Reservation is the flood control space required under present authorization. When water is stored in this space, reservoir releases must be in accordance with requirements of this diagram.

USE OF DIAGRAM

1. Rain flood parameters define the flood control space reservation on any given day and are computed daily from the weighted accumulation of seasonal basin mean precipitation by adding the current day's precipitation in inches to 97% of the parameter computed the preceding day.
2. Except when larger releases are required by the accompanying Emergency Spillway Release Diagram, water stored within the Flood Control Reservation, defined hereon, shall be released as rapidly as possible subject to the following schedule:
   - a. Required Flood Control Release[1/] — Maximum inflow up to 115,000 cfs but not less than 20,000 cfs when inflows are increasing.
   - b. Releases will not be increased more than 15,000 cfs or decreased more than 10,000 cfs during any 2 hour period.

[1/] Maximum inflow is the greatest inflow since storage entered into Flood Control Reservation.

FOLSOM DAM AND LAKE
American River, California

FLOOD CONTROL DIAGRAM

Prepared Pursuant to Flood Control Regulations for Folsom Dam and Lake in accordance with the Code of Federal Regulations Title 33 Part 208.11

APPROVED ______ Brigadier General, USA, Division Engineer South Pacific Division

APPROVED ______ Regional Director Mid Pacific Region U.S.B.R.

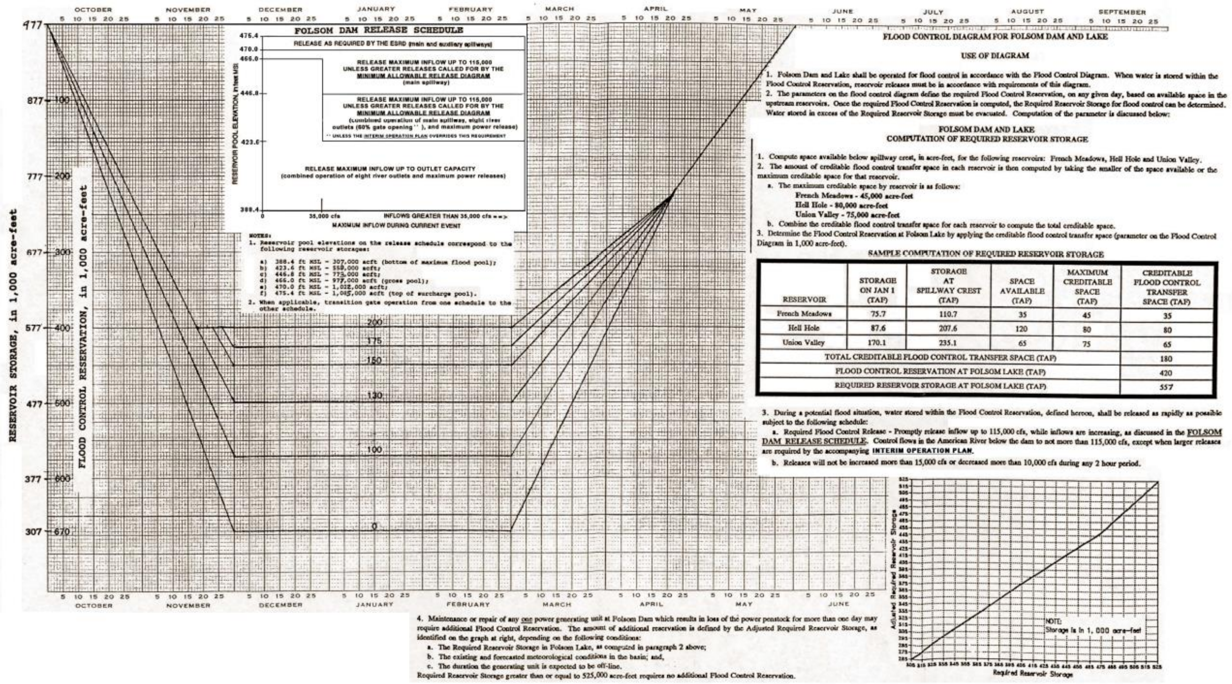
Effective Date 7 November 1986 File No. AM-1-26-584

CHART A-1

Source: 1987 Water Control Manual for the Folsom Dam and Lake.

Figure A.6-1. Fixed-400 Water Control Diagram.

The Sacramento Area Flood Control Agency's variable 400-670 water control diagram is shown in Figure A.6-2.



NOTES:
1. Reservoir pool elevations on the release schedule correspond to the following reservoir storages:
   - a) 388.4 ft MSL - 307,000 acft (bottom of maximum flood pool);
   - b) 423.6 ft MSL - 550,000 acft;
   - c) 446.8 ft MSL - 773,000 acft;
   - d) 466.0 ft MSL - 977,000 acft (gross pool);
   - e) 470.0 ft MSL - 1,022,000 acft;
   - f) 475.4 ft MSL - 1,085,000 acft (top of surcharge pool).
2. When applicable, transition gate operation from one schedule to the other schedule.

FLOOD CONTROL DIAGRAM FOR FOLSOM DAM AND LAKE

USE OF DIAGRAM

1. Folsom Dam and Lake shall be operated for flood control in accordance with the Flood Control Diagram. When water is stored within the Flood Control Reservation, reservoir releases must be in accordance with requirements of this diagram.
2. The parameters on the flood control diagram define the required Flood Control Reservation, on any given day, based on available space in the upstream reservoirs. Once the required Flood Control Reservation is computed, the Required Reservoir Storage for flood control can be determined. Water stored in excess of the Required Reservoir Storage must be evacuated. Computation of the parameter is discussed below:

FOLSOM DAM AND LAKE
COMPUTATION OF REQUIRED RESERVOIR STORAGE

1. Compute space available below spillway crest, in acre-feet, for the following reservoirs: French Meadows, Hell Hole and Union Valley.
2. The amount of creditable flood control transfer space in each reservoir is then computed by taking the smaller of the space available or the maximum creditable space for that reservoir.
   - a. The maximum creditable space by reservoir is as follows:
     French Meadows - 45,000 acre-feet
     Hell Hole - 80,000 acre-feet
     Union Valley - 75,000 acre-feet
   - b. Combine the creditable flood control transfer space for each reservoir to compute the total creditable space.
3. Determine the Flood Control Reservation at Folsom Lake by applying the creditable flood control transfer space (parameter on the Flood Control Diagram in 1,000 acre-feet).

SAMPLE COMPUTATION OF REQUIRED RESERVOIR STORAGE

RESERVOIR	STORAGE ON JAN 1 (TAF)	STORAGE AT SPILLWAY CREST (TAF)	SPACE AVAILABLE (TAF)	MAXIMUM CREDITABLE SPACE (TAF)	CREDITABLE FLOOD CONTROL TRANSFER SPACE (TAF)
French Meadows	75.7	110.7	35	45	35
Hell Hole	87.6	207.6	120	80	80
Union Valley	170.1	235.1	65	75	65
TOTAL CREDITABLE FLOOD CONTROL TRANSFER SPACE (TAF)					180
FLOOD CONTROL RESERVATION AT FOLSOM LAKE (TAF)					420
REQUIRED RESERVOIR STORAGE AT FOLSOM LAKE (TAF)					557

3. During a potential flood situation, water stored within the Flood Control Reservation, defined hereon, shall be released as rapidly as possible subject to the following schedule:
   - a. Required Flood Control Release - Promptly release inflow up to 115,000 cfs, while inflows are increasing, as discussed in the FOLSOM DAM RELEASE SCHEDULE. Control flows in the American River below the dam to not more than 115,000 cfs, except when larger releases are required by the accompanying **INTERIM OPERATION PLAN**.
   - b. Releases will not be increased more than 15,000 cfs or decreased more than 10,000 cfs during any 2 hour period.

4. Maintenance or repair of any one power generating unit at Folsom Dam which results in loss of the power penstock for more than one day may require additional Flood Control Reservation. The amount of additional reservation is defined by the Adjusted Required Reservoir Storage, as identified on the graph at right, depending on the following conditions:
   - a. The Required Reservoir Storage in Folsom Lake, as computed in paragraph 2 above;
   - b. The existing and forecasted meteorological conditions in the basin; and,
   - c. The duration the generating unit is expected to be off-line.

Required Reservoir Storage greater than or equal to 525,000 acre-feet requires no additional Flood Control Reservation.

Source: 1994 SAFCA's Interim Reoperation of Folsom Dam and Reservoir Final EIR/EA.

Figure A.6-2. Variable 400-670 Water Control Diagram.

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Appendix B: Water Quality Modeling

Water Quality

1.1 Background

The water quality section includes a discussion of water temperatures in the Lower American River (LAR) and water quality in the Sacramento–San Joaquin River Delta (Delta). Changes in the timing and magnitude of releases resulting from modifications to the Folsom Reservoir operations could affect the freshwater inflow into the Delta and, therefore, the salinity in the Delta. Water quality in Delta is of great importance to the native fish species as well the drinking water intakes, mainly the Contra Costa Water District's (CCWD) Rock Slough intake.

Changes to the Folsom Reservoir operations as part of the Folsom Water Control Manual (WCM) Update Project could change the in-stream temperatures in the LAR, Feather, and Sacramento Rivers. Riverine temperatures are especially important in the evaluation of effects to identified fish species and their aquatic habitat. This section presents general changes in the riverine temperatures, while impacts to fish species because of the changes in riverine temperatures can be found in Chapter 7, Fisheries.

1.2 Analytical Approach

For the water quality effects evaluation of this report, Central Valley Project/State Water Project Operations Model (CalSim II) models for all the scenarios were executed for an 82-year period of record (POR) extending from water year 1921 through water year 2003. The model output parameters selected for all of water quality comparative evaluations in this document were based on either their regulatory relevance or their historical importance in characterizing effects to water quality in the Delta with respect to the Central Valley Project (CVP)/State Water Project (SWP) system.

The U.S. Bureau of Reclamation's (Reclamation's) monthly water temperature model for the Sacramento and Feather Rivers was used for the comparative evaluation of water temperatures in the Sacramento and Feather Rivers. Reclamation's temperature model has a simulation period of 81 years, extending from January 1922 to December 2002. A detailed description of this model is in Appendix 4A, Reclamation Water Temperature Model.

The U.S. Army Corps of Engineers' (USACE's) Hydrologic Engineering Center (HEC) has developed the HEC-5Q water quality model that was used previously in Reclamation's Final Environmental Impact Statement for the Coordinated Long-Term Operation of the Central Valley Project and State Water Project. For the WCM Project, daily LAR water temperatures for all the scenarios were simulated for a period of about 81 years from January 1922 to September 2002. A detailed description of this model is in Appendix 4B (under development).

1.2.1 Model Output Parameters

The model output parameters selected for the water quality effects evaluation in the Delta were based on their regulatory and operational relevance. These model output parameters are:

- **Delta Outflow**

The State Water Resources Control Board (SWRCB) Water Rights Decision 1641(D-1641) established minimum Delta outflow requirements that were proposed in the 1995 Water Quality Control Plan (WQCP). Delta outflow is an important factor in determining water quality in the Delta. A lower Delta outflow might result in a larger seawater intrusion in the Delta, which can affect the migration of estuarine species as well the salinity at drinking water intakes. The outflow objectives for February through June are based on the X2 objectives. Delta outflow objectives for July through January are presented in Table 4-1.

Table 4-1. Delta Outflow Objectives

Month	Minimum Delta Outflow (cubic feet per second)
January	4,500 (6,000 if Eight River Index[1] is > 800 thousand acre-feet)
July	8,000 for wet and above-normal water years 6,500 for below-normal water years 5,000 for dry water years 4,000 for critical water years
August	4,000 for wet, above-normal, and below-normal water years 3,500 for dry water years 3,000 for critical water years
September	3,000
October	4,000 for all except critical water years 3,000 for critical water years
November–December	4,500 for all except critical water years 3,500 for critical water years

- **Location of X2**

The location of X2 is the geographical location of two parts per thousand, near-bottom salinity isohaline, measured in kilometers (km) upstream from the Golden Gate Bridge. The location of X2 is considered significant to the biologically important entrapment zone of the estuary and native fish. X2 is an index of both Delta outflow and estuarine salinity gradient.

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[1] The Eight River Index refers to the sum of the unimpaired runoff as published in the California Department of Water Resources Bulletin 120 for the following locations: Sacramento River flow at Bend Bridge, near Red Bluff; Feather River, total inflow to Oroville Reservoir; Yuba River flow at Smartville; American River, total inflow to Folsom Reservoir; Stanislaus River, total inflow to New Melones Reservoir; Tuolumne River, total inflow to Don Pedro Reservoir; Merced River, total inflow to Exchequer Reservoir; and San Joaquin River, total inflow to Millerton Lake.

D-1641 specifies that the location of X2 must remain west of the confluence of the Sacramento and San Joaquin Rivers (Collinsville, measured 81 km upstream from the Golden Gate Bridge) for February through June. The X2 compliance can be achieved in one of three ways:

1. Daily average Electrical Conductivity (EC) is less than or equal to 2.64 millimhos per centimeter (mmhos/cm) at the compliance location.
2. 14-day running average EC is less than or equal to 2.64 mmhos/cm at the compliance location.
3. Three-day running average Delta outflow is greater than or equal to minimum Delta outflow at the compliance location.

In addition, X2 compliance must be met at Chipps Island (measured 74 km upstream from the Golden Gate Bridge) and Roe Island (or Port Chicago EC Monitory Station, measured 64 km upstream from the Golden Gate Bridge), for a certain number of days each month from February through June, based on previous month's Eight River Index.

D-1641 also specifies a salinity starting condition in X2 standards, which requires the daily average or 14-day running average EC at Collinsville to be less than 2.64 mmhos/cm for at least one day between February 1 and February 14, given that the January Eight River Index is greater than 900 thousand acre-feet (TAF). For very dry January conditions (i.e., Eight River Index is less than 900 TAF), the requirement is based on the CALFED Operations group discretion.

- **Delta Export to Import (E/I) Ratio.**

The ratio of CVP/SWP exports from the Delta relative to inflow to the Delta 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 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 limit for February can be relaxed depending on the Eight River Index for January. If the 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.

CalSim II model outputs were tabulated for long-term average and average by 40-30-30 Sacramento Valley Index water year-type average for each of these parameters. These tables can be found in Tables 146 through 148 of each comparison in Appendix A Monthly Data Products Volume I.

1.2.2 Delta Water Quality Refined Level Evaluation

In addition to the parameters discussed above, a more refined level evaluation was completed for Delta parameters such as X2, Delta outflow, and salinity of water at the CCWD Rock Slough intake. This refined level consists of comparison of scenarios based on a consistency formulation. Interpretive thresholds were developed to define deviations from the baseline condition from this formulation. The following indices were selected:

- The February through June location of the X2 relative to river km 64 (Port Chicago), 74 (Chipps Island), and 81 (Collinsville).
- The relative X2 location and relative change in monthly position from the baseline condition. To determine consistency with the baseline condition, the following rules are applied:
  - If the magnitude of the difference in the X2 position is ever equal to or greater than 1 km, then the two models are "not consistent."
  - If the two models have greater than 5 occurrences of a less than 1 km change, then the models are "not consistent."
  - If the two models have less than or equal to 5 and greater than or equal to 2 occurrences of a less than 1 km change, then the models are "moderately consistent."
  - If the two models have less than 2 occurrences of a less than 1 km change, then the models are "consistent."
- Delta outflows were evaluated through comparison of model outputs against fall X2 standards and D-1641 outflow objectives.
- Salinity at CCWD's Rock Slough intake was evaluated through comparison of model outputs against D-1641 standards. D-1641 standards call for a minimum number of days that the mean daily chloride concentrations are less than or equal to 150 milligrams per liter (mg/L). These standards are provided in Table 4-2.

Table 4-2. D-1641 Requirements for CCWD Rock Slough Intake

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

A consistency formulation for salinity at Rock Slough intake was developed as shown below:

- If the difference in count of occurrences greater than 150 mg/L is less than or equal to 1 and the difference in mg/L is greater than 3 mg/L, then the two models are "not consistent."
- If the difference in count of occurrences greater than 150 mg/L is less than or equal to 1 and the difference in mg/L is less than or equal to 3 mg/L but greater than 1 mg/L, then the two models are "moderately consistent."

- If the difference in count of occurrences greater than 150 mg/L is less than or equal to 1 and the difference in mg/L is less than or equal to 1 mg/L, then the two models are "consistent."

Counts of the X2 location occurring east of three control points (64, 74, and 81 km east of the Golden Gate Bridge) for the February through June period, for each of the 82-years, sorted by water year type are presented in Table 169 of each comparison in Appendix A Monthly Data Products Volume I.

To further refine the comparison of the models, the average, maximum, and minimum monthly X2 position was then developed for all months to compare the variability between the models, using a representation of the upper and lower boundaries of the data, and are presented in Table 170 of each comparison in Appendix A Monthly Data Products Volume I.

These maximum and minimum values discussed above present the end points in the data and do not consider changes within a given year. Therefore, the monthly shift in the X2 position was evaluated on a year-to-year basis for each month in the 82-year POR. The results are shown in Table 171 of each comparison in Appendix A Monthly Data Products Volume I.

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 was derived as a final derivative of the variation between the models. Table 172 of each comparison in Appendix A Monthly Data Products Volume I shows the results of this comparison.

Delta outflow for September and October are required to maintain monthly average X2 no greater than 74 km from the Golden Gate Bridge. If the preceding spring was above normal, then the criterion is 81 km for both months. The variability of X2 values based on the complete 82-year POR, the POR delimited by water type, and differences of these parameters between each models are presented in Table 173 of each comparison in Appendix A Monthly Data Products Volume I.

The Delta outflow objectives for February through June are based on the X2 objectives which have already been discussed in earlier sections of this report. The Delta outflow objectives for July through January are defined in D-1641. Table 174 of each comparison in Appendix A Monthly Data Products Volume I shows count of months where Delta outflow is less than the objectives.

Monthly count of occurrences where salinity in CCWD's Rock Slough intake is greater than 150 mg/L is presented in Table 177 of each comparison in Appendix A Monthly Data Products Volume I.

1.2.3 Riverine Temperatures

USACE selected the model output nodes specified below for this evaluation because of their regulatory relevance, their historical importance in characterizing effects on water temperature in the CVP/SWP system, and/or because they represent locations downstream of notable accretions or depletions.

- Water temperature in the Sacramento River
  - Below Keswick Dam

  - At Bend Bridge
  - Below the Feather River confluence
  - At Freeport
- Water temperature in the Feather River
  - Below the Thermalito Afterbay Outlet
  - At the mouth of lower Feather River
- Water temperature in the American River
  - Below Nimbus Dam
  - At Watt Avenue
  - At the mouth of LAR (river mile [RM] 1)

USACE used monthly average simulated water temperatures over the entire simulation period and by water year type (based on the Sacramento Valley Index) to compare differences between the alternatives and the basis of comparison. Long-term average water temperatures for each month and monthly average water temperatures by water year type are presented in tabular format. In addition, water temperature differences were evaluated over the entire monthly exceedance distributions and over the warmest 25 percent of the monthly exceedance distributions. Water temperature exceedance distributions (or curves) illustrate the distribution of simulated water temperatures under the two compared scenarios. These data products are presented in:

- Tables 42 through 119 of each comparison in Appendix A Monthly Data Products Volume I;
- Figures 40 through 111 of each comparison in Appendix A Monthly Data Products Volume I;
- Tables Daily-2 through Daily-40 of each comparison in Appendix C Daily Data Products; and
- Figures Daily-30 through Daily-65 of each comparison in Appendix C Daily Data Products.

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. For the purposes of identifying general increases and decreases in water temperatures, USACE applied a metric of greater than 0.3 degree Fahrenheit (°F) in order to describe “measurable” increases and decreases in water temperatures (YCWA et al. 2007). Specifically, USACE identified measurable increases and decreases in water temperature for long-term average monthly and average monthly by water year type water temperatures for each node evaluated.

Over the monthly exceedance distributions, net measurable changes in water temperature were computed over the entire monthly distributions as well as over the warmest 25 percent of the monthly distributions for each node evaluated. Net measurable changes were calculated as a percentage of time by subtracting the percentage of time represented by measurable decreases in water temperature from the percentage of time represented by measurable increases in water temperature. Net measurable changes representing 10 percent or more of the monthly distribution evaluated are reported in this section.

While general differences in water temperatures are discussed in this section, more-detailed evaluations of water temperature exceedance distributions are presented in Chapter 7, Fisheries, to identify the effects on fish species of focused evaluation. Specifically, Chapter 7, Fisheries, evaluates differences in the probability of simulated water temperatures exceeding fish species and lifestage-specific water temperature index values with the Folsom WCM alternatives, relative to the basis of comparison.

1.3 E504 ELD Model Development

The E504 ELD CalSim II model build served as the basis of water quality effects evaluation for E504 ELD. E504 ELD incorporates the flood storage reserve requirements associated with a 400/670 TAF variable storage operation utilizing upstream storage crediting from French Meadows, Hell Hole, and Union Valley (SAFCA and Reclamation 2004). The Joint Federal Project is not part of this model build. E504 ELD represents a 2013 level of demand condition. A detailed presentation of the E504 ELD CalSim II model is found in Chapter 2, Water Supply. No modifications were made to Reclamation's monthly temperature model, other than revising the flow and storage input values from the CalSim II build for E504 ELD.

1.4 J604 FLD Model Development

J604 FLD incorporates the flood storage reserve requirements associated with a 400/670 TAF variable storage operation utilizing upstream storage crediting from French Meadows, Hell Hole, and Union Valley (SAFCA and Reclamation 2004). The Joint Federal Project auxiliary spillway is used only under emergency conditions. J604 FLD represents a 2020/2033 level of demand condition. A detailed presentation of these calculations is found in Chapter 2, Water Supply. No modifications were made to Reclamation's monthly temperature model, other than revising the flow and storage input values from the CalSim II build for J604 FLD.

1.5 Comparison of E504 ELD and J604 FLD

1.5.1 General Observations

Delta water quality model outputs indicate that, in general, these parameters show slight differences for the two scenarios. The magnitude of differences in Delta outflow is within a range of ±1.6 percent for the full simulation period average monthly outflow, with a maximum decrease of 2.5 percent in April of below-normal water years, and maximum increase of 4.4 percent in August of critical water years. The J604 FLD March through May long-term average and water year type outflows show a 0.1-percent increase for long-term and all water year types, except for a 0.3-percent increase for below-normal water years.

The long-term monthly mean E/I ratios indicate slight differences between J604 FLD and E504 ELD with a maximum absolute difference of –1.3 percent in average of all Augusts. The full simulation period differences ranges from –2.4 percent in average of all Augusts to 6.2 percent in average of all Aprils.

The long-term average monthly X2 location has a positive shift of 0.2 km in July and 0.1 km in August, November, and December. The average X2 location in May shifts negatively by 0.2 km. For all other months, there is no change in the full simulation period average monthly X2 location for the two scenarios compared. Average monthly X2 location by water year type shows a change of ±0.2 km.

1.5.2 Detailed Observations

Table 4-3. Delta Outflow, E/I Ratio, X2 Location, and Rock Slough Salinity for J604 FLD vs. E504 ELD.

Delta Outflow	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Long-term and water year type average Delta Outflow – Generally similar long-term average delta outflows and generally similar average delta outflow most of the time during all water year types (±2.5%).	Monthly Maximum Reduction	–1.4%	–1.8%	–1.3%	–2.5%	–1.3%	√
	Delta Outflow March–May	√	√	√	√	√	√
	Delta Outflow Objectives	NA	NA	NA	NA	NA	NA
E/I Ratio	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Long-term and water year type average E/I Ratio – Generally similar long-term average and generally similar most of the time during all water year types. The maximum change is seen is (±16.6%) in Critical year types.	E/I Ratio	–2.4%	–1.5%	√	√	–4.5%	–16.6%
X2 Location	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
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.	X2 Location (km)	0.2	0.2	0.2	0.1	0.1	0.1

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

1.5.2.1 Riverine Temperatures

Simulated monthly water temperatures at representative nodes in the rivers in the Project Area indicate that water temperatures under J604 FLD relative to E504 ELD would generally: be (1) similar most of the time during most of the year in the Sacramento River, but would be somewhat warmer more often during July and August below Keswick Dam, somewhat warmer more often during August and October at Bend Bridge, somewhat warmer more often during August and somewhat cooler more often during July below the Feather River confluence, and somewhat warmer more often during July through September at Freeport; (2) generally similar most of the time in the Feather River below the Thermalito Afterbay Outlet and at the mouth, but somewhat warmer during August below the Thermalito Afterbay Outlet; and (3) generally similar or cooler during the fall, and warmer more often during the spring and summer in the American River.

Changes in simulated water temperatures within each evaluated water body under J604 FLD relative to E504 ELD are summarized in Table 4-4 below.

Table 4-4. Riverine Water Temperatures for J604 FLD vs. E504 ELD.

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 long-term average water temperatures and average water temperatures by water year type during most months at most locations, except for warmer water temperatures during the spring and summer and cooler temperatures during the fall in the American River, and warmer water temperatures during August in the Sacramento River.	**Long-term and Water Year Type Average Water Temperature**					
		Long-term	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Sacramento River below Keswick Dam		✓	✓	✓	✓	✓	Warmer in Aug
Sacramento River at Bend Bridge		✓	✓	✓	✓	✓	Warmer in Aug
Sacramento River at Feather River confluence		✓	✓	✓	✓	✓	✓
Sacramento River at Freeport		✓	✓	✓	✓	✓	Warmer in Aug
Feather River below Thermalito Afterbay Outlet		✓	✓	✓	✓	✓	✓
Feather River at the mouth		✓	✓	✓	✓	✓	✓
American River below Nimbus Dam		Cooler in Dec; warmer in Aug	Cooler in Dec; warmer in Aug	✓	Cooler in Nov & Dec	Cooler in Dec & May	Cooler in Dec & Jan; warmer in Jun–Aug
American River at Watt Avenue		Cooler in Dec; warmer in May–Sep	Warmer in Jul & Aug	Warmer in May & Jul–Sep	Cooler in Dec; warmer in Apr–Jul & Sep	Warmer in Apr–Sep	Cooler in Dec; warmer in Mar–Sep
American River at the mouth		Warmer in Mar–Sep	Warmer in May–Sep	Warmer in May–Sep	Cooler in Dec; warmer in Apr–Jul & Sep	Warmer in Mar–Sep	Cooler in Dec; warmer in Mar–Sep

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Results
Water Temperature – Net Measurable Differences over Entire Monthly Exceedance Distributions		
River and Location	Generally similar water temperatures over most of the monthly exceedance distributions, but with warmer water temperatures more often in the American River during the spring and summer and cooler temperatures during the fall.	**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		✓
American River below Nimbus Dam		Net measurable increases during Aug–Sep; net decreases in Nov–Dec
American River at Watt Avenue		Net measurable increases during Mar–Sep; net decreases in Nov–Dec
American River at the mouth		Net measurable increases during Mar–Sep; net decrease in Dec
Water Temperature – Net Measurable Differences over Warmest 25% of Monthly Exceedance Distributions		
River and Location	Generally similar water temperatures over most of the monthly exceedance distributions, but warmer temperatures during some months in summer in the Sacramento and Feather Rivers, and during the spring and summer in the American River, and cooler temperatures in Dec in the American River.	**Warmest 25% of the Monthly Exceedance Distributions**
Sacramento River below Keswick Dam		Net measurable increases during Jul and Aug
Sacramento River at Bend Bridge		Net measurable increases during Aug and Oct
Sacramento River at Feather River confluence		Net measurable increase during Aug and net measurable decrease during Jul
Sacramento River at Freeport		Net measurable increases during Jul–Sep
Feather River below Thermalito Afterbay Outlet		Net measurable increase during Aug
Feather River at the mouth		✓
American River below Nimbus Dam		Net measurable increases during Mar and Jun–Sep and net measurable decreases during Dec
American River at Watt Avenue		Net measurable increases during Mar–Sep and net measurable decrease during Dec
American River at the mouth		Net measurable increases during Feb–Sep and net measurable decrease during Dec

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

Additional discussion of water temperature changes in the LAR 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 or generally similar during most months of the year, but would be measurably warmer during August and cooler during December. Monthly water temperatures by water year type would be generally equivalent or cooler during the fall and winter of most water year types, and generally similar or warmer more often during the spring and summer. Monthly water temperature exceedance probability distributions would be cooler more often during October through January, generally similar during February through May, and similar or warmer more often during June through September.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more of the time during November and December, and net measurable increases in water temperature would occur over 10 percent or more of the time during August and September. 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 December, and net measurable increases would occur over 10 percent or more in the distributions during March and June through September.

American River at Watt Avenue

Long-term average monthly water temperatures in the American River at Watt Avenue would be essentially equivalent or generally similar most of the time, but would be measurably warmer during May through August. Monthly water temperatures by water year type would be generally equivalent or cooler during the fall and winter, and generally similar or warmer during the spring and summer. Monthly water temperature exceedance probability distributions would be generally similar or cooler during October through December, similar or warmer during January and March, and warmer more often during April through September.

Over the entire monthly distributions, net measurable decreases would occur during November and December, and net measurable increases would occur during March through September. Over the warmest 25 percent of the monthly distributions, net measurable decreases in water temperature would occur during December, and net measurable increases would occur over 10 percent or more in the distributions during March through September.

American River at the Mouth

Long-term average monthly water temperatures in the American River at the mouth would be measurably warmer during March through September. Monthly water temperatures by water year type would be generally equivalent or cooler during October through February and warmer more often during March through September of most water year types. Monthly water temperature exceedance probability distributions would be generally similar during October, November and February, cooler during December through January, and warmer more often during March through September.

Over the entire monthly distributions, a net measurable decrease would occur during December, and net measurable increases would occur during March through September. Also, over the warmest 25 percent of the monthly distributions, net measurable decreases in water temperature would occur during December, and net measurable increases would occur over 10 percent or more in the distributions during February through September.

1.5.3 Evaluation of Effects

As described earlier in this chapter, no changes were made to the Folsom Reservoir operations for J604 FLD relative to E504 ELD. Therefore, this discussion of water quality effects is limited to the observations caused by other differences between E504 ELD and J604 FLD.

From the Delta water quality perspective, E504 ELD and J604 FLD show very little difference in the CalSim II model outputs. Delta outflow would change very minimally. These changes represent a percent difference of 1.6 or less. The long-term average monthly X2 location would shift by ±0.2 km for some months, while would remain the same for most months. E/I ratio shows slightly higher percentage changes but is well under the regulatory limits of 65 percent and 35 percent.

Evaluation of effects related to the river water temperatures are discussed as part of the fisheries effects evaluation in Chapter 7, Fisheries.

1.6 J602F3 ELD Model Development

J602F3 ELD was built from the E504 ELD CalSim II build. The inflow-forecast-based operations compute the required available storage level, or top-of-conservation-pool storage volumes, as a function of forecasted inflow volume. Inflow volumes are computed from runoff forecast data provided by the National Weather Service. J602F3 ELD represents a 2013 level of demand condition. A detailed description of this model is found in Chapter 2, Water Supply. No modifications were made to Reclamation's monthly temperature model, other than revising the flow and storage input values from the CalSim II build for J602F3 ELD.

1.7 Comparison of J602F3 ELD and E504 ELD

1.7.1 General Observations

Delta water quality modeling indicates that, in general, these parameters show little difference for the two scenarios compared. The magnitude of differences in Delta outflow is within a range of ±1.0 percent for the full simulation period average. 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.

The Delta X2 location in general also shows minimal difference for the two scenarios. 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.

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.

The average X2 for J602F3 ELD moves east of the control point relative to E504 ELD twice: 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 J602F3 ELD relative to E504 ELD decreases by one in May of dry water years. Results indicate that the scenarios are "consistent" with respect to the fall X2 standards. Both scenarios have X2 locations greater than those required by September standards while meeting October X2 standards. Both scenarios meet the Delta outflow objectives for July through January. The X2 for J602F3 ELD shows four instances with a greater than or equal to 1 km shift and those occurred in March, April, November, and December. With consistency-based criteria, J602F3 ELD was determined to be "not consistent" with E504 ELD.

The CCWD Rock Slough intake shows no increases in occurrences of salinity 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. The maximum difference in salinity was an increase of 12.56 mg/L (from 171.79 mg/L to 184.35 mg/L) occurring in water year 1935, a below-normal water year. The difference of >3 mg/L means that J602F3 ELD is considered "not consistent" with E504 ELD based on the consistency formulation for Rock Slough salinity.

1.7.2 Detailed Observations

Table 4-5. Delta Outflow, E/I Ratio, X2 Location, and Rock Slough Salinity for J602F3 ELD vs. E504 ELD.

Delta Outflow	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Long-term and water year type average Delta Outflow – Generally similar long-term average delta outflows and generally similar average delta outflow most of the time during all water year types (±2.0%).	Monthly Maximum Reduction	√	–1.1%	–1.7%	–1.3%	–2.0%	√
	Delta Outflow March–May	√	√	√	√	√	√
	Delta Outflow Objectives	NA	√	√	√	√	√
E/I Ratio	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Long-term and water year type average E/I Ratio – Generally similar long-term average and generally similar most of the time during all water year types. The maximum change is seen is (±4.1%) in dry year types.	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%

X2 Location	Evaluation Parameters	Long-term	Wet	Above Normal	Below Normal	Dry	Critical
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.	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 Count 81 km	NA	√	√	√	√	√
	X2 Location Count 74 km	NA	√	√	1	–1	√
	X2 Location Count 64 km	NA	√	√	√	1	√

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 (±1.5 km).	Change in X2 Location Monthly Maximum Value km	0.3 west
	Change in X2 Location Monthly Minimum Value km	0.4 east
	X2 Location Relative Change km (Maximum)	1.2
	X2 Location Relative Change km (Minimum)	–3.1
	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

Salinity Rock Slough	Evaluation Parameters	Long-term	Wet	Above Normal	Below Normal	Dry	Critical
Water year type Salinity at Rock Slough Intake – Generally similar long-term average and generally similar most of the time during all water year types.	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.

1.7.2.1 Riverine Temperatures

Simulated monthly water temperatures at representative nodes in the rivers in the Project Area indicate that water temperatures under J602F3 ELD relative to E504 ELD 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, 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; (2) equivalent or similar most of the time in the Feather River below the Thermalito Afterbay Outlet and at the mouth; and (3) generally similar most of the time in the LAR, 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.

Changes in simulated water temperatures within each evaluated water body under J602F3 ELD relative to E504 ELD are summarized in Table 4-10 below.

Table 4-6. Riverine Water Temperatures for J602F3 ELD vs. E504 ELD.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Results**					
Water Temperature – Long-term Average and Average by Water Year Type							
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	Generally similar long-term average water temperatures and average water temperatures by water year type during most months, with some differences during some months in the American River.	✓	✓	✓	✓	✓	✓
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		✓	✓	✓	✓	✓	✓
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

Water Temperature – Net Measurable Differences over Entire Monthly Exceedance Distributions

River and Location		**Entire Monthly Exceedance Distributions**
Sacramento River below Keswick 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.	✓
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		✓
American River below Nimbus Dam		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

Water Temperature – Net Measurable Differences over Warmest 25% of Monthly Exceedance Distributions		
River and Location		**Warmest 25% of the Monthly Exceedance Distributions**
Sacramento River below Keswick 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 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		✓
American River below Nimbus Dam		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

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

Additional discussion of water temperature changes in the LAR 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 similar most of the time by water year type, but would be measurably cooler during May of below-normal years and during May and June of dry water years. Monthly water temperature exceedance probability distributions would be generally similar most of the time during most months, but would be cooler during April through August and October, and warmer during March.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more of the time during May and June. 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 April through July, while a net measurable increase would occur during March.

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, except for May when temperatures would be measurably cooler. Monthly water temperatures by water year type would be generally similar during all water year types, but would be measurably cooler during May and June of above-normal and dry water years, May of below-normal water years, and July of critical water years. Monthly water temperature exceedance probability distributions would be generally similar most of the time during most months, but would be cooler during May, June, and July.

Over the entire monthly distributions, a net measurable decrease in water temperature would occur over 10 percent or more of the time during May and June. 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 May, June and July.

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. Generally, monthly water temperatures by water year type would be similar during most months of all water year types, but would be measurably cooler during March of wet years, May and June of above-normal and dry water years, and July of critical water years, and would be measurably warmer during March of dry water years. Monthly water temperature exceedance probability distributions would be generally similar most of the time, but would be cooler during May and June and warmer during August.

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

1.7.3 Evaluation of Effects

The Delta water quality effects evaluation for E504 ELD and J602F3 ELD indicates that J602F3 ELD would be generally similar to E504 ELD over the full simulation period. The changes in the long-term averages for Delta outflow, X2, and E/I ratio represent a difference of 1 percent or less. Consistency-based evaluation shows that the two scenarios would be consistent for Delta outflow, but “not consistent” for X2 and salinity at Rock Slough intake.

A positive shift of greater than or equal to 1 km in X2 location occurs four times over the simulation period. Further investigation of the scenarios indicates that the X2 shifts positively by 1.2 km in December 1950, an above-normal water year. This is due in part to the change in the maximum allowable storage at Folsom Reservoir and the ability for Folsom Reservoir to store more water during this month. The X2 shifts positively by 1 km in March 1932, a dry water year, and by 1.1 km both in April 1960, a dry water year, and November 1962, a wet water year. This is due in part to the changes in the Folsom Reservoir storages and associated Folsom-Shasta reservoir storage balancing in the CalSim II model. While this change would be considered "not consistent" with the consistency-based formulation, it is rare enough that the two scenarios would still be considered generally equivalent. In addition, the consistency criteria of X2 ever shifting positively by >1 km is very rigorous and should be considered in tandem with fisheries evaluation for effects on the Delta fish population.

The salinity at Rock Slough intake increases by >3 mg/L making the two scenarios "not consistent." It should be noted that for the below-normal, dry, and critical water years, the count of occurrences of >150 mg/L decreases by one time.

1.12 References

Water Quality

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Appendix C: Vegetation and Wildlife, Part 1

CALIFORNIA DEPARTMENT OF FISH and WILDLIFE RareFind

Query Summary:
Quad IS (Carmichael (3812153) OR Citrus Heights (3812163) OR Clarksville (3812161) OR Folsom (3812162) OR Pilot Hill (3812171) OR Rocklin (3812172) OR Sacramento East (3812154) OR Sacramento West (3812155))

Print Close

CNDDB Element Query Results

Scientific Name	Common Name	Taxonomic Group	Element Code	Total Occs	Returned Occs	Federal Status	State Status	Global Rank	State Rank	CA Rare Plant Rank	Other Status	Habitats
Accipiter cooperii	Cooper's hawk	Birds	ABNKC12040	107	4	None	None	G5	S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Cismontane woodland, Riparian forest, Riparian woodland, Upper montane coniferous forest
Agelaius tricolor	tricolored blackbird	Birds	ABPBXB0020	859	28	None	Candidate Threatened	G2G3	S1S2	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_EN-Endangered, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Marsh & swamp, Swamp, Wetland
Andrena blennospermatis	Blennosperma vernal pool andrenid bee	Insects	IIHYM35030	15	1	None	None	G2	S2	null	null	Vernal pool
Andrena subapasta	an andrenid bee	Insects	IIHYM35210	5	2	None	None	G1G2	S1S2	null	null	null
Antrozous pallidus	pallid bat	Mammals	AMACC10010	406	1	None	None	G5	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFS_S-Sensitive, WBWG_H-High Priority	Chaparral, Coastal scrub, Desert wash, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Riparian woodland, Sonoran desert scrub, Upper montane coniferous forest, Valley & foothill grassland
Aquila chrysaetos	golden eagle	Birds	ABNKC22010	312	3	None	None	G5	S3	null	BLM_S-Sensitive, CDF_S-Sensitive, CDFW_FP-Fully Protected, CDFW_WL-Watch List, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Broadleaved upland forest, Cismontane woodland, Coastal prairie, Great Basin grassland, Great Basin scrub, Lower montane coniferous forest, Pinon & juniper woodlands, Upper montane coniferous forest, Valley & foothill grassland
Archoplites interruptus	Sacramento perch	Fish	AFCQB07010	5	1	None	None	G2G3	S1	null	AFS_TH-Threatened, CDFW_SSC-Species of Special Concern	Aquatic, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters
Ardea alba	great egret	Birds	ABNGA04040	37	3	None	None	G5	S4	null	CDF_S-Sensitive, IUCN_LC-Least Concern	Brackish marsh, Estuary, Freshwater marsh, Marsh &

												swamp, Riparian forest, Wetland
Ardea herodias	great blue heron	Birds	ABNGA04010	137	7	None	None	G5	S4	null	CDF_S-Sensitive, IUCN_LC-Least Concern	Brackish marsh, Estuary, Freshwater marsh, Marsh & swamp, Riparian forest, Wetland
Astragalus tener var. ferrisiae	Ferris' milk-vetch	Dicots	PDFAB0F8R3	18	1	None	None	G2T1	S1	1B.1	BLM_S-Sensitive	Meadow & seep, Valley & foothill grassland, Wetland
Athene cunicularia	burrowing owl	Birds	ABNSB10010	1914	21	None	None	G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Coastal prairie, Coastal scrub, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Sonoran desert scrub, Valley & foothill grassland
Balsamorhiza macrolepis	big-scale balsamroot	Dicots	PDAST11061	43	1	None	None	G2	S2	1B.2	BLM_S-Sensitive, USFS_S-Sensitive	Chaparral, Cismontane woodland, Ultramafic, Valley & foothill grassland
Banksula californica	Alabaster Cave harvestman	Arachnids	ILARA14020	1	1	None	None	GH	SH	null	null	Limestone
Bombus occidentalis	western bumble bee	Insects	IIHYM24250	282	1	None	None	G2G3	S1	null	USFS_S-Sensitive, XERCES_IM-Imperiled	null
Branchinecta lynchi	vernal pool fairy shrimp	Crustaceans	ICBRA03030	751	22	Threatened	None	G3	S3	null	IUCN_VU-Vulnerable	Valley & foothill grassland, Vernal pool, Wetland
Branchinecta mesovallensis	midvalley fairy shrimp	Crustaceans	ICBRA03150	126	6	None	None	G2	S2S3	null	null	Vernal pool, Wetland
Buteo regalis	ferruginous hawk	Birds	ABNKC19120	107	1	None	None	G4	S3S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Great Basin grassland, Great Basin scrub, Pinon & juniper woodlands, Valley & foothill grassland
Buteo swainsoni	Swainson's hawk	Birds	ABNKC19070	2409	65	None	Threatened	G5	S3	null	BLM_S-Sensitive, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Great Basin grassland, Riparian forest, Riparian woodland, Valley & foothill grassland
Calystegia stebbinsii	Stebbins' morning-glory	Dicots	PDCON040H0	13	1	Endangered	Endangered	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Ultramafic
Carex xerophila	chaparral sedge	Monocots	PMCYP03M60	15	1	None	None	G2G3	S2S3	1B.2	null	Chaparral, Cismontane woodland, Lower montane coniferous forest, Ultramafic
Ceanothus roderickii	Pine Hill ceanothus	Dicots	PDRHA04190	8	4	Endangered	Rare	G1	S1	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Ultramafic
Chlorogalum grandiflorum	Red Hills soaproot	Monocots	PMLIL0G020	82	3	None	None	G2	S2	1B.2	BLM_S-Sensitive	Chaparral, Cismontane woodland, Lower montane coniferous forest, Ultramafic
Cicindela hirticollis abrupta	Sacramento Valley tiger beetle	Insects	IICOL02106	6	1	None	None	G5TH	SH	null	null	Sand shore
Clarkia biloba ssp. brandegeeae	Brandegee's clarkia	Dicots	PDONA05053	89	9	None	None	G4G5T4	S4	4.2	BLM_S-Sensitive	Chaparral, Cismontane woodland, Lower montane coniferous forest

Coccyzus americanus occidentalis	western yellow-billed cuckoo	Birds	ABNRB02022	155	1	Threatened	Endangered	G5T2T3	S1	null	BLM_S-Sensitive, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Riparian forest
Cosumnoperla hypocrena	Cosumnes stripetail	Insects	IIPLE23020	12	4	None	None	G2	S2	null	null	Aquatic
Crocanthemum suffrutescens	Bisbee Peak rush-rose	Dicots	PDCIS020F0	31	9	None	None	G2Q	S2	3.2	null	Chaparral, Ione formation, Ultramafic
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	Insects	IICOL48011	271	41	Threatened	None	G3T2	S2	null	null	Riparian scrub
Downingia pusilla	dwarf downingia	Dicots	PDCAM060C0	126	1	None	None	GU	S2	2B.2	null	Valley & foothill grassland, Vernal pool, Wetland
Dumontia oregonensis	hairy water flea	Crustaceans	ICBRA23010	2	1	None	None	G1G3	S1	null	null	Vernal pool
Elanus leucurus	white-tailed kite	Birds	ABNKC06010	162	20	None	None	G5	S3S4	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_LC-Least Concern	Cismontane woodland, Marsh & swamp, Riparian woodland, Valley & foothill grassland, Wetland
Elderberry Savanna	Elderberry Savanna	Riparian	CTT63440CA	4	3	None	None	G2	S2.1	null	null	Riparian scrub
Emys marmorata	western pond turtle	Reptiles	ARAAD02030	1187	9	None	None	G3G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable, USFS_S-Sensitive	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh & swamp, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Falco columbarius	merlin	Birds	ABNKD06030	35	1	None	None	G5	S3S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Estuary, Great Basin grassland, Valley & foothill grassland
Fremontodendron decumbens	Pine Hill flannelbush	Dicots	PDSTE03030	10	3	Endangered	Rare	G1	S1	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_UCBBG-UC Berkeley Botanical Garden	Chaparral, Cismontane woodland, Ultramafic
Fritillaria agrestis	stinkbells	Monocots	PMLIL0V010	32	2	None	None	G3	S3	4.2	null	Chaparral, Cismontane woodland, Ultramafic, Valley & foothill grassland
Galium californicum ssp. sierrae	El Dorado bedstraw	Dicots	PDRUB0N0E7	16	4	Endangered	Rare	G5T1	S1	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Lower montane coniferous forest, Ultramafic
Gratiola heterosepala	Boggs Lake hedge-hyssop	Dicots	PDSCR0R060	94	2	None	Endangered	G2	S2	1B.2	BLM_S-Sensitive	Freshwater marsh, Marsh & swamp, Vernal pool, Wetland
Great Valley Cottonwood Riparian Forest	Great Valley Cottonwood Riparian Forest	Riparian	CTT61410CA	56	1	None	None	G2	S2.1	null	null	Riparian forest

Haliaeetus leucocephalus	bald eagle	Birds	ABNKC10010	325	4	Delisted	Endangered	G5	S3	null	BLM_S-Sensitive, CDF_S-Sensitive, CDFW_FP-Fully Protected, IUCN_LC-Least Concern, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Lower montane coniferous forest, Oldgrowth
Hibiscus lasiocarpos var. occidentalis	woolly rose-mallow	Dicots	PDMAL0H0R3	173	1	None	None	G5T2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Freshwater marsh, Marsh & swamp, Wetland
Hydrochara rickseckeri	Ricksecker's water scavenger beetle	Insects	IICOL5V010	13	2	None	None	G2?	S2?	null	null	Aquatic, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters
Juncus leiospermus var. ahartii	Ahart's dwarf rush	Monocots	PMJUN011L1	13	1	None	None	G2T1	S1	1B.2	null	Valley & foothill grassland
Lasionycteris noctivagans	silver-haired bat	Mammals	AMACC02010	138	2	None	None	G5	S3S4	null	IUCN_LC-Least Concern, WBWG_M-Medium Priority	Lower montane coniferous forest, Oldgrowth, Riparian forest
Lasiurus cinereus	hoary bat	Mammals	AMACC05030	235	1	None	None	G5	S4	null	IUCN_LC-Least Concern, WBWG_M-Medium Priority	Broadleaved upland forest, Cismontane woodland, Lower montane coniferous forest, North coast coniferous forest
Laterallus jamaicensis coturniculus	California black rail	Birds	ABNME03041	244	1	None	Threatened	G3G4T1	S1	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_NT-Near Threatened, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Brackish marsh, Freshwater marsh, Marsh & swamp, Salt marsh, Wetland
Legenere limosa	legenere	Dicots	PDCAM0C010	78	6	None	None	G2	S2	1B.1	BLM_S-Sensitive	Vernal pool, Wetland
Lepidurus packardi	vernal pool tadpole shrimp	Crustaceans	ICBRA10010	320	28	Endangered	None	G4	S3S4	null	IUCN_EN-Endangered	Valley & foothill grassland, Vernal pool, Wetland
Linderiella occidentalis	California linderiella	Crustaceans	ICBRA06010	430	38	None	None	G2G3	S2S3	null	IUCN_NT-Near Threatened	Vernal pool
Melospiza melodia	song sparrow ("Modesto" population)	Birds	ABPBXA3010	92	2	None	None	G5	S3?	null	CDFW_SSC-Species of Special Concern	null
Navarretia myersii ssp. myersii	pincushion navarretia	Dicots	PDPLM0C0X1	14	1	None	None	G2T2	S2	1B.1	null	Vernal pool, Wetland
Northern Hardpan Vernal Pool	Northern Hardpan Vernal Pool	Herbaceous	CTT44110CA	126	10	None	None	G3	S3.1	null	null	Vernal pool, Wetland
Northern Volcanic Mud Flow Vernal Pool	Northern Volcanic Mud Flow Vernal Pool	Herbaceous	CTT44132CA	7	3	None	None	G1	S1.1	null	null	Vernal pool, Wetland
Oncorhynchus mykiss irideus	steelhead - Central Valley DPS	Fish	AFCHA0209K	31	4	Threatened	None	G5T2Q	S2	null	AFS_TH-Threatened	Aquatic, Sacramento/San Joaquin flowing waters
Oncorhynchus tshawytscha	chinook salmon - Central Valley spring-run ESU	Fish	AFCHA0205A	13	1	Threatened	Threatened	G5	S1	null	AFS_TH-Threatened	Aquatic, Sacramento/San Joaquin flowing waters
Oncorhynchus tshawytscha	chinook salmon - Sacramento River winter-run ESU	Fish	AFCHA0205B	2	1	Endangered	Endangered	G5	S1	null	AFS_EN-Endangered	Aquatic, Sacramento/San Joaquin flowing waters

Orcuttia viscida	Sacramento Orcutt grass	Monocots	PMPOA4G070	12	4	Endangered	Endangered	G1	S1	1B.1	null	Vernal pool, Wetland
Packera layneae	Layne's ragwort	Dicots	PDAST8H1V0	48	10	Threatened	Rare	G2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Ultramafic
Pandion haliaetus	osprey	Birds	ABNKC01010	491	1	None	None	G5	S4	null	CDF_S-Sensitive, CDFW_WL-Watch List, IUCN_LC-Least Concern	Riparian forest
Phalacrocorax auritus	double-crested cormorant	Birds	ABNFD01020	38	1	None	None	G5	S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Riparian forest, Riparian scrub, Riparian woodland
Pogonichthys macrolepidotus	Sacramento splittail	Fish	AFCJB34020	15	1	None	None	GNR	S3	null	AFS_VU-Vulnerable, CDFW_SSC-Species of Special Concern, IUCN_EN-Endangered	Aquatic, Estuary, Freshwater marsh, Sacramento/San Joaquin flowing waters
Progne subis	purple martin	Birds	ABPAU01010	68	10	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Broadleaved upland forest, Lower montane coniferous forest
Rana draytonii	California red-legged frog	Amphibians	AAABH01022	1405	1	Threatened	None	G2G3	S2S3	null	CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable	Aquatic, Artificial flowing waters, Artificial standing waters, Freshwater marsh, Marsh & swamp, Riparian forest, Riparian scrub, Riparian woodland, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Riparia riparia	bank swallow	Birds	ABPAU08010	297	4	None	Threatened	G5	S2	null	BLM_S-Sensitive, IUCN_LC-Least Concern	Riparian scrub, Riparian woodland
Sagittaria sanfordii	Sanford's arrowhead	Monocots	PMALI040Q0	93	16	None	None	G3	S3	1B.2	BLM_S-Sensitive	Marsh & swamp, Wetland
Spea hammondii	western spadefoot	Amphibians	AAABF02020	449	3	None	None	G3	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened	Cismontane woodland, Coastal scrub, Valley & foothill grassland, Vernal pool, Wetland
Spirinchus thaleichthys	longfin smelt	Fish	AFCHB03010	45	1	Candidate	Threatened	G5	S1	null	CDFW_SSC-Species of Special Concern	Aquatic, Estuary
Symphyotrichum lentum	Suisun Marsh aster	Dicots	PDASTE8470	173	1	None	None	G2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_USDA-US Dept of Agriculture	Brackish marsh, Freshwater marsh, Marsh & swamp, Wetland
Taxidea taxus	American badger	Mammals	AMAJF04010	517	3	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Alkali marsh, Alkali playa, Alpine, Alpine dwarf scrub, Bog & fen, Brackish marsh, Broadleaved upland forest, Chaparral, Chenopod scrub, Cismontane woodland, Closed-cone coniferous forest, Coastal bluff scrub, Coastal dunes,

												Coastal prairie, Coastal scrub, Desert dunes, Desert wash, Freshwater marsh, Great Basin grassland, Great Basin scrub, Interior dunes, Ione formation, Joshua tree woodland, Limestone, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Mojavean desert scrub, Montane dwarf scrub, North coast coniferous forest, Oldgrowth, Pavement plain, Redwood, Riparian forest, Riparian scrub, Riparian woodland, Salt marsh, Sonoran desert scrub, Sonoran thorn woodland, Ultramafic, Upper montane coniferous forest, Upper Sonoran scrub, Valley & foothill grassland
Thamnophis gigas	giant gartersnake	Reptiles	ARADB36150	347	4	Threatened	Threatened	G2	S2	null	IUCN_VU-Vulnerable	Marsh & swamp, Riparian scrub, Wetland
Valley Needlegrass Grassland	Valley Needlegrass Grassland	Herbaceous	CTT42110CA	45	1	None	None	G3	S3.1	null	null	Valley & foothill grassland
Vireo bellii pusillus	least Bell's vireo	Birds	ABPBW01114	472	2	Endangered	Endangered	G5T2	S2	null	IUCN_NT-Near Threatened, NABCI_YWL-Yellow Watch List	Riparian forest, Riparian scrub, Riparian woodland
Wyethia reticulata	El Dorado County mule ears	Dicots	PDAST9X0D0	25	13	None	None	G2	S2	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Lower montane coniferous forest, Ultramafic

Appendix C: Vegetation and Wildlife, Part 2

Terrestrial Resources

1.1 Background

This section describes the existing terrestrial resources in the lower American River (LAR) and Folsom Reservoir and presents the U.S. Army Corps of Engineers' (USACE) analysis of the effects of the Folsom Dam Water Control Manual (WCM) Update alternatives on these resources. USACE's first task was to identify areas along the LAR that, as per previous observations and studies, were most susceptible to fluctuations in water flow. USACE compared various existing, with-project, and future flow scenarios and used the output to determine the effects at each of the identified susceptible focus sites.

USACE's data sources for the terrestrial assessment included previously reported field observations, analyses, and resource agency input. USACE used this information to determine the specific LAR locations (i.e., focus sites) at which to evaluate the effects of the Folsom WCM alternatives on terrestrial resources.

Figure 1 of Appendix 5B shows the seven terrestrial focus sites along the LAR that USACE selected based on the following four elements: (1) riparian locations identified by the U.S. Fish and Wildlife Service (USFWS) as potential erosion study sites (Appendix 5B, Figure 1); (2) existing mitigation and restoration sites along the LAR (Appendix 5B, Figure 4); (3) mapped locations of occurrences of California Natural Diversity Database (CNDDB) species and communities along the lower-gradient banks of the LAR (Appendix 5B, Figure 3); and (4) stands of valley elderberry longhorn beetle (VELB; *Desmocerus californicus dimorphus*) habitat (i.e., elderberry shrubs; Sambucus species) mapped by Sacramento County (Appendix 5B, Figures 1 and 2).

In addition, USACE identified an eighth focus site to evaluate effects on terrestrial species and habitat within the reservoir itself. In this case, USACE did not select a specific location for use in the evaluation; rather, the evaluation is general to the band of habitat that occurs just above the fluctuation zone of Folsom Reservoir (Appendix 5B, Figure 5). Further descriptions of the LAR focus sites and the reservoir used in this effects assessment are provided below.

1.1.1 Folsom Reservoir

Folsom Dam is a concrete gravity dam on the American River located at the juncture of the north and south forks of the American River. The dam is 340 feet high and 1,400 feet long and is flanked by earthen wing dams. Construction was completed in 1955, and the official opening occurred the following year. The dam and its reservoir, known as Folsom Reservoir or Folsom Lake, are part of the Central Valley Project (CDPR 2016). Below Folsom Reservoir, the river passes through an urbanized area but is buffered by a riparian park, the American River Parkway (Parkway). The dam was built by USACE and transferred to the U.S. Bureau of Reclamation (Reclamation) for operation at the completion of construction.

Figure 5 in Appendix 5B is a vegetation map of Folsom Reservoir. Figure 6 in Appendix 5B is a CNDDB map with elevation contours of Folsom Reservoir. The terrestrial section evaluates the effects of the

Folsom WCM alternatives on habitat types and wildlife species surrounding Folsom Reservoir. The following section briefly describes the vegetation and wildlife found around the reservoir.

1.1.1.1 Vegetation of Folsom Reservoir

Habitats associated with Folsom Reservoir include non-native grassland, blue oak woodland, and mixed oak woodland. Non-native grasslands occur around the reservoir, primarily at the southern end. Folsom Reservoir's rim is surrounded by a barren band (the fluctuation zone) as a result of historic fluctuations in water elevations. The majority of this zone is generally devoid of substantial vegetation, although arroyo willows (*Salix lasiolepis*) and narrow-leaved willows (*Salix exigua*) have established in some areas (USFWS 1991).

The only contiguous riparian vegetation occurs along Sweetwater Creek at the southern end of Folsom Reservoir (USFWS 1991). Fremont cottonwood (*Populus fremontii*) stands occur along upper reaches of creeks, farther away from the reservoir itself (LSA 2003). The three best examples occur along the south fork of the American River: at Sweetwater Creek, Hancock Creek, and Pilot Creek (LSA 2003). The understory along these disturbed creeks is choked with the non-native Himalayan blackberry (*Rubus discolor*), and California grape (*Vitus californica*) blankets the shrub layer. In several cases, these creeks appear to have once been seasonal streams that have become perennial as a result of runoff from surrounding upstream development (LSA 2003).

The Folsom Reservoir shoreline fluctuation zone occurs between the mean annual low and high water elevations (425-foot and 466-foot elevations; Reclamation 2004 and LSA 2003), which correspond with the existing minimum and maximum pool volumes for the reservoir. This zone is subject to extreme fluctuations. During high pool conditions from late winter to mid-spring, this fluctuation zone is partially or fully inundated and has water depths ranging from greater than 1 foot at its upper reaches to less than 20 feet at its lower reaches. During low pool conditions over the rest of the year, the shoreline fluctuation zone has fully desiccated soils along its upper reaches and saturated or near-saturated soil conditions along its lower reaches (LSA 2003). This zone is barren and is generally devoid of vegetation or supports less than 10 percent cover. Areas of deep sand and rock are prevalent in the fluctuation zone (Reclamation 2004). Because the fluctuation zone is virtually devoid of vegetation and the sparse willows that have established in some areas do not form a contiguous riparian community, the fluctuation zone does not have substantial habitat value for wildlife.

The blue oak woodland and mixed oak woodland habitat is located on the upland banks and slopes of the reservoir, above the fluctuation zone, and is dominated by interior live oak (*Quercus wislizenii*), blue oak (*Quercus douglasii*), and foothill pine (*Pinus sabiniana*) with several species of understory shrubs and forbs, including poison oak (*Toxicodendron diversilobum*), manzanita (*Arctostaphylos* sp.), California wild rose (Rosa californica), and lupine (Lupinus sp.). The largest unbroken stands of blue oak woodland are found on the Peninsula section of the reservoir (where the north and south forks of the American River converge; Appendix 5B, Figures 5 and 6) on well-drained, sandy or rocky soil (LSA 2003). Additional blue oak woodlands occur along the lower portion of the south fork of the American River and in scattered patches around the body of the reservoir (LSA 2003).

Non-native grassland consists of wild oats (*Avena fatua*), soft chess brome (*Bromus hordeaceus*), ryegrass (*Lolium multiflorum*), mustard (*Brassica* sp.), and foxtail (*Hordeum murinum* ssp. *leporinum*). Herbaceous forbs and wildflowers present in this vegetation include both native species such as fiddleneck (*Amsinckia* spp.), western ragweed (*Ambrosia psilostachya*), and popcorn flower (*Plagiobothrys* spp.) and non-native species such as shortpod mustard (*Hirschfeldia incana*), yellow star thistle (*Centaurea solstitialis*), and dove weed (*Eremocarpus setigerus*).

1.1.1.2 Wildlife of Folsom Reservoir

Blue oak woodlands and non-native grasslands in the Folsom Reservoir area support a variety of birds, including acorn woodpecker (*Melanerpes formicivorus*), Nuttall's woodpecker (*Picoides nuttallii*), western wood pewee (*Contopus sordidulus*), scrub jay (*Aphelocoma californica*), Bewick's wren (*Thryomanes bewickii*), plain titmouse (*Parus inornatus*), hermit thrush (*Catharus guttatus*), loggerhead shrike (*Lanius ludovicianus*), black-headed grosbeak (*Pheucticus melanocephalus*), dark-eyed junco (*Junco hyemalis*), and Bullock's oriole (*Icterus bullockii*).

A number of raptors also use oak woodlands for nesting, foraging, and roosting. These include red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), sharp-shinned hawk (Accipiter striatus), Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), great horned owl (*Bubo virginianus*), and long-eared owl (*Asio otus*).

Mammal species likely to occur in the woodland habitat include mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), Virginia opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), black-tailed jackrabbit (*Lepus californicus*), California ground squirrel (*Spermophilois beecheyi*), and a variety of rodents.

Amphibians and reptiles that can be found in oak woodlands include California newt (*Taricha torosa*), Pacific tree frog (*Hyla regilla*), western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis melanoleucus*), common kingsnake (*Lampropeltis getulus*), and western rattlesnake (*Crotalus viridis*).

Non-native grasslands surrounding Folsom Reservoir provide habitat for a variety of rodents, which in turn serve as a prey base for carnivores such as hawks, owls, coyote, bobcat, gray fox, and some snakes. Although very few birds will nest in the grassland areas, a number of species will forage in this habitat, species including white-crowned sparrow (*Zonotrichia leucophrys*), lesser goldfinch (*Carduelis psaltria*), western meadowlark (*Sturnella neglecta*), and several raptor species. Migratory waterfowl are known to feed and rest in the grasslands associated with the north fork of the American River (USFWS 1991). Several of the reptiles and amphibians that inhabit the oak woodlands also will occur in the adjacent non-native grasslands.

1.1.2 Lower American River

Extending from Folsom Reservoir to the confluence with the Sacramento River, the LAR (also known as the south fork of the American River) has undergone tremendous change over the past 100 years (Reclamation 2004). A combination of gold mining, gravel dredging, levee building, land clearing, water diversion projects, and reservoir construction have dramatically altered the riverbed and channel as well as the river's overall flow regimes. Specifically, the construction of flood-control levees has reduced the width of the riparian corridor by isolating the floodplain from the river; these levees have also changed channel erosion patterns and reduced river migration.

In addition, the construction of Folsom and Nimbus Dams has significantly altered both the streamflow and sediment regime of the LAR. In particular, the magnitude and frequency of flood flows has been effectively moderated, causing a reduction in the frequency of overbank flows that deposit sediments conducive to seed germination on the higher terraces. Creation of the dam complex has also significantly reduced the sediment supply from the watershed that had fed the lower reaches of the river (Reclamation 2004).

The existing channel morphology of the LAR spans a continuum from a meandering belt confined within relatively resistant terraces and bluffs in the upper reaches to a low-gradient and semi-confined floodplain channel in the lower reaches (Watson 1985). Channel pattern and morphology in the upper 11 miles of the river, above the Folsom and Nimbus Dam complex, is largely controlled by resistant bedrock exposures that characterize this portion of the river. Bank erosion and sediment deposition are relatively minor, with most sediment being transported through or temporarily stored in the river channel. Point bars within this reach are forming in some areas but are typically small.

Prior to urbanization and levee construction, the American River deposited sediment in a floodplain belt that widened as it reached the confluence with the Sacramento River. Lateral migration of the river channel was slowly occurring over time. However, channel realignment and levee construction have confined the river to a substantially narrower belt. The reduced gradient and channel migration blockages have led to the formation of gravel bars and sediment deposits throughout the LAR. Terraces, once commonplace and complex as a result of extensive overbank flooding, now occur only in specific areas between the levees (Reclamation 2004).

As a result of these factors, several riparian vegetation zones exist along the banks of the LAR. The composition and vegetative structure of these zones at any particular location along the river depends on the geomorphology and other physical characteristics of the riverbank. In general, willow riparian scrub tends to occupy areas within the active channel of the LAR; these areas are repeatedly disturbed by elevated flows that occur in winter and spring. Plant species that occur in this habitat typically include various species of willow (*Salix* spp.). Cottonwood willow forests occupy the narrow belts along the active river channel where seasonal disturbance by occasional large flows influence community structure. Fremont cottonwood is the dominant tree species within the riparian forest. Other species associated with this habitat include willow, poison oak, wild grape, blackberry (*Rubus ursinus*), northern California black walnut (*Juglans californica* var. *hindsii*), and white alder (*Alnus rhombifolia*).

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, although some of the sites also have a cottonwood component as a result of infrequent flood inundation. 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 along the length of the LAR but occur more regularly downstream of the Watt Avenue bridge (river mile [RM] 9.0). 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*).

1.1.3 Bureau of Reclamation Environmental Assessment

In 2004, Reclamation prepared a Finding of No Significant Impact (FONSI) and Final Environmental Assessment (EA) for the Sacramento Area Flood Control Agency (SAFCA) Long-term Reoperation of Folsom Dam and Reservoir. The FONSI and EA consisted of three independent components: (1) operation of Folsom Dam and Reservoir in accordance with the Amended 400/670 flood diagram, as part of the Long-term Agreement between SAFCA and Reclamation for the Reoperation of Folsom Dam and Reservoir; (2) temperature control shutter reconfiguration at Folsom Dam; and (3) floodplain habitat enhancement in the LAR. Each of the three components was a necessary component of the Long-term Agreement.

The impact assessments conducted for the EA used hydrologic model output to evaluate the potential for impacts due to implementing these three components and the associated results on various resources, including terrestrial resources. The EA concluded that terrestrial resources, including riparian corridor vegetation, the vegetation’s associated habitat value, and special-status species that rely on the resource, along the waterways and water bodies within the project and regional study areas would not be adversely affected by changes in river flows or reservoir surface elevations resulting from implementing the three components, in relation to the No Action Alternative.

1.1.4 U.S. Fish and Wildlife Service Staff Report

In a report dated June 23, 2014, USFWS included potential study sites for erosion modeling related to riparian habitat. The report was written after USFWS staff conducted a field visit to identify sites along the LAR which had high riparian habitat value at that time and would also be expected to be the most sensitive to changes in upstream water releases (i.e., changes in flood management operations at Folsom Dam). The focus was placed on areas with a higher potential for erosional loss that would result in an anticipated corresponding loss of riparian and shaded riverine aquatic (SRA) cover value. Consideration was also given to previous geotechnical work and other materials discussed during a USFWS terrestrial resources coordination meeting that occurred on May 12, 2014. In the staff report, USFWS identified 14 potential assessment sites. These sites are presented in Appendix 5B, Figure 1. This terrestrial assessment includes 6 of the 14 potential representative sites, which are dispersed along three reaches of the LAR. The three reaches are described below.

1.1.5 River Reaches and Focus Sites Identified for the Terrestrial Assessment

For this analysis, USACE divided the LAR below Folsom Dam to the confluence with the Sacramento River into three river reaches. Within each reach, USACE identified focus sites that reflected some combination of high habitat value, high susceptibility to change, previous designation as a mitigation site with corresponding restoration actions in place, and/or other factors, such as wildlife composition, that warranted inclusion as an assessment area. Below are brief descriptions of each of the three reaches along with identification of the focus site locations.

1.1.5.1 Reach I – Confluence (River Mile 0) to H Street Bridge (River Mile 6.0)

Upstream of the confluence with the Sacramento River, from about RM 0 to RM 6, the LAR is encroached by urban infrastructure including transmission lines, pipelines, railroad tracks, bridges, and recreation areas. The river channel has a sandy bed and is predominantly flatwater, bordered on the right bank by partially vegetated, steep slopes and on the left bank by moderate- to high-quality riparian vegetation (River Corridor Management Plan 2002).

About 20 percent of the banks are armored with riprap, primarily on the left bank; the unprotected banks tend to be steep and are eroding slowly due to channel widening (River Corridor Management Plan 2002). The channel is about 500 feet wide but has a relatively wide floodplain about 2,000 to 3,000 feet between levees, primarily occurring adjacent to the right bank. The floodplain supports grasslands, cottonwood willow forest, and valley oak woodlands.

Natural features in the area of Discovery Park (RM 0 to RM 1) include high-quality cottonwood and mixed riparian forests as well as a large patch of early to mid-successional riparian scrub habitat between the Jedediah Smith Memorial Bicycle Trail and the right bank. A seasonal wetland is located at roughly RM 1, as well as areas of degraded riparian habitat along the right bank of the river. There are also several large open grassland areas dominated by non-native species. There is a concentration of elderberry shrub (clumps) located on the right bank between RM 0.3 and RM 0.5 and on the left bank between RM 0.5 and RM 1.7.

Natural features occurring near Bannon Slough (RM 1 to RM 1.8) and Urrutia Pond include mature cottonwood willow forest on the right floodplain and on the left bank at Jibboom Street East. Similar to the Discovery Park sub-reach, the river channel is flatwater bordered on the right bank by partially vegetated steep banks and on the left bank by moderate- to high-quality vegetation.

Between RM 1.8 and RM 2, a large restored seasonal wetland and riparian area is located on the right bank. Steelhead Creek (the Natomas East Main Drainage Canal) enters the LAR in this sub-reach.

In the Woodlake area, from RM 2 to RM 3.7, much of the area along the right bank was farmed during the early to mid-1900s and was planted in hay until 1998. A high berm (levee) along the right bank limits inundation of the floodplain along this sub-reach. The river channel is predominantly flatwater and is bordered by steep banks. Natural features include moderate- to high-quality cottonwood willow forest along both banks and along an urban drainage channel that runs parallel to the right-bank levee. The floodplain in this area is dominated by ruderal grasses infested by non-native vegetation and by a seasonal wetland with degraded habitat. This area also contains VELB mitigation sites and bank-protection mitigation sites with numerous elderberry shrubs along the right bank from RM 2.1 to RM 3.7.

Between RM 3.7 and RM 5.5 the primary feature is Bushy Lake, a shallow pond bordered by old-growth cottonwood willow forest and willow riparian scrub. The right bank of the river also contains high-quality early to mid-successional cottonwood willow forest habitats. Grassland with scattered elderberry shrubs occurs in open areas. The left bank was subject to major erosion from flooding in the late 1990s but has since been protected (River Corridor Management Plan 2002). Two of the seven LAR terrestrial focus sites occur in this sub-reach; Site G is on the right bank between RM 3.4 and 3.69 and Site F is on the right bank between RM 4.82 and 5.0.

The LAR between RM 5 and RM 6.0 includes a large sandy point bar deposit (Paradise Beach) along the left bank that hosts scattered pockets of willow riparian scrub and mature cottonwood forests that occur at the downstream end of the bar. Paradise Beach experiences high-velocity flows during high reservoir discharge which erodes fine-textured material and produces a naturally armored cobble surface (River Corridor Management Plan 2002). The bed of the river transitions from sand to sand and gravel bed at this location. The right bank contains moderate-quality cottonwood willow forest. A third focus site, Site E, occurs along this sub-reach on the right bank between RM 5.34 and 5.69.

1.1.5.2 Reach 2 – H Street Bridge (River Mile 6.0 to River Mile 12.0)

The LAR from RM 6.0 to RM 12.0 remains confined by Federal-State levees, with the floodplain narrowing from a width of about 2,000 feet at the downstream end to about 1,000 feet along most of the reach. The river has low flood conveyance capacity and long stretches of steep banks that are protected with rock armoring, much of it devoid of vegetation. The reach includes areas with severely eroded banks. Below Howe Avenue (RM 7.6) the entire left bank is protected by revetment, while the right bank has natural soil. Above Howe Avenue, about 60 percent of the right bank is protected by revetment, while the left bank is more natural with a small floodplain (River Corridor Management Plan 2002).

Generally, the channel and aquatic habitat diversity increase within the LAR from RM 6.0 to RM 12.0 as a result of the occurrence of several submerged and emergent sand bars, flatwater areas, glides, and pools. However, because of the narrowing of the floodplain there are fewer overbank features such as sloughs, lakes, borrow pits, canals, wetlands, and upland terraces. High-quality riparian vegetation is present, but, because of high-velocity flows and bank erosion along this reach, constraints on cottonwood growth and establishment of new seedlings limit the capacity for future riparian regeneration.

Most of the bank on the left side and some on the right side from RM 6 to RM 7.8 is armored with rock bank protection. Several bridges and the City of Sacramento’s Water Intake Structure occur in this section of the LAR. Natural features include willow riparian scrub and cottonwood willow forest along portions of the right bank. In addition, sycamore (Platanus occidentalis) trees and valley oak riparian woodland occur along either side of the LAR. In general, the near-shore habitats are degraded.

Between Howe and Watt avenues (RM 7.8 to RM 9.2), instream mining along the left bank created a series of interconnected ponds. The river here is constricted and the channel is incised, with the floodplain narrowly aligned on steep banks adjacent to the channel. Natural features include mature cottonwood willow forest and valley oak woodlands along the shoreline (floodplain) and on instream islands that continue to undergo bank erosion on both banks.

The river from RM 9.2 to RM 11 features narrow strips of floodplain along both banks with a series of gravel mine pits along the right floodplain captured by the LAR. The American River Project levees on the left bank end at RM 11. Natural features along this sub-reach include stands of willow riparian scrub and cottonwood willow forests along the LAR and at the edges of abandoned mine pits and mid-channel islands. Patches of valley oak woodland are found at slightly higher elevations on both banks. However, the upper portions of the floodplain on the right bank are infested with yellow star-thistle and support little native habitat. Between RM 9.5 and RM 9.7, naturally resistant bedrock provides a secure toe on the right bank, but the overlying emergent bank has relatively low cohesion and continues to erode. The following terrestrial assessment includes a fourth focus site along this sub-reach between RM 11.35 and RM 11.59; this focus site is identified as Site D on the right bank.

1.1.5.3 Reach 3 - River Mile 12.0 to Nimbus Dam (River Mile 23)

The LAR from RM 12 to RM 23 is primarily non-leveed, and the channel contains multiple bar complexes with associated riffles, runs, glides, and pools bordered by natural bluff formations and relatively flat, elevated terraces. Channel substrate consists mostly of gravels, cobble, and bedrock. Broad, high terraces are covered primarily by live oak and blue oak woodlands, grasslands, and active or fallow agricultural fields. The oak woodlands in this area represent the largest contiguous woodland in the American River Parkway. However, annual grasslands dominated by yellow star-thistle and dredger mine tailings fragment many of these woodland patches. The river banks are relatively unvegetated, and much of the aquatic zone in this reach provides little cover for aquatic or terrestrial species.

Bluffs largely contain the active high-gradient channel between RM 12 and RM 13.5, along with extensive dredger deposits and abandoned mine pits that create perennial and seasonal ponds off the active channel and on Arden Bar. Some pond margins support dense stands of willow riparian scrub and cottonwood and mixed riparian forests, but most of the pond's bank habitat is in a degraded state because of poor vegetative cover, cobbles, and infestations of invasive non-native weeds. Exposed bedrock formations in the channel form the Arden Rapids. The channel structure is highly modified by past mining activities, primarily along the right bank. The sub-reach between RM 13.41 and RM 14.0 is included as the fifth focus site in the following terrestrial assessment and is identified as Site C on the right bank.

Rossmoor Bar and Arden Bar are prominent features between RM 13.5 and RM 15.The upstream portion of the floodplain is leased for agricultural uses. The river channel in this sub-reach has also been highly modified by mining activities. Riffles and instream islands are present with little shoreline vegetation. This area includes the largest contiguous upper terrace of interior live oak and blue oak woodland, with patches of valley oak woodland at lower elevations. The left bank downstream of the pedestrian bridge supports a willow riparian scrub community, and USFWS has identified critical habitat for VELB in this river section.

Natural features occurring within the 300-acre Ancil Hoffman Park and 90-acre Effie Yeaw Nature Area along the right bank between RM 14.8 and RM 16.7 include live oak, blue oak, and valley oak woodlands; a large gravel bar; and Carmichael Creek, which flows through the park in a series of three ponds surrounded by bluffs. For most of the extent, both banks are dominated by cobble with sparse vegetation. The river channel contains extensive gravel deposits and periodic instream islands and riffles. The following terrestrial assessment includes the reach between RM 15.5 and RM 15.87 as the sixth LAR focus site, identified in the analysis as Site B on the left bank.

The San Juan Bluffs on the right bank and Rossmoor Bar on the left bank characterize the features between RM 16.3 and RM 18.7. Live oaks, blue oaks, and valley oaks dominate the upland areas, and pond slickens provide isolated wetland and riparian habitats. Unvegetated dredger mine tailings cover most of the interior of Rossmoor Bar. The southwestern half of this area is leased for agriculture. The river channel provides important aquatic habitat with extensive gravel and several riffles, including the San Juan Rapids. The Carmichael Water District owns land at RM 17 for its water-collection structures (instream collectors). The sub-reach between RM 18.49 and RM 18.83 was identified as the final (seventh) terrestrial focus site along the LAR and is labeled as Site A on the left bank.

On the right bank downstream from Sunrise Boulevard, Sacramento Bar, located between RM 18 and RM 20, contains natural features similar to Rossmoor Bar, with poorly vegetated dredger mine tailings covering most of the interior of the bar. The downstream part of the bar supports willow riparian scrub and cottonwood willow forest. Several seasonal and perennial ponds support a fringe of cottonwood and mixed riparian forest. The river channel in this sub-reach has riffles throughout, extensive gravels, and sparse shoreline vegetation.

Sunrise Bar on the left bank and the Sunrise Bluffs along the right bank are natural features found between RM 19 and RM 22.5. Vegetation includes willow riparian scrub on lower-elevation bars, mature cottonwood willow forests, valley oak woodlands, and live oak and blue oak woodlands at higher terraces. The Sunrise Bluffs are subject to erosion as a result of undercutting by the river, soil conditions, and the influences of the underlying strata.

The river channel contains multiple riffles, instream islands, and extensive gravels. The Nimbus Salmon and Steelhead Hatchery is located at the upstream end of this sub-reach.

Sailor Bar, located on the right bank between Hazel Avenue and the old Fair Oaks Bridge (RM 21 to RM 23), is characterized by poorly vegetated cobbles from dredger mine tailing deposits that cover most of the bar. Stands of interior live oak woodland are found in upland areas, and willow riparian scrub and cottonwood willow forests are found in the ravines between tailings. Some riparian scrub is established along the river edge, but much of the bank consists of unvegetated cobbles or ruderal vegetation. The river channel in this sub-reach has extensive riffles and small instream gravel bars.

1.1.5.4 Wildlife of the Lower American River

Previous studies have determined that the cottonwood-dominated riparian forest and areas associated with the backwater and off-river ponds have a high wildlife diversity and species richness in the region (Sands et al. 1985; USFWS 1991; Watson 1985). Along with providing food, cover, and nesting habitat for several species, the LAR functions as a wildlife corridor for the movement of animals between the valley floor and the foothills of the Sierra Nevada.

More than 220 species of birds have been recorded along the LAR, and more than 60 species are known to nest in the riparian habitats (USFWS 1991). Common species that can be found along the river include great blue heron (*Ardea herodias*), mallard (*Anas platyrhynchos*), red-tailed hawk, red-shouldered hawk, American kestrel, California quail (*Callipepla californica*), killdeer (*Charadrius vociferous*), belted kingfisher (*Ceryle alcyon*), western scrub jay (*Aphelocoma californica*), ash-throated flycatcher (*Myiarchus cinerascens*), tree swallow (*Tachycineta bicolor*), and American robin (*Turdus migratorius*).

Additionally, more than 30 species of mammals reside along the river, including striped skunk, Virginia opossum, brush rabbit (*Sylvilagus bachmani*), raccoon (*Procyon lotor*), western gray squirrel (*Sciurus griseus*), California ground squirrel, meadow vole (*Microtus pennsylvanicus*), muskrat (*Ondatra zibethicus*), black-tailed deer (*Odocoileus hemionus*), gray fox, and coyote.

The most common reptiles and amphibians that depend on the riparian habitats along the LAR include western toad (Bufo boreas), Pacific tree frog, bullfrog (*Rana catesbeiana*), western pond turtle (*Clemmys marmorata*), western fence lizard, common garter snake (*Thamnophis sirtalis*), and gopher snake.

Vegetation around the backwater or off-river ponds is typical of the riparian associations in the LAR area and is composed of mixed-age willow, alder, and cottonwood (see Section 5.2.2 for additional discussion). Wildlife species that have been recorded in these areas include pied-billed grebe (*Podilymbus podiceps*), American bittern (*Botaurus lentiginosus*), green heron (*Butorides striatus*), common merganser (Mergus merganser), white-tailed kite (*Elanus leucurus*), wood duck (*Aix sponsa*), yellow warbler (*Dendroica petechia*), warbling vireo (*Vireo gilvus*), duskyfooted woodrat (*Neotoma fuscipes*), western gray squirrel, Pacific tree frog, and western toad.

1.2 Terrestrial Assessment Approach

Because of the biological importance of riparian habitat and off-river (or backwater) ponds along the LAR to overall habitat diversity and species richness (as described in the previous sections), USACE's terrestrial analysis for the Folsom WCM Update focused on the effects of change in river flows to both cottonwood trees (indicative of riparian habitat) and river-associated ponds (Reclamation 2004).

The full simulation period for water storage within Folsom Reservoir is an 82-year period and flows in the LAR is a 73-year period, and the water year types used in the analysis were defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification. The modeling output provides daily average elevations and predicted variation between each alternative scenario and the base condition. The difference between the alternative scenario and the base condition indicates a benefit or a reduction of benefit to the terrestrial resource.

1.2.1 Lower American River Riparian Vegetation

The timing and duration of flooding are important factors in regulating species composition in a riparian zone, and periodic flooding by the river has historically been a fundamental characteristic of the LAR floodplain and riparian ecology pre- and post-reservoir construction. Cottonwood seed germination and tree establishment coincides with flood events. Because cottonwood seed release and establishment have adapted over time to the flow regime and fluvial process of the LAR, maintenance of this regime is vital to maintaining a viable cottonwood-dominated riparian system (Reclamation 2004).

1.2.1.1 Relationship between River Flows and Cottonwood Success

The germination, establishment, growth, and long-term survival of Fremont cottonwoods along the LAR are dependent on the dynamic flow regimes and fluvial geomorphic processes of the river. In particular, the capacity of the river to erode, transport, and deposit alluvial materials is central to the structure and maintenance of cottonwood ecosystems.

Successful regeneration of cottonwoods relies on the synchronous timing of seed dispersal and appropriate soil moisture levels to germinate and establish successfully (Stromberg 1995). Cottonwoods disperse seeds over a 2- to 6-week period, typically in the early to mid-spring months. Dispersed seeds rapidly lose the ability to germinate, so seeds must encounter suitable germination sites soon after release. Germination takes place on freshly deposited alluvial soils in areas along the river bank low enough in elevation to provide adequate moisture but high enough to avoid subsequent same-year flooding after establishment. Peak water flows of sufficient magnitude are necessary, just prior to seed dispersal, to provide these suitable germination sites.

To survive, cottonwood seedlings require a continuous source of adequate moisture (Scott et al. 1993). Consequently, river flows must decline at a rate that allows seedling roots to maintain continuous contact with saturated or sufficiently moist substrate. If river flows and the alluvial groundwater table drop too rapidly, seedling survival decreases appreciably (Scott et al. 1993). Studies have shown that first-year seedlings of Fremont cottonwood survive only where the groundwater depth is less than 1 meter, and seedlings tolerate daily declines of no more than a few centimeters per day (Segelquist et al. 1993; Stromberg 1995). Summer flows are critical to the continued survival of newly established seedlings and provide necessary moisture when evapotranspiration is highest (Scott et al. 1993).

Long-term survival of established cottonwoods is generally related to the depth to groundwater and to river flows. While cottonwoods can adapt to drought periods, overall growth and long-term maintenance of these trees depends on the ability of root systems to reach the alluvial groundwater table, the recharging of which depends on adequate river flows.

While very few studies on the long-term flow regimes necessary for continued cottonwood regeneration and growth maintenance have been conducted along the LAR, several short-term studies have provided insights into the relationship between river flows and cottonwood growth. In one study, the annual radial growth rate of young cottonwoods along a particular segment of the LAR was found to be significantly related to the groundwater depth and to river flows during the March–October growing season (Stromberg

1995). The study found that cottonwoods had little or no radial growth when average river flows during the growing season dropped below 1,765 cubic feet per second (cfs).

A second study found that cottonwood regeneration and growth are vulnerable to dewatering as a result of river damming where local precipitation is lower than potential evapotranspiration. Cottonwood decline occurs within 5 years from drought stress or when groundwater is less available due to dewatering from river damming (Rood et al. 2003). For rivers that have been dammed, water often flows from the river into the riparian groundwater, instead of the river obtaining additional groundwater flow from the adjacent alluvial and hill-slope aquifers. Therefore, cottonwoods along rivers that have been dammed are reliant for growth on the water that infiltrates from the river into the riparian groundwater (Rood et al. 2003).

1.2.1.2 Flow Thresholds for Cottonwood Success

For this analysis, USACE considered cottonwoods a key indicator species for overall health of LAR riparian vegetation; therefore, they are the focus of this evaluation of the effects of different mean monthly flow regimes on riparian vegetation. USFWS has stated that a LAR mean monthly flow of 1,765 cfs represents the minimum flow required to maintain basic or minimal radial growth of cottonwoods, while 3,000 cfs is the minimum flow to ensure optimal growth (Caicco 1996 as cited in Reclamation 2004). These flow thresholds have not been historically maintained in all years on the LAR; therefore, cottonwoods have shown that they can withstand occasional stress from inadequate flows in very dry years (Reclamation 2004). In addition, USFWS found that flows of 5,000 cfs to 13,000 cfs are required to inundate the higher terraces, which is essential for the germination of new cottonwoods (USFWS 1996).

For this analysis, a substantial effect on riparian vegetation would occur if:

1. A Folsom WCM alternative would cause a substantial decrease in the frequency of flows at or above the minimum flow requirements for maintenance and growth of cottonwoods (1,765 cfs for minimal growth and 3,000 cfs for optimal growth); or
2. A Folsom WCM alternative would cause a substantial decrease in the frequency of flows at or above minimum flow requirements for inundation of riparian terraces adjacent to and remote from the LAR for germination of new cottonwoods (5,000 cfs).

Flow projections at each of the seven sites are characterized by the average number of days per month within the 73-year period of record during which the flows are projected to remain above or below each of the thresholds (1,765 cfs, 3,000 cfs, and 5,000 cfs). The difference between each alternative scenario and the baseline condition (either the National Environmental Policy Act [NEPA] baseline or the California Environmental Quality Act [CEQA] baseline) indicates a beneficial or detrimental effect on evaluated terrestrial resources. For a definition of each baseline, see Section 5.3.

1.2.2 Lower American River Backwater Ponds

Backwater (or off-river) ponds are areas adjacent to the main stem of a river that can be connected to the river by surface water during high winter flood flows and/or by groundwater during other times of the year. Backwater pond areas along the American River Parkway generally are the result of naturally formed gravel deposits or human-created tailing deposits, although some might be remnant natural oxbow lakes, such as Bushy Lake (Sands et al. 1985). These backwater ponds are known to occur throughout the LAR system but occur predominantly at Sacramento Bar, Arden Bar, and Rossmoor Bar and between Watt Avenue and Howe Avenue (Sands et al. 1985). For more information, see Sections 5.1.5.1 through 5.1.5.3.

Studies have been conducted to determine how these backwater ponds are influenced by flows in the LAR (Sands et al. 1985). These ponds are located at varied distances from the river channel, have varied depths, and are at different elevations along the river. Ponds were studied in the spring of 1985 at flow regimes of 1,300 cfs and 2,750 cfs. In general, these studies concluded the following: (1) while the interrelationships of the ponds with the river is complex, the ponds do respond to changes in water levels in the American River; (2) the response of ponds to changes in water flows and river levels depends on the distance of the ponds from the river channel, the permeability of the soils surrounding the ponds, and the nature of intervening soils and gravels; (3) the effect of changes in pond water levels on vegetation (and secondarily, wildlife) can differ in intensity between sites depending on local soil compaction and root distribution of individual plants; (4) flows of at least 2,700 cfs are required to adequately recharge the ponds closest to the river; (5) at sustained flows of 1,300 cfs or below, many of the ponds would become more shallow and smaller, hold very little water, and become choked with willows; (6) further reductions in river flows, to levels in the 500 cfs range, would result in these ponded areas becoming completely dry, resulting in deterioration of the riparian vegetation and quality of wildlife habitats associated with the ponds; and (7) flows in the range of 2,700 cfs to 4,000 cfs are needed to provide continued recharge of more-distant off-river ponds (Sands 1986; Sands et al. 1985).

An important consideration for the maintenance of backwater pond habitats is the necessary frequency and duration of the recharge flows. Past studies have not come to definitive conclusions regarding specific frequency and/or duration requirements. Historically, however, the flows that are high enough to allow recharge of these ponds have occurred most often in either the winter or spring (Reclamation 2004). This pattern allows the backwater ponds to be recharged prior to the important spring and summer growing seasons. Therefore, it appears that regular recharge flows during most of the winter or spring are sufficient to maintain backwater pond habitats. Previous field studies conducted on the LAR indicated that mean monthly flows of 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).

1.2.2.1 Flow Thresholds for Backwater Pond Success

For purposes of this analysis, a substantial effect on backwater ponds and off-river ponds would occur if:

1. A Folsom WCM alternative would cause a substantial decrease in the frequency of flows at or above the minimum flow requirements for backwater recharge of ponds closest to the river (2,700 cfs); or
2. A Folsom WCM alternative would cause a substantial decrease in the frequency of flows at or above minimum flow requirements for backwater recharge of off-river ponds farther from the river (4,000 cfs).

Flow projections at each of the seven sites are characterized by the average number of days per month within the 73-year period of record during which the flows are projected to remain above or below each of the thresholds (2,700 cfs and 4,000 cfs). The difference between the each alternative scenario and the baseline condition (either NEPA or CEQA) indicates a beneficial or detrimental effect on evaluated terrestrial resources. For a definition of each baseline, see Section 5.3.

1.2.2.2 Flow Thresholds for Elderberry Shrubs

USFWS has designated the American River Parkway as critical habitat for VELB, and this species has been recorded in elderberry shrubs near backwater ponds along the LAR. Elderberry is a riparian plant species that is characteristically adapted to the hydro-period of a river and relies on it for seed dispersal and predictable water table depths to establish its seedlings. The timing and duration of flooding are important factors in regulating species composition in the riparian zone. Riparian shrubs are differentially adapted to the duration of flood events, and most are able to tolerate several days of flooding (Riparian Habitat Joint Venture 2009).

For this analysis, since many of the elderberry shrubs occur near the backwater ponds, a substantial effect on elderberry shrub growth and dispersal would occur if:

1. A Folsom WCM alternative would cause a substantial decrease in the frequency of flows at or above the minimum flow requirements for backwater recharge of ponds closest to the river (2,700 cfs); or
2. A Folsom WCM alternative would cause a substantial decrease in the frequency of flows at or above minimum flow requirements for backwater recharge of off-river ponds farther from the river (4,000 cfs).

Flow projections at each of the seven sites are characterized by the average number of days per month within the 73-year period of record during which the flows would be projected to remain above or below each of the thresholds (2,700 cfs and 4,000 cfs). The difference between each alternative scenario and the baseline condition (either NEPA or CEQA) indicates a beneficial or detrimental effect on elderberry shrubs. For a definition of each baseline, see Section 5.3.

1.2.3 Folsom Reservoir

USACE layered an Environmental Systems Research Institute (ESRI) aerial image onto a geographic information systems (GIS) meta-database to evaluate water storage levels in Folsom Reservoir under two scenarios. USACE obtained vegetation datasets from the California Resources Agency (Cal Atlas 2012), special-status species records from the CNDDB (2015), and lake contour levels from a 2005 Reclamation sediment study (Reclamation 2005).

Historically, Folsom Reservoir has annual water levels that routinely fluctuate, and the reservoir's rim is surrounded by a barren band (the fluctuation zone) as a result of these historic fluctuations in water elevations. During normal water years, the reservoir typically reaches 466 feet above mean sea level (amsl) during the wettest months (March through August). This terrestrial assessment focuses on the potential for changes to vegetation that could occur in the band of habitat that occurs just above the fluctuation zone in Folsom Reservoir as a result of the Folsom WCM scenarios.

Specifically, for this analysis, a substantial negative effect on Folsom Reservoir vegetation, and possibly on associated wildlife, would occur if the average number of consecutive days with water elevations above the 466 foot-amsl threshold were to increase as a result of implementing a Folsom WCM alternative.

1.2.4 Summary of Impact Indicators and Threshold of Significance

Impact indicators for terrestrial resources include different environmental conditions (e.g., flows and backwater recharge) that could affect riparian vegetation. USACE developed specific significance criteria for terrestrial resources based on available guidelines and resource agency standards (Table 5-1).

Table 0-1. Terrestrial Resource Impact Indicators and Significance Criteria

Parameter	Impact Indicators	Significance Criteria
Lower American River		
Growth of cottonwoods	Daily flows (cfs) below Nimbus Dam to the confluence	An adverse effect would result from a substantial decrease in the occurrence of daily flows at or above the 1,765-cfs threshold by a frequency and duration that would impede maintenance and growth of cottonwoods, or a decrease in the number of days that meet minimal flow requirements, relative to the basis of comparison (baseline), for any given month over the simulated 73-year period of record.
		An adverse effect would result from a substantial decrease in the occurrence of daily flows at or above the 3,000-cfs threshold by a frequency and duration that would inhibit reasonable to maximal growth and maintenance of cottonwoods; or a decrease in the number of days that meet minimal flow requirements, relative to the basis of comparison (baseline), for any given month over the simulated 73-year period of record.

Parameter	Impact Indicators	Significance Criteria
		An adverse effect would result from a substantial decrease in the occurrence of spring daily flows above 5,000 cfs (estimated to represent historical peak flows of 5,000 to 13,000 cfs required for seed dispersal) by a frequency and magnitude that would hinder inundation of riparian terraces adjacent to and remote from the lower American River; or a decrease in the number of days that meet minimal flow requirements, relative to the basis of comparison (baseline), over the simulated 73-year period of record.
Backwater recharge	Daily flows (cfs) below Nimbus Dam to the confluence	An adverse effect would result from a substantial decrease in winter and spring mean monthly flows at or above 2,700 cfs by a frequency and magnitude that would adversely affect adequate recharge of backwater ponds close to the river, relative to the basis of comparison, (baseline) over the simulated 73-year period of record.
		An adverse effect would result from a substantial decrease in winter and spring mean monthly flows at or above 4,000 cfs by a frequency and magnitude that would adversely affect adequate recharge of more distant off-river ponds to the river, relative to the basis of comparison (baseline), over the simulated 73-year period of record.
	Elderberry shrubs and other associated species on open terraces and backwater areas during December through May	An adverse effect would result from a substantial change in instream flow by a frequency and magnitude that would adversely affect elderberry shrubs and their associated species, relative to the basis of comparison (baseline), over the simulated 73-year period of record.

Parameter	Impact Indicators	Significance Criteria
Folsom Reservoir		
Riparian Vegetation	Average daily reservoir water surface elevation (feet amsl)	An adverse effect on vegetation, and possibly on associated wildlife, would result from a substantial increase in the average number of consecutive days with water elevations above the 466-foot-amsl threshold within a month, given a range of water year type periods, relative to the basis of comparison (baseline) over the 73-year period of record.

1.2.5 E504 ELD Model Development

USACE used the California Department of Water Resources' (DWR) 2013 Delivery Reliability Report (DRR) CalSim II build as the base model for developing the Folsom WCM Update Existing Condition CalSim II build. E504 ELD represents a 400/600-thousand-acre-feet (TAF) variable flood storage space in Folsom Reservoir. The 2004 SAFCA/Reclamation water control diagram with upstream reservoir storage credit was used. E504 ELD does not adopt the parameters of the joint federal project operations.

See Section 5.3 for details regarding the DRR CalSim II build model, including assumptions and parameters used to simulate the E504 ELD over the 73-year and 82-year periods of record.

1.3 J602F3 ELD Model Development

USACE used the 2013 DWR DRR CalSim II build as the base model for developing the Folsom WCM Update with-project ELD CalSim II build. The with-project ELD represents a 400/670 TAF variable flood storage space in Folsom Reservoir with upstream storage crediting, and basin wetness and forecasts applied to determine flood storage requirements.

1.3.1 Comparison of E504 ELD and J602F3 ELD

1.3.1.1 Lower American River

The LAR terrestrial assessment focuses on cottonwood growth and backwater recharge. This section includes a summary of the results.

1.3.1.1.1 Cottonwood Growth

The LAR flows with J602F3 ELD could decrease 3.7 to 4.2 average days below the 1,765-cfs threshold over a 3-consecutive-month period during the cottonwood growing season relative to E504 ELD and provide a potential benefit to cottonwood radial growth. However, the overall effects on vegetation growth in the riparian corridor of the LAR under J602F3ELD would stay relatively consistent where volume flow rates would continue to be sufficient and groundwater would be available for cottonwood growth. A detailed analysis of cottonwood growth and maintenance along the LAR for this comparison is provided in Appendix 5A.

1.3.1.1.2 Backwater Recharge

Relative to E504 ELD, J602F3 ELD would result in a minimal change in the average number of days when average daily flows are below the thresholds during winter and spring. Given the minimal difference between E504 ELD and J602F3ELD, average daily flows are projected to remain essentially the same. As a result, there would be essentially no change to the magnitude and frequency of flows to substantially alter the existing backwater habitats dependent on the LAR. A detailed analysis of backwater recharge along the LAR for this comparison is provided in Appendix 5A.

1.3.1.2 Folsom Reservoir

With J602F3 ELD, the water surface elevation fluctuations at Folsom Reservoir would remain within normal operating parameters (i.e., USACE does not anticipate that water elevations would exceed the 466 foot-amsl threshold or barren band for durations that could affect existing vegetation). Folsom Reservoir has water levels that routinely fluctuate. J602F3 ELD would result in water surface elevation patterns that are the same as or slightly lower that those with E504 ELD. A detailed analysis for the Folsom Reservoir is provided in Appendix 5A.

1.3.1.3 Evaluation of Effects

Relative to E504 ELD, J602F3 ELD results indicate that the LAR average daily flows under the 1,765-cfs threshold could decrease between 3.7 to 4.2 average days per month over a 3-consecutive-month period during the cottonwood growing season, relative to E504 ELD. This decrease could provide additional flows for cottonwood radial growth and provide a potential benefit during the cottonwood growing season. However, when looking at change under the 3,000-cfs threshold comparison, cottonwood maintenance and optimal growth would stay relatively consistent during the cottonwood growing season between E504 ELD and J602F3ELD. Therefore, effects on vegetation growth in the riparian corridor of the LAR with J602F3 ELD would be less than substantial. In addition, there would be no substantial difference in the pattern of peak flows necessary to inundate terraces for cottonwood dispersal and regeneration between J602F3 ELD and E504 ELD. As discussed in Section 8 (Erosion), J602F3 ELD critical shear values for riparian study sites along the LAR would also be less than substantial, with a low probability of exceedance beyond the critical shear threshold. This results in a low probability of habitat being lost along the bank edges due to erosional effects of altered water flows.

USFWS has designated the Parkway as critical habitat for VELB, and this species has been recorded in elderberry shrubs near backwater ponds along the LAR. Sanford’s arrowhead, western pond turtle, and tri-colored blackbirds are special-status species known to occur in several backwater pond areas along the LAR. However, these flows would not be reduced by sufficient magnitude and frequency to substantially alter existing water fluctuations (pond levels) and vegetation dependent on these ponds. Because effects on backwater habitats with J602F3 ELD would be less than substantial, effects on elderberry shrubs and special-status species that depend on these habitats would also be less than substantial.

J602F3 ELD 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 amsl. USACE does not expect this duration 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.

1.4 References

Terrestrial

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Appendix C: Vegetation and Wildlife, Part 3

APPENDIX 5A

1 Terrestrial Resources – Appendix – Detailed Analysis

This appendix focuses on the presentation of the model development for a set of with-project scenarios and their comparison to a set of appropriated model baseline conditions to satisfy the project requirements for compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

1.1 J602F3 ELD Model Development

USACE used the 2013 DWR DRR CalSim II build as the base model for developing the Folsom WCM Update With-Project level of demand CalSim II build. The With-Project existing level of demand represents a 400/670-TAF variable flood storage space in Folsom Reservoir with upstream storage crediting, and basin wetness and forecasts applied to determine flood storage requirements.

1.1.1 Comparison of E504 ELD and J602F3 ELD

1.1.1.1 Lower American River

The LAR terrestrial assessment focuses on cottonwood growth and backwater recharge.

1.1.1.1.1 Cottonwood Growth

1.1.1.1.1.1.1 Reach 3

Simulated flows exhibited the same results at Sites A, B, and C. Table 31 summarizes simulated flows in Reach 3 (RM 12.0 to Nimbus Dam); this example is from Site A. For the first two comparisons of E504 ELD and J602F3 ELD in the table (1,765 and 3,000 cfs), preferred results would be lower numbers, as the goal is to keep flows at or above these thresholds and these modeling outputs reflect how many days that flows would fall below the desired flows. For the third comparison (5,000 cfs), preferred results would be higher numbers, showing a greater number of days when banks might flood and cottonwood seed dispersal could occur at the upper terraces (for more details, see Section 5.2.1).

Table 1. Average number of days when flows would be below or above a specified threshold for riparian vegetation in the lower American River at Site A (RM 18.49–18.83) under E504 ELD and J602F3 ELD

Month1	Average Number of Days by Month below/above Specified Thresholds (73-year Record)											
	Effects on Riparian Vegetation											
	Number of Days **below** Flow Threshold[2] (1,765 cfs)				Number of Days **below** Flow Threshold[3] (3,000 cfs)				Number of Days **above** Flow Threshold[4] (5,000 cfs)			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Jan	15.9	16.2	0.3	2%	18.8	19.2	0.4	2%	8.9	8.8	-0.1	-1%
Feb	11.7	12.9	1.2	10%	14.0	15.5	1.5	11%	10.9	9.8	-1.1	-10%
Mar	15.9	12.2	-3.7	-23%	19.2	18.8	-0.4	-2%	7.2	8.4	1.2	17%

Apr	16.4	12.2	-4.2	-26%	20.2	18.4	-1.8	-9%	6.2	7.2	1.0	16%
May	15.2	10.9	-4.3	-28%	18.9	18.5	-0.4	-2%	7.9	8.1	0.2	3%
Jun	14.1	12.4	-1.7	-12%	18.8	18.3	-0.5	-3%	7.0	7.3	0.3	4%
Jul	5.6	5.7	0.1	2%	11.8	12.3	0.5	4%	3.8	3.5	-0.3	-8%
Aug	15.3	14.6	-0.7	-5%	22.0	21.8	-0.2	-1%	0.9	0.2	-0.7	-78%
Sep	14.7	14.2	-0.5	-3%	19.8	19.1	-0.7	-4%	4.0	4.5	0.5	13%
Oct	18.6	18.2	-0.4	-2%	25.1	24.2	-0.9	-4%	0.9	0.8	-0.1	-11%
Nov	10.8	9.3	-1.5	-14%	19.1	19.3	0.2	1%	3.8	3.6	-0.2	-5%
Dec	9.2	8.0	-1.2	-13%	24.1	24.2	0.1	0%	4.6	4.8	0.2	4%

BOLD = Most Positive Output (potentially beneficial; meets threshold for maximum days); ***Italics*** = Most Negative Output (potentially adverse; meets threshold for fewest number of days)

1 The period from March through October is considered the cottonwood growing season; February through April is considered the seed dispersal season.

2 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 1,765 cfs, which is the minimum flow required to maintain cottonwood radial growth maintenance.

3 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 3,000 cfs, which is considered the threshold for optimal growth of cottonwoods.

4 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are ABOVE 5,000 cfs, which is considered to be the minimal required flows for the inundation of river bank terraces for germination of cottonwood seeds.

During the cottonwood growing season (March through October) in Reach 3, J602F3 ELD would decrease the average days (0.4 to 4.3 days) below 1,765 cfs during March, April, May, June, August, September, and October and would increase the average days (0.1 day) below 1,765 cfs during July relative to E504 ELD. October would have the greatest average number of days (during the cottonwood growing season) with 18.6 average days below 1,765 cfs in the LAR (E504 ELD). During October, J602F3 ELD would decrease the average number of days by 0.4 day to an average of 18.2 days below 1,765 cfs relative to E504 ELD. July would have the fewest average days below 1,765 cfs in the LAR with 5.6 average days below 1,765 cfs (E504 ELD). During July, J602F3 ELD would increase the average number of days by 0.1 day to an average of 5.7 days below 1,765 cfs relative to E504 ELD. The largest decrease in the number of days below threshold would occur during May, when J602F3 ELD would decrease the average number of days by 4.3 days to an average of 10.9 days below 1,765 cfs relative to the average of 15.2 days for E504 ELD. Overall, J602F3 ELD would decrease the average number of days below 1,765 cfs in the LAR, with the greatest decreases occurring during March, April, and May. A decrease of 3.7 to 4.2 average days below the threshold over a 3-consecutive-month period could provide additional flows with J602F3 ELD for cottonwood radial growth and provide a potential benefit during the cottonwood growing season.

In the second comparison, J602F3 ELD would decrease the average number of days (0.2 to 1.8 days) below 3,000 cfs during March, April, May, June, August, September, and October relative to E504 ELD. On the other hand, J602F3 ELD would increase the average number of days below the threshold by 0.5 during July. October would have the greatest average number of days (during the cottonwood growing season) below 3,000 cfs in the LAR with an average number of 25.1 days below 3,000 cfs (E504 ELD). J602F3 ELD would decrease this number of days by 0.9 day to 24.2 average days below the threshold relative to E504 ELD during October. July would have the lowest average number of days below 3,000 cfs in the LAR with an average of 11.8 days below 3,000 cfs (E504 ELD). J602F3 ELD would increase the average number of days by 0.5 day below 3,000 cfs relative to E504 ELD during July. Overall, 7 of the 8 months would have a slight decrease in the average number of days below the threshold. However, these slight decreases over the 7 months would be negligible where volume flow rates would continue to be sufficient and groundwater would be available to support cottonwood growth; therefore, conditions would remain relatively consistent under either E504 ELD or J602F3 ELD.

Cottonwoods typically disperse seed between February and April. J602F3 ELD would result in minor changes in the average number of days (–1.1 to +1.2 days) when flows would be above the 5,000-cfs threshold relative to E504 ELD. J602F3 ELD would change the average number of days above 5,000 cfs during February (1.1-day decrease), March (1.2-day increase), and April (1.0-day increase) relative to E504 ELD. This minor difference likely falls within the range of error for the models and would not affect the overall frequency of flows above 5,000 cfs, which implies that instantaneous flows sufficient to inundate the terraces and facilitate cottonwood seed dispersal would remain largely consistent with E504 ELD over the 73-year period of record.

1.1.1.1.1.2 Reach 2

Table 32 summarizes simulated flows at Site D in Reach 2 (H Street Bridge [RM 6.0] to RM 12.0). For the first two comparisons of E504 ELD and J602F3 ELD in the table (1,765 and 3,000 cfs), preferred results would be lower numbers, as the goal is to keep flows at or above these thresholds and these modeling outputs reflect how many days that flows would fall below the desired flows. For the third comparison (5,000 cfs), preferred results would be higher numbers, showing a greater number of days when banks might flood and cottonwood seed dispersal could occur at the upper terraces (for more details, see Section 5.2.1).

Table 2. Average number of days when flows would be below or above a specified threshold for riparian vegetation in the lower American River at Site D (RM 11.35–11.59) under E504 ELD and J602F3 ELD

Month[1]	Average Number of Days by Month below/above Specified Thresholds (73-year Record)											
	Effects on Riparian Vegetation											
	Number of Days **below** Flow Threshold[2] (1,765 cfs)				Number of Days **below** Flow Threshold[3] (3,000 cfs)				Number of Days **above** Flow Threshold[4] (5,000 cfs)			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Jan	15.8	16.2	0.4	3%	18.8	19.1	0.3	2%	9.0	8.8	-0.2	-2%
Feb	11.7	12.8	1.1	9%	14.0	15.5	1.5	11%	10.8	9.9	-0.9	-8%
Mar	15.9	12.3	-3.6	-23%	19.2	18.8	-0.4	-2%	7.3	8.4	1.1	15%
Apr	16.4	12.2	-4.2	-26%	20.1	18.5	-1.6	-8%	6.1	7.1	1.0	16%
May	15.2	10.9	-4.3	-28%	18.9	18.5	-0.4	-2%	7.9	8.0	0.1	1%
Jun	14.1	12.3	-1.8	-13%	18.7	18.3	-0.4	-2%	7.1	7.3	0.2	3%
Jul	5.5	5.7	0.2	4%	11.7	12.2	0.5	4%	3.7	3.6	-0.1	-3%

Aug	15.3	14.5	-0.8	-5%	21.9	21.8	-0.1	0%	0.9	0.2	-0.7	-78%
Sep	14.6	14.2	-0.4	-3%	19.8	19.1	-0.7	-4%	4.0	4.6	0.6	15%
Oct	18.5	18.1	-0.4	-2%	25.0	24.2	-0.8	-3%	0.9	0.8	-0.1	-11%
Nov	10.8	9.3	-1.5	-14%	19.1	19.2	0.1	1%	3.8	3.6	-0.2	-5%
Dec	9.1	8.0	-1.1	-12%	24.1	24.1	0.0	0%	4.6	4.8	0.2	4%

BOLD = Most Positive Output (potentially beneficial; meets threshold for maximum days); ***Italics*** = Most Negative Output (potentially adverse; meets threshold for fewest number of days)

1 The period from March through October is considered the cottonwood growing season; February through April is considered the seed dispersal season.

2 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 1,765 cfs, which is the minimum flow required to maintain cottonwood radial growth maintenance.

3 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 3,000 cfs, which is considered the threshold for optimal growth of cottonwoods.

4 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are ABOVE 5,000 cfs, which is considered to be the minimal required flows for the inundation of river bank terraces for germination of cottonwood seeds.

During the cottonwood growing season (March through October) in Reach 2, J602F3 ELD would decrease the average number of days below 1,765 cfs during March, April, May, June, August, September, and October (decrease of 0.4 to 4.3 days) and would increase the average days below the threshold by 0.2 day during July relative to E504 ELD. October would have the greatest average number of days below threshold (during the cottonwood growing season) with 18.5 average days below 1,765 cfs in the LAR (E504 ELD). During October, J602F3 ELD would decrease the number of days by 0.4 to an average of 18.1 days below 1,765 cfs relative to E504 ELD. July would have the fewest average days below 1,765 cfs in the LAR with 5.5 average days below 1,765 cfs (E504 ELD). During July, J602F3 ELD would increase this average by 0.2 day to an average number of days below the threshold of 5.7 days relative to E504 ELD. The largest decrease would occur during May; J602F3 ELD would decrease the average number of days by 4.3 days to an average of 10.9 days below 1,765 cfs relative to the average of 15.2 days for E504 ELD. Overall, J602F3 ELD would decrease the average number of days below 1,765 cfs in the LAR, with the greatest decreases occurring during March, April, and May. Decreases of 3.6 to 4.3 days per month on average below the threshold over a 3-consecutive-month period could provide additional flows with J602F3 ELD for cottonwood radial growth and provide a potential benefit during the cottonwood growing season.

In the second comparison, J602F3 ELD would decrease the average number of days (0.1 to 1.6 days) below 3,000 cfs during March, April, May, June, August, September, and October relative to E504 ELD. On the other hand, J602F3 ELD would increase the average number of days below the threshold by 0.5 to 12.2 days during July. October would have the greatest average number of days (during the cottonwood growing season) below 3,000 cfs in the LAR with an average of 25.0 days that fall below 3,000 cfs (E504 ELD). J602F3 ELD would decrease this average number of days by 0.8 day for an estimated average of 24.2 days that fall below the threshold relative to E504 ELD during October. July would have the lowest average number of days below 3,000 cfs in the LAR with an average of 11.7 days below 3,000 cfs (E504 ELD). J602F3 ELD would increase this number of days by 0.5 day to an average of 12.4 days below 3,000 cfs relative to E504 ELD during July. Overall, 7 of the 8 months would have a slight decrease in the average number of days below the threshold. However, these slight decreases over the 7 months would be negligible, where volume flow rates would continue to be sufficient and groundwater would be available, for cottonwood growth under either E504 ELD or J602F3 ELD.

Cottonwoods typically disperse seed between February and April. J602F3 ELD would result in minor changes to the average number of days (–0.9 to +1.1 days) when flows would be above 5,000 cfs relative to E504 ELD. J602F3 ELD would increase or decrease the average number of days above 5,000 cfs during February (0.9-day decrease), March (1.1-day increase), and April (1.0-daysincrease) relative to E504 ELD. This minor difference would not affect the overall frequency of flows above 5,000 cfs, which implies that instantaneous flows sufficient to inundate the terraces and facilitate cottonwood seed dispersal would remain largely consistent with E504 ELD over the 73-year period of record.

1.1.1.1.1.3 Reach 1

Table 33 summarizes flows at Site E, Table 34 summarizes flows at Site F, and Table 35 summarizes flows at Site G, all of which are in Reach 1 (Confluence to H Street Bridge). For the first two comparisons of E504 ELD and J602F3 ELD in each table (1,765 and 3,000 cfs), preferred results would be lower numbers, as the goal is to keep flows at or above these thresholds and these modeling outputs reflect how many days that flows would fall below the desired flows. For the third comparison (5,000 cfs), preferred results would be higher numbers, showing a greater number of days when banks might flood and cottonwood seed dispersal could occur at the upper terraces (for more details, see Section 5.2.1).

Table 3. Average number of days when flows would be below or above a specified threshold for riparian vegetation in the lower American River at Site E (RM 5.34–5.69) under E504 ELD and J602F3 ELD

Month[1]	Average Number of Days by Month below/above Specified Thresholds (73-year Record)											
	Effects on Riparian Vegetation											
	Number of Days **below** Flow Threshold[2] (1,765 cfs)				Number of Days **below** Flow Threshold[3] (3,000 cfs)				Number of Days **above** Flow Threshold[4] (5,000 cfs)			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Jan	15.8	16.3	0.5	3%	18.8	19.2	0.4	2%	8.9	8.9	0.0	0%
Feb	11.6	12.7	1.1	9%	14.1	15.5	1.4	10%	10.8	9.9	-0.9	-8%
Mar	15.5	12.2	-3.3	-21%	19.1	18.9	-0.2	-1%	7.3	8.4	1.1	15%
Apr	16.3	12.0	-4.3	-26%	20.2	18.4	-1.8	-9%	6.2	7.2	1.0	16%
May	15.1	10.9	-4.2	-28%	18.9	18.4	-0.5	-3%	7.8	8.0	0.2	3%
Jun	14.0	12.2	-1.8	-13%	18.8	18.3	-0.5	-3%	7.0	7.3	0.3	4%
Jul	5.5	5.6	0.1	2%	11.9	12.4	0.5	4%	3.8	3.6	-0.2	-5%
Aug	15.2	14.5	-0.7	-5%	22.0	22.0	0.0	0%	0.9	0.2	-0.7	-78%
Sep	14.7	14.3	-0.4	-3%	19.9	19.4	-0.5	-3%	4.0	4.6	0.6	15%
Oct	18.5	18.1	-0.4	-2%	25.1	24.3	-0.8	-3%	0.9	0.8	-0.1	-11%
Nov	10.8	9.2	-1.6	-15%	19.3	19.4	0.1	1%	3.8	3.6	-0.2	-5%

Dec	9.1	8.0	-1.1	-12%	24.2	24.2	0.0	0%	4.6	4.8	0.2	4%

BOLD = Most Positive Output (potentially beneficial; meets threshold for maximum days); ***Italics*** = Most Negative Output (potentially adverse; meets threshold for fewest number of days)

1 The period from March through October is considered the cottonwood growing season; February through April is considered the seed dispersal season.

2 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 1,765 cfs, which is the minimum flow required to maintain cottonwood radial growth maintenance.

3 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 3,000 cfs, which is considered the threshold for optimal growth of cottonwoods.

4 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are ABOVE 5,000 cfs, which is considered to be the minimal required flows for the inundation of river bank terraces for germination of cottonwood seeds.

Table 4. Average number of days when flows would be below or above a specified threshold for riparian vegetation in the lower American River at Site F (RM 4.82–5) under E504 ELD and J602F3 ELD

Month[1]	Average Number of Days by Month above/below Specified Thresholds (73-year Record)											
	Effects on Riparian Vegetation											
	Number of Days **below** Flow Threshold[2] (1,765 cfs)				Number of Days **below** Flow Threshold[3] (3,000 cfs)				Number of Days **above** Flow Threshold[4] (5,000 cfs)			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Jan	15.8	16.3	0.5	3%	18.9	19.2	0.3	2%	8.9	8.9	0.0	0%
Feb	11.5	12.6	1.1	10%	14.2	15.5	1.3	9%	10.8	9.9	-0.9	-8%
Mar	15.0	12.0	-3.0	-20%	19.1	18.9	-0.2	-1%	7.3	8.4	1.1	15%
Apr	16.1	12.0	-4.1	-25%	20.2	18.4	-1.8	-9%	6.2	7.2	1.0	16%
May	15.1	11.0	-4.1	-27%	18.9	18.4	-0.5	-3%	7.8	8.0	0.2	3%
Jun	14.1	12.3	-1.8	-13%	18.8	18.3	-0.5	-3%	7.0	7.2	0.2	3%
Jul	5.5	5.6	0.1	2%	12.1	12.6	0.5	4%	3.8	3.6	-0.2	-5%
Aug	15.2	14.5	-0.7	-5%	22.1	22.0	-0.1	0%	0.9	0.2	-0.7	-78%
Sep	14.7	14.2	-0.5	-3%	20.0	19.3	-0.7	-4%	4.1	4.6	0.5	12%
Oct	18.5	18.1	-0.4	-2%	25.1	24.2	-0.9	-4%	0.9	0.8	-0.1	-11%
Nov	10.7	9.2	-1.5	-14%	19.3	19.4	0.1	1%	3.8	3.6	-0.2	-5%
Dec	9.1	8.0	-1.1	-12%	24.2	24.2	0.0	0%	4.6	4.8	0.2	4%

BOLD = Most Positive Output (potentially beneficial; meets threshold for maximum days); ***Italics*** = Most Negative Output (potentially adverse; meets threshold for fewest number of days)

[1] The period from March through October is considered the cottonwood growing season; February through April is considered the seed dispersal season.

[2] Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 1,765 cfs, which is the minimum flow required to maintain cottonwood radial growth maintenance.

[3] Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 3,000 cfs, which is considered the threshold for optimal growth of cottonwoods.

[4] Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are ABOVE 5,000 cfs, which is considered to be the minimal required flows for the inundation of river bank terraces for germination of cottonwood seeds.

Table 5. Average number of days when flows would be below or above a specified threshold for riparian vegetation in the lower American River at Site G (RM 3.4–3.69) under E504 ELD and J602F3 ELD

Month[1]	Average Number of Days by Month below/above Specified Thresholds (73-year Record)											
	Effects on Riparian Vegetation											
	Number of Days **below** Flow Threshold[2] (1,765 cfs)				Number of Days **below** Flow Threshold[3] (3,000 cfs)				Number of Days **above** Flow Threshold[4] (5,000 cfs)			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Jan	15.6	16.1	0.5	3%	18.8	19.2	0.4	2%	8.9	8.9	0.0	0%
Feb	11.2	12.2	1.0	9%	14.1	15.5	1.4	10%	10.8	9.9	-0.9	-8%
Mar	13.9	11.6	-2.3	-17%	19.1	18.9	-0.2	-1%	7.3	8.4	1.1	15%
Apr	15.9	11.7	-4.2	-26%	20.2	18.5	-1.7	-8%	6.2	7.2	1.0	16%
May	15.0	10.9	-4.1	-27%	19.0	18.4	-0.6	-3%	7.8	8.0	0.2	3%
Jun	14.0	12.2	-1.8	-13%	18.8	18.3	-0.5	-3%	7.0	7.3	0.3	4%
Jul	5.5	5.6	0.1	2%	12.1	12.6	0.5	4%	3.8	3.6	-0.2	-5%
Aug	15.1	14.4	-0.7	-5%	22.1	22.0	-0.1	0%	0.9	0.2	-0.7	-78%
Sep	14.7	14.3	-0.4	-3%	20.1	19.3	-0.8	-4%	4.1	4.6	0.5	12%
Oct	18.5	18.1	-0.4	-2%	25.1	24.2	-0.9	-4%	0.9	0.8	-0.1	-11%
Nov	10.7	9.2	-1.5	-14%	19.3	19.4	0.1	1%	3.8	3.6	-0.2	-5%
Dec	9.0	8.0	-1.0	-11%	24.3	24.2	-0.1	0%	4.6	4.8	0.2	4%

BOLD = Most Positive Output (potentially beneficial; meets threshold for maximum days); ***Italics*** = Most Negative Output (potentially adverse; meets threshold fewest number of days)

1 The period from March through October is considered the cottonwood growing season; February through April is considered the seed dispersal season.

2 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 1,765 cfs, which is the minimum flow required to maintain cottonwood radial growth maintenance.

3 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are BELOW 3,000 cfs, which is considered the threshold for optimal growth of cottonwoods.

4 Average numbers of days in referenced month across the 73-year simulation period when the mean daily river flows below Nimbus Dam are ABOVE 5,000 cfs, which is considered to be the minimal required flows for the inundation of river bank terraces for germination of cottonwood seeds.

During the cottonwood growing season (March through October) in Reach 1, J602F3 ELD would decrease the average number of days per month by 0.4 to 4.3 days during March, April, May, June, August, September, and October and would increase the average number of days per month below 1,765 cfs during July by 0.1 average day per month relative to E504 ELD at all sites. October would have the greatest average number of days (during the cottonwood growing season) below 1,765 cfs in the LAR with 18.5 days at all sites (E504 ELD). During October, J602F3 ELD would decrease this average number of days below the threshold by 0.4 day to an average of 18.1 days at all three sites relative to E504 ELD. July would have the lowest average number of days below 1,765 cfs in the LAR with an average number of 5.5 days below 1,765 cfs at all sites (E504 ELD). During July, J602F3 ELD would increase this average by 0.1 day to an average number of days below the threshold of 5.6 days at all sites relative to E504 ELD. The largest decrease from J602F3 ELD would occur during April; J602F3 ELD would decrease the average number of days by 4.3 days at Site E, 4.1 days at Site F (which is also seen in May for Site F), and 4.2 days at Site G to an average of 12.0 days at Sites E and F, and 11.7 days at Site G, below 1,765 cfs relative to the average of 16.3 days at Site E, 16.1 days at Site F, and 15.9 days at Site G (E504 ELD). Overall, J602F3 ELD would decrease the average number of days below 1,765 cfs in the LAR, with the greatest decreases occurring during March, April, and May. A decrease of 2.3 to 4.2 average days below the threshold over a 3-consecutive-month period could provide additional flows with J602F3 ELD for cottonwood radial growth and provide a potential benefit during the cottonwood growing season.

In the next comparison, J602F3 ELD would decrease the average number of days (0.1 to 1.8 days depending on the site) below 3,000 cfs during March, April, May, June, September, and October relative to E504 ELD at all three sites. J602F3 ELD would increase the average number of days below 3,000 cfs during July (0.5 day) relative to E504 ELDs at all three sites. J602F3 ELD average number of days below 3,000 cfs would remain unchanged during August at Site E, while Sites F and G would have minimal decreases of 0.1 day during July. October would have the greatest average number of days (during the cottonwood growing season) below 3,000 cfs in the LAR with an average number of 25.1 days per month below 3,000 cfs at all three sites (E504 ELD). J602F3 ELD would decrease the average number of days per month below 3,000 cfs by 0.8 day at Site E, and 0.9 day at Sites F and G, to 24.3 average days at Site E, and 24.2 average days at Sites F and G, relative to E504 ELD during October. July would have the lowest average number of days below 3,000 cfs in the LAR with 11.9 average days at Site E and 12.1 average days at Sites F and G (E504 ELD). J602F3 ELD would increase this average number of days by 0.5 day at all sites relative to E504 ELD during July. Overall, 7 of the 8 months would have a slight decrease in the average number of days below the threshold. However, these slight decreases in monthly average days below threshold over the 7 months would be negligible, volume flow rates would continue, and cottonwood growth would remain consistent under either E504 ELD or J602F3 ELD.

Cottonwoods typically disperse seed between February and April. J602F3 ELD would result in minor changes in the average number of days (–0.9 to +1.1 days) when flows would be above 5,000 cfs relative to E504 ELD. J602F3 ELD would change the average number of days in a month above the threshold during February (0.9-day decrease), March (1.1-day increase), and April (1.0-day increase) at all three sites relative to E504 ELD. This minor difference would not affect the overall frequency of flows above 5,000 cfs, which implies that instantaneous flows sufficient to inundate the terraces and facilitate cottonwood seed dispersal would remain largely consistent with E504 ELD over the 73-year period of record.

1.1.1.1.2 Backwater Recharge

1.1.1.1.2.1 Reach 3

Simulated flows exhibited the same results at Sites A, B, and C in Reach 3. Table 36 summarizes simulated flows in Reach 3 (RM 12.0 to Nimbus Dam); this example is from Site A. For both comparisons (average days below 2,700 cfs and below 4,000 cfs), lower values are preferred, as this reflects the number of days that fall *below* the threshold that supports backwater recharge.

Table 6. Average number of days when flows would be below a specified threshold for backwater recharge in the lower American River at Site A (RM 18.49–18.83) under E504 ELD and J602F3 ELD

Month	Average Number of Days by Month Below Specified Threshold (73-year Record)							
	Average Number of Days below the 2,700-cfs Flow Threshold[1]				Average Number of Days below the 4,000-cfs Flow Threshold[2]			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Dec	23.7	23.7	0.0	0%	25.6	25.4	-0.2	-1%
Jan	18.5	18.8	0.3	2%	20.6	20.8	0.2	1%
Feb	13.5	14.8	1.3	10%	15.8	17.0	1.2	8%
Mar	18.4	18.1	-0.3	-2%	21.5	21.0	-0.5	-2%
Apr	19.5	17.7	-1.8	-9%	21.9	20.7	-1.2	-5%
May	18.4	17.5	-0.9	-5%	21.1	20.7	-0.4	-2%
Jun	18.1	17.3	-0.8	-4%	21.0	20.7	-0.3	-1%
Jul	10.0	10.0	0.0	0%	19.3	18.7	-0.6	-3%
Aug	20.3	19.5	-0.8	-4%	25.0	27.2	2.2	9%
Sep	19.0	17.9	-1.1	-6%	22.8	22.6	-0.2	-1%
Oct	23.7	23.2	-0.5	-2%	27.9	27.9	0.0	0%
Nov	18.2	18.4	0.2	1%	23.8	23.8	0.0	0%

1 Number of days in referenced month during the 73-year record when the average daily river flows would be below the 2,700-cfs threshold for backwater pond recharge on the lower American River.

2 Number of days in referenced month during the 73-year record when the average daily river flows would be below the 4,000-cfs threshold for off-river pond recharge on the lower American River.

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. Flows of 2,700 cfs are required to recharge these ponds. Periods with average daily flows that meet this threshold for backwater recharge (2,700 cfs) are projected to continue during the 73-year hydrologic period under J602F3 ELD. Projected flows under J602F3 ELD show no effect during December, a decrease in the average number of days below 2,700 cfs during March (0.3 day), April (1.8 days), and May (0.9 day), and a slight increase in the average number of days below 2,700 cfs during January (0.3 day) and February (1.3 days) relative to E504 ELD. December is the recharge month when the average number of days below the threshold in the LAR would be the greatest, with 23.7 average days falling below the minimal threshold for backwater recharge (E504 ELD). J602F3 ELD would not affect this average number of days relative to E504 ELD. February is the recharge month when the average number of days below threshold would be the lowest in the LAR with 13.5 average days below 2,700 cfs (E504 ELD). J602F3 ELD would increase the average number of days by 1.3 days to 14.8 average days below 2,700 cfs relative to E504 ELD. Given the minimal difference between E504 ELD and J602F3 ELD for this comparison, average daily flows are projected to remain essentially the same for either scenario for backwater recharge of ponds closest to the river during the 73-year hydrologic period.

Winter and spring months are also when farther-off-river ponds are recharged by high flow, requiring a minimal threshold of 4,000 cfs. Projected flows under J602F3 ELD show a slight decrease in the average number of days below 4,000 cfs during December (0.2 day), March (0.5 day), April (1.2 days), and May (0.4 day), and a slight increase during January (0.2 day) and February (1.2 days) relative to E504 ELD. December would have the greatest number of average days during the recharge months with a 25.6 average number of days below 4,000 cfs under E504 ELD. In December, J602F3 ELD would decrease the average number of days by 0.2 day to 25.4 average days below 4,000 cfs relative to E504 ELD. February would have the lowest average number of days below the threshold during recharge months in the LAR with 15.8 days below 4,000 cfs (E504 ELD). J602F3 ELD would increase the average number of days by 1.2 days to 17.0 average days below 4,000 cfs relative to E504 ELD. Given the minimal difference between E504 ELD and J602F3 ELD for this comparison, average daily flows are projected to remain essentially the same for either scenario for recharge of farther off-river ponds during the 73-year hydrologic period.

Projected flows under J602F3 ELD at Site A would be slightly different from flows under E504 ELD, but not at a frequency or duration that would affect backwater or off-river pond recharge or vegetation associated with the ponds.

1.1.1.1.2.2 Reach 2

Table 37 summarizes flows at Site D in Reach 2 (RM 12.0 to Nimbus Dam).

Table 7. Average number of days when flows would be below a specified threshold for backwater recharge in the lower American River at Site D (RM 11.35–11.59) under E504 ELD and J602F3 ELD

Month	Average Number of Days by Month Below Specified Threshold (73-year Record)							
	Average Number of Days below the 2,700-cfs Flow Threshold[1]				Average Number of Days below the 4,000-cfs Flow Threshold[2]			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Dec	23.6	23.7	0.1	0%	25.6	25.4	-0.2	-1%
Jan	18.5	18.8	0.3	2%	20.6	20.8	0.2	1%
Feb	13.5	14.9	1.4	10%	15.8	17.0	1.2	8%
Mar	18.4	18.0	-0.4	-2%	21.4	21.0	-0.4	-2%
Apr	19.5	17.6	-1.9	-10%	21.9	20.6	-1.3	-6%
May	18.3	17.5	-0.8	-4%	21.0	20.6	-0.4	-2%
Jun	18.0	17.2	-0.8	-4%	20.9	20.7	-0.2	-1%
Jul	9.9	10.0	0.1	1%	19.2	19.0	-0.2	-1%
Aug	20.2	19.4	-0.8	-4%	25.0	27.2	2.2	9%
Sep	19.0	17.9	-1.1	-6%	22.7	22.7	0.0	0%
Oct	23.7	23.1	-0.6	-3%	27.9	27.9	0.0	0%
Nov	18.2	18.4	0.2	1%	23.7	23.8	0.1	0%

[1] Number of days in referenced month during the 73-year record when the average daily river flows would be below the 2,700-cfs threshold for backwater pond recharge on the lower American River.

[2] Number of days in referenced month during the 73-year record when the average daily river flows would be below the 4,000-cfs threshold for off-river pond recharge on the lower American River.

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. Flows of 2,700 cfs are required to recharge these ponds. Periods with average daily flows that meet this threshold for backwater recharge (2,700 cfs) are projected to continue during the 73-year hydrologic period under J602F3 ELD. Projected flows under J602F3 ELD show decreases in the average number of days below 2,700 cfs during March (0.4 day), April (1.9 days), and May (0.8 day), and slight increases in the average number of days below 2,700 cfs during December (0.1 day), January (0.3 day), and February (0.7 day) relative to E504 ELD. December is the recharge month where the average number of days below the threshold in the LAR would be the highest, with 23.6 average numbers of days (E504 ELD). J602F3 ELD would increase this average number of days by 0.1 day to 23.7 average days below 2,700 cfs relative to E504 ELD. February is the recharge month when the average number of days would be the lowest in the LAR with 13.5 average days below 2,700 cfs (E504 ELD). J602F3 ELD would increase the average number of days by

1.4 days to 14.9 average days below 2,700 cfs relative to E504 ELD. Given the minimal difference between E504 ELD and J602F3 ELD for this comparison, average daily flows are projected to remain essentially the same for either scenario for backwater recharge of ponds closest to the river during the 73-year hydrologic period.

Winter and spring months are also when farther-off-river ponds are recharged by high flow, requiring a minimal threshold of 4,000 cfs. Projected flows under J602F3 ELD show a slight decrease in average number of days below 4,000 cfs during December (0.2 day), March (0.4 day), April (1.3 days), and May (0.4 day), and a slight increase during January (0.2 day) and February (1.2 days) relative to E504 ELD. December would have the greatest average number of days in the recharge months with a 25.6 average number of days below 4,000 cfs under E504 ELD. In December, J602F3 ELD would decrease the average number of days by 0.2 day to 25.4 average days below 4,000 cfs relative to E504 ELD. February would have the lowest average number of days below the threshold during recharge months in the LAR with 15.8 days below 4,000 cfs (E504 ELD). J602F3 ELD would increase the average number of days by 1.2 days to 17.0 average days below 4,000 cfs relative to E504 ELD. Given the minimal difference between E504 ELD and J602F3 ELD for this comparison, average daily flows are projected to remain essentially the same for either scenario for recharge of farther-off-river ponds during the 73-year hydrologic period.

Projected flows under J602F3 ELD at Site D would be slightly different from flows under E504 ELD, but not at a frequency or duration that would affect backwater or off-river pond recharge or vegetation associated with the ponds.

1.1.1.1.2.3 Reach 1

Table 38 summarizes flows at Site E, Table 39 summarizes flows at Site F, and Table 40 summarizes flows at Site G, all of which are in Reach 1 (Confluence to H Street Bridge).

Table 8. Average number of days when flows would be below a specified threshold for backwater recharge in the lower American River at Site E (RM 5.34–5.69) under E504 ELD and J602F3 ELD

Month	Average Number of Days by Month Below Specified Threshold (73-year Record)							
	Average Number of Days below the 2,700-cfs Flow Threshold[1]				Average Number of Days below the 4,000-cfs Flow Threshold[2]			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Dec	23.7	23.7	0.0	0%	25.6	25.5	-0.1	0%
Jan	18.5	18.8	0.3	2%	20.6	20.8	0.2	1%
Feb	13.4	14.8	1.4	10%	15.9	16.9	1.0	6%
Mar	18.4	18.0	-0.4	-2%	21.3	21.0	-0.3	-1%
Apr	19.5	17.6	-1.9	-10%	21.9	20.6	-1.3	-6%
May	18.2	17.4	-0.8	-4%	21.0	20.7	-0.3	-1%
Jun	18.0	17.2	-0.8	-4%	20.9	20.6	-0.3	-1%
Jul	9.9	9.9	0.0	0%	19.1	18.9	-0.2	-1%
Aug	20.2	19.3	-0.9	-4%	24.9	27.1	2.2	9%
Sep	18.9	17.8	-1.1	-6%	22.7	22.7	0.0	0%
Oct	23.7	23.1	-0.6	-3%	27.9	27.9	0.0	0%
Nov	18.2	18.5	0.3	2%	23.8	23.9	0.1	0%

1 Number of days in referenced month during the 73-year record when the average daily river flows would be below the 2,700-cfs threshold for backwater pond recharge on the lower American River.

2 Number of days in referenced month during the 73-year record when the average daily river flows would be below the 4,000-cfs threshold for off-river pond recharge on the lower American River.

Table 9. Average number of days when flows would be below a specified threshold for backwater recharge in the lower American River at Site F (RM 4.82–5) under E504 ELD and J602F3 ELD

Month	Average Number of Days by Month Below Specified Threshold (73-year Record)							
	Average Number of Days below the 2,700-cfs Flow Threshold[1]				Average Number of Days below the 4,000-cfs Flow Threshold[2]			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Dec	23.7	23.7	0.0	0%	25.6	25.5	-0.1	0%
Jan	18.5	18.7	0.2	1%	20.6	20.8	0.2	1%
Feb	13.4	14.8	1.4	10%	15.9	16.9	1.0	6%
Mar	18.4	18.0	-0.4	-2%	21.3	21.0	-0.3	-1%
Apr	19.5	17.6	-1.9	-10%	21.9	20.6	-1.3	-6%
May	18.2	17.4	-0.8	-4%	21.0	20.7	-0.3	-1%
Jun	18.0	17.2	-0.8	-4%	20.9	20.6	-0.3	-1%
Jul	9.9	10.0	0.1	1%	19.1	18.9	-0.2	-1%
Aug	20.2	19.3	-0.9	-4%	24.9	27.1	2.2	9%
Sep	19.0	17.8	-1.2	-6%	22.7	22.7	0.0	0%
Oct	23.7	23.1	-0.6	-3%	27.9	27.9	0.0	0%
Nov	18.2	18.5	0.3	2%	23.8	23.9	0.1	0%

[1] Number of days in referenced month during the 73-year record when the average daily river flows would be below the 2,700-cfs threshold for backwater pond recharge on the lower American River.

[2] Number of days in referenced month during the 73-year record when the average daily river flows would be below the 4,000-cfs threshold for off-river pond recharge on the lower American River.

Table 10. Average number of days when flows would be below a specified threshold for backwater recharge in the lower American River at Site G (RM 3.4–3.69) under E504 ELD and J602F3 ELD

Month	Average Number of Days by Month Below Specified Threshold (73-year Record)							
	Average Number of Days below the 2,700-cfs Flow Threshold[1]				Average Number of Days below the 2,700-cfs Flow Threshold[1]			
	E504 ELD	J602F3 ELD	Diff	% Diff	E504 ELD	J602F3 ELD	Diff	% Diff
Dec	23.7	23.7	0.0	0%	25.6	25.5	-0.1	0%
Jan	18.5	18.7	0.2	1%	20.6	20.8	0.2	1%
Feb	13.5	14.8	1.3	10%	15.9	16.9	1.0	6%
Mar	18.4	18.0	-0.4	-2%	21.3	21.0	-0.3	-1%
Apr	19.4	17.6	-1.8	-9%	21.9	20.6	-1.3	-6%
May	18.2	17.4	-0.8	-4%	21.0	20.6	-0.4	-2%
Jun	17.9	17.2	-0.7	-4%	20.9	20.6	-0.3	-1%
Jul	9.9	10.0	0.1	1%	19.1	19.0	-0.1	-1%
Aug	20.2	19.3	-0.9	-4%	24.9	27.1	2.2	9%
Sep	19.0	17.9	-1.1	-6%	22.7	22.7	0.0	0%
Oct	23.7	23.1	-0.6	-3%	27.9	27.9	0.0	0%
Nov	18.2	18.5	0.3	2%	23.8	23.9	0.1	0%

1 Number of days in referenced month during the 73-year record when the average daily river flows would be below the 2,700-cfs threshold for backwater pond recharge on the lower American River.

2 Number of days in referenced month during the 73-year record when the average daily river flows would be below the 4,000-cfs threshold for off-river pond recharge on the lower American River.

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. Flows of 2,700 cfs are required to recharge these ponds. Periods with average daily flows that meet this threshold for backwater recharge (2,700 cfs) are projected to continue during the 73-year hydrologic period under J602F3 ELD. Projected flows under J602F3 ELD show no effect during December, a slight decrease in the average number of days below 2,700 cfs during March (0.4 day), April (1.8 to 1.9 days depending on the site), and May (0.8 day), and a slight increase in the average number of days below 2,700 cfs during January (0.2 to 0.3 day depending on the site) and February (1.3 to 1.4 days depending on the site) relative to E504 ELD. December is the recharge month when the number of average days projected to be below the threshold would be highest with 23.7 days below 2,700 cfs at all sites. J602F3 ELD would have no effect on average days below 2,700 cfs relative to E504 ELD at all sites during December. February would have the lowest average number of days below the threshold during recharge months in the LAR with 13.4 to 13.5 days (depending on the site) below 2,700 cfs (E504 ELD). J602F3 ELD would increase the average number of days by 1.4 days (Sites E and F) and 1.3 days (Site G) to 14.8 (all sites) average days below 2,700 cfs relative to E504 ELD for February. Given the minimal difference between E504 ELD and

J602F3 ELD for this comparison, average daily flows are projected to remain essentially the same for either scenario for backwater recharge of ponds closest to the river during the 73-year hydrologic period.

Winter and spring months are also when farther-off-river ponds are recharged by high flow, requiring a minimal threshold of 4,000 cfs. Projected flows under J602F3 ELD show a slight decrease in average number of days below 4,000 cfs during December (0.1 day), March (0.3 day), April (1.3 days), and May (0.4 day), and a slight increase during January (0.2 day) and February (1.0 day) relative to E504 ELD. December would have the greatest average number of days in the recharge months with a 25.6 average number of days below 4,000 cfs under E504 ELD. In December, J602F3 ELD would decrease the average number of days by 0.1 day to 25.5 average days below 4,000 cfs relative to E504 ELD. February would have the lowest average number of days below the threshold during recharge months in the LAR with 15.9 days at all sites below 4,000 cfs (E504 ELD). J602F3 ELD would increase the average number of days by 1.0 day to 16.9 average days at all sites below 4,000 cfs relative to E504 ELD for February. Given the minimal difference between E504 ELD and J602F3 ELD for this comparison, average daily flows are projected to remain essentially the same for either scenario for recharge of farther-off-river ponds during the 73-year hydrologic period.

Projected flows under J602F3 ELD at Sites E, F, and G would be slightly different from flows under E504 ELD, but not at a frequency or duration that would affect backwater or off-river pond recharge or vegetation associated with the ponds.

1.1.1.2 Folsom Reservoir

A summary table of the long-term and water year type average of Folsom Reservoir end-of-month elevations under E504 ELD and J602F3 ELD is provided in Appendix C, Table Daily-80 149 E504ELD-J602F3ELD. The highest elevations predicted for Folsom Reservoir under J602F3 ELD are 465 feet, which would occur in June for wet.

In wet and above-normal years, June would have the highest predicted water levels in Folsom Reservoir; the simulation for dry and critical years prolongs the elevated water levels to include May and June. Output from the full 82-year simulation period shows a maximum variance of 11 feet in elevation between E504 ELD and J602F3 ELD over the full 82-year simulation period (ranging from a 1-foot decrease to a 10-foot increase). For the simulations for individual water year types, the largest changes would occur in February with a 9-foot gain (2.2-percent increase) and March with a 10-foot gain (2.4-percent increase) in wet years followed by a 7-foot gain (1.9-percent increase) in February and March for above-normal years. Besides the predicted increases in February and March for both wet and above-normal years, fluctuations generally would range from a 1-foot loss to a 4-foot gain in reservoir elevation, with less than 2-percent variation between E504 ELD and J602F3 ELD across all months for all water year type simulations. In critical years, a 1-foot loss to a 1-foot gain with no change in elevation is predicted for all months. Moderate fluctuations (1-foot loss to 3-foot gain in elevation) are predicted in below-normal and dry years. Wet and above-normal years have the most predicted fluctuation (1-foot loss to 10-foot gain in elevation). More than half of the simulated years for J602F3 ELD in wet years have an increase in reservoir elevation from E504 ELD; water elevations would range from 415 to 464 feet. Above-normal years would have similar variation between conditions, with 8 months of modeled increases in reservoir elevation and water levels ranging between 407 and 463 feet. For below-normal, dry, and critical years, there would be a slight variation in elevation between conditions, with elevation levels ranging from 388 to 460 feet.

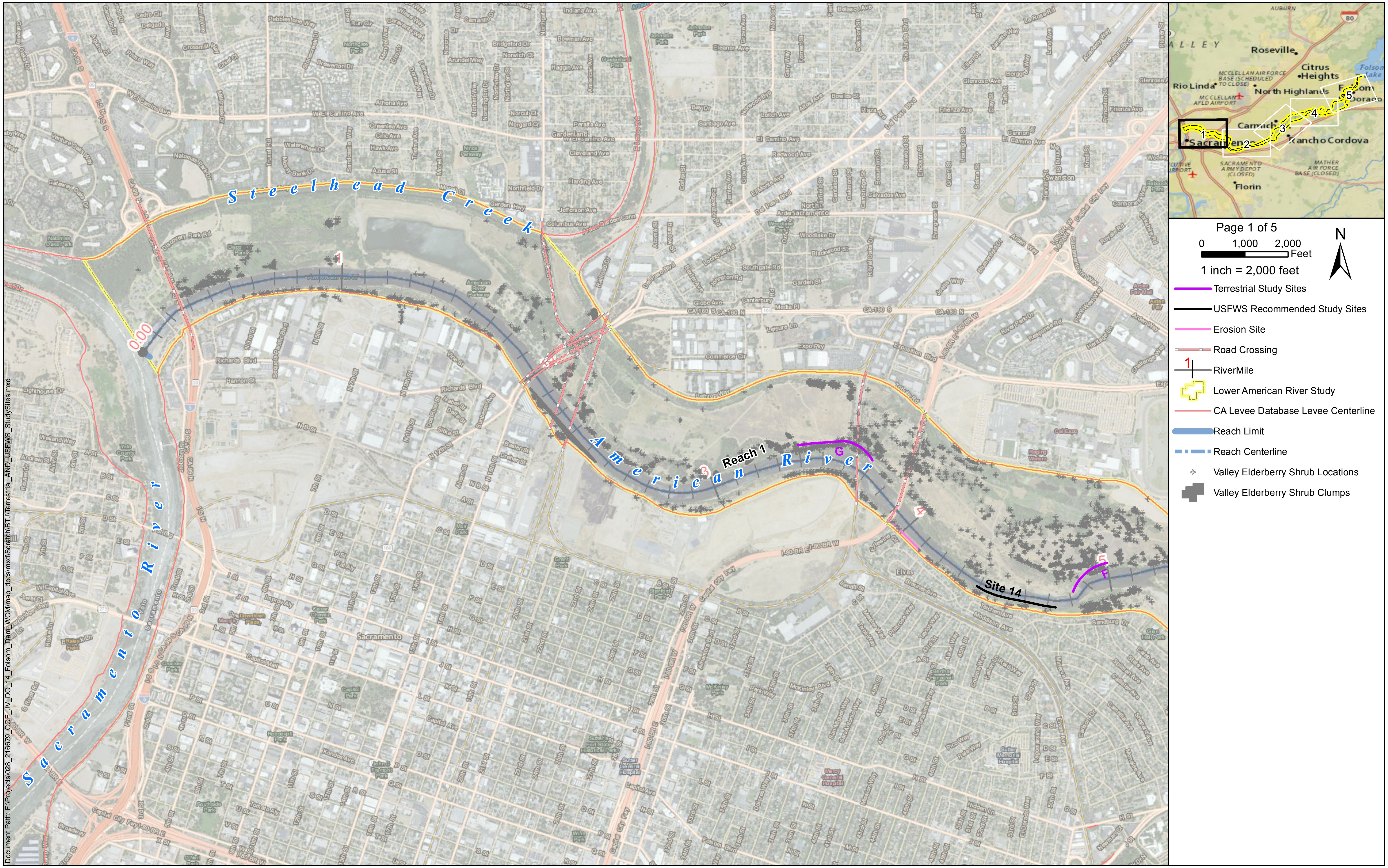
1.1.1.3 Evaluation of Effects

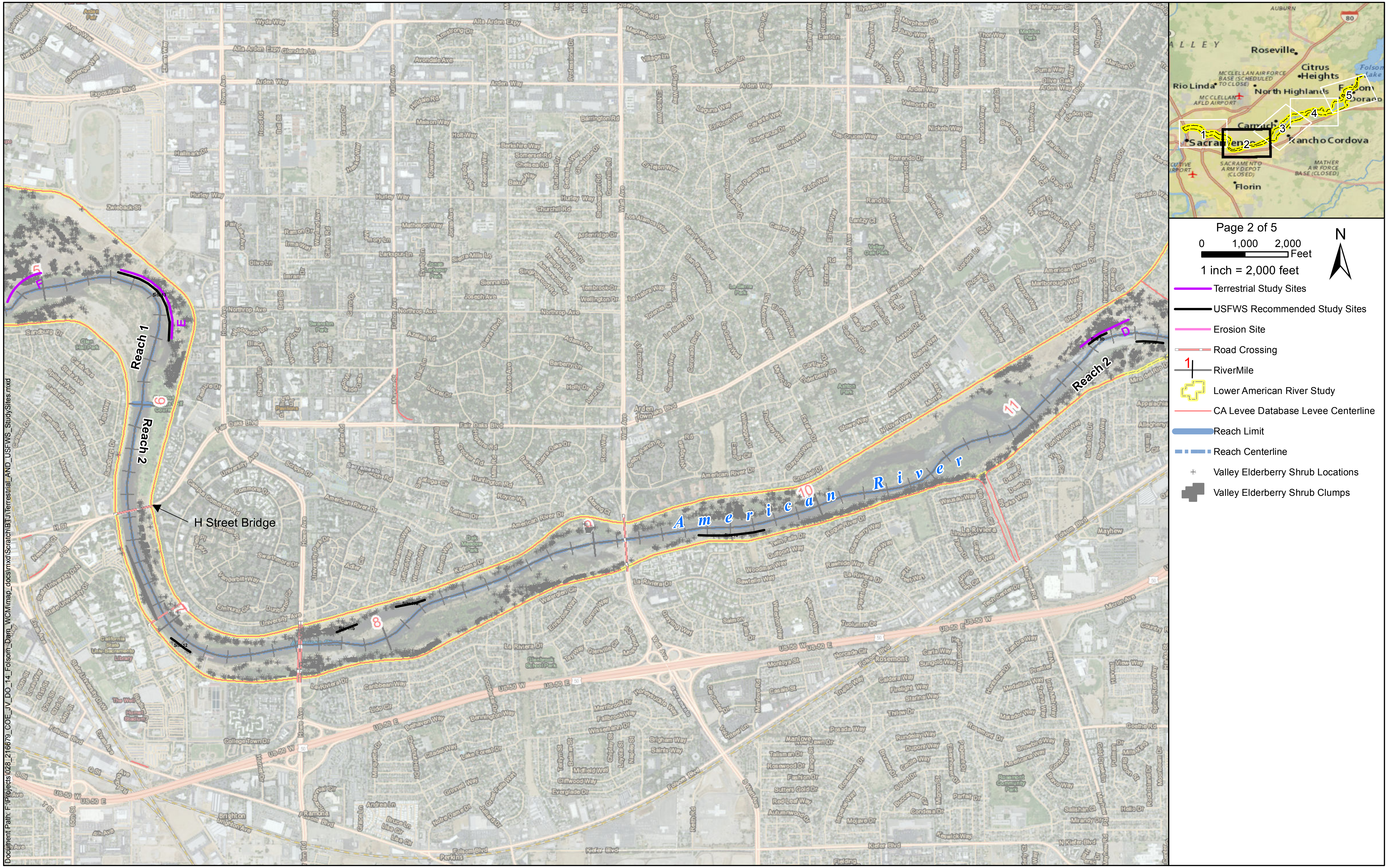
The J602F3 ELD results indicate that the LAR flows under the 1,765-cfs threshold could decrease between 3.7 to 4.2 average days over a 3-consecutive-month period during the cottonwood growing season relative to E504 ELD. A decrease of 3 to 4 average days below the threshold over a 3-consecutive-month period could provide additional flows with J602F3 ELD for cottonwood radial growth and provide a potential benefit during the cottonwood growing season. However, cottonwood maintenance and optimal growth under the 3,000-cfs threshold would stay relatively consistent during the cottonwood growing season between E504 ELD and J602F3 ELD. Therefore, effects on vegetation growth in the riparian corridor of the LAR under J602F3 ELD would be a potential benefit under the 1,765-cfs threshold and less than substantial under the 3,000-cfs threshold. In addition, there would be no substantial difference in the pattern of peak flows necessary to inundate terraces for cottonwood dispersal and regeneration between J602F3 ELD and E504 ELD. As discussed in Section 8 (Erosion), J602F3 ELD critical shear values for riparian study sites along the LAR would also be less than substantial, with a low probability of exceedance beyond the critical shear threshold.

USFWS has designated the Parkway as critical habitat for VELB, and this species has been recorded in elderberry shrubs near backwater ponds along the LAR. Sanford’s arrowhead, western pond turtle, and tri-colored blackbirds are special-status species known to occur in several backwater pond areas along the LAR. Relative to E504 ELD, J602F3 ELD would result in fluctuations between 2 less to 1 more day when average daily flows are below the evaluated thresholds during winter and spring months. The difference in flows would not change by a sufficient magnitude and frequency to substantially alter existing water fluctuations (pond levels) and vegetation dependent on these ponds. Because effects on backwater habitats under J602F3 ELD would be less than substantial, effects on elderberry shrubs and special-status species that depend on these habitats also would be less than substantial.

Under J602F3 ELD, the water surface elevation fluctuations that would take place at Folsom Reservoir would remain within normal operating parameters (i.e., water elevations would not exceed the 466-foot-amsl threshold or barren band for durations that could impact existing vegetation). Folsom Reservoir has water levels that routinely fluctuate. J602F3 ELD would result in water surface elevation patterns that are the same as or slightly lower than those with E504 ELD. J602F3 ELD would not change the distribution of vegetation or alter riparian vegetation scattered around the reservoir. The fluctuation zone at Folsom Reservoir is essentially devoid of vegetation. 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.

Appendix 5B - Terrestrial Figures

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Terrestrial Study Sites
USFWS Recommended Study Sites
Erosion Site
Road Crossing
RiverMile
Lower American River Study
CA Levee Database Levee Centerline
Reach Limit
Reach Centerline
Valley Elderberry Shrub Locations
Valley Elderberry Shrub Clumps
American River
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Reach 2
H Street Bridge
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Citrus Heights
Rio Linda
North Highlands
Carmichael
Sacramento
Rancho Cordova
Florin
Folsom
Folsom Lake
El Dorado
AUBURN
McCLELLAN AIR FORCE BASE (SCHEDULED TO CLOSE)
McCLELLAN AFLD AIRPORT
SACRAMENTO ARMY DEPOT (CLOSED)
MATHER AIR FORCE BASE (CLOSED)
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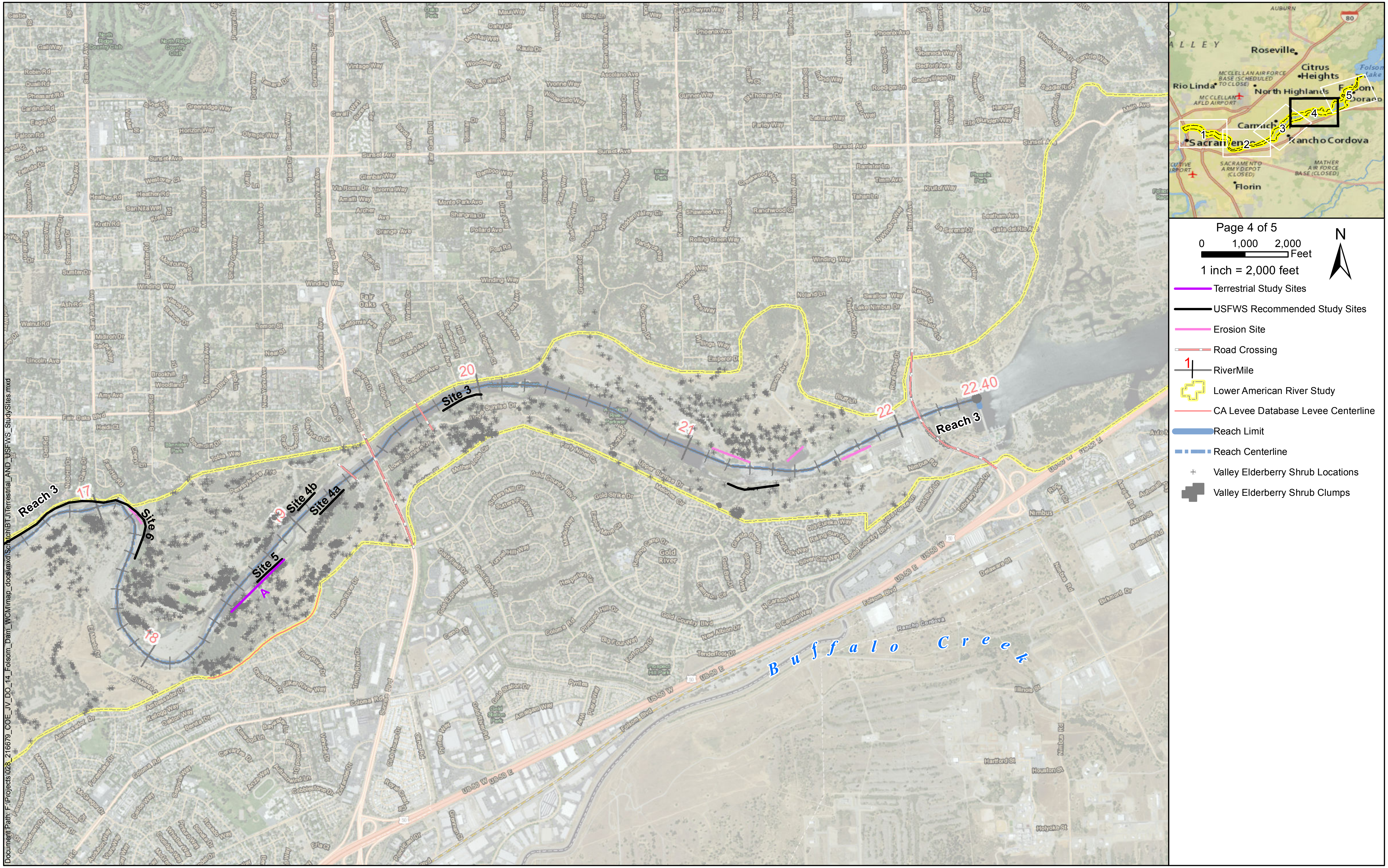Page 4 of 5
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Terrestrial Study Sites
USFWS Recommended Study Sites
Erosion Site
Road Crossing
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RiverMile
Lower American River Study
CA Levee Database Levee Centerline
Reach Limit
Reach Centerline
Valley Elderberry Shrub Locations
Valley Elderberry Shrub Clumps
Reach 3
Reach 3
Site 3
Site 4a
Site 4b
Site 5
Site 6
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22.40
Buffalo Creek
AUBURN
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VALLEY
Roseville
Citrus Heights
Rio Linda
McCLELLAN AIR FORCE BASE (SCHEDULED TO CLOSE)
McCLELLAN AFLD AIRPORT
North Highlands
Folsom
Folsom Lake
El Dorado
Carmichael
Sacramento
Rancho Cordova
SACRAMENTO ARMY DEPOT (CLOSED)
MATHER AIR FORCE BASE (CLOSED)
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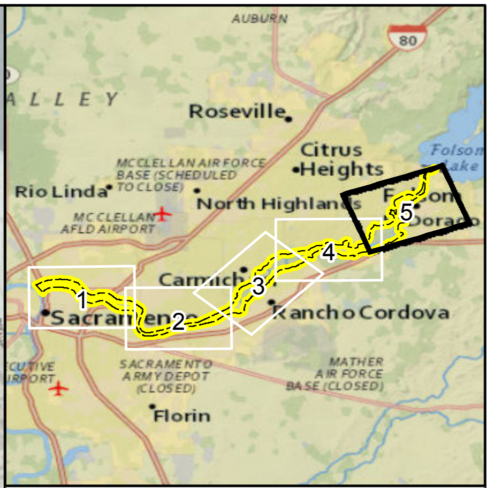

Page 5 of 5

0 1,000 2,000 Feet

1 inch = 2,000 feet

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- Terrestrial Study Sites
- USFWS Recommended Study Sites
- Erosion Site
- Road Crossing
- 1 RiverMile
- Lower American River Study
- CA Levee Database Levee Centerline
- Reach Limit
- Reach Centerline
- Valley Elderberry Shrub Locations
- Valley Elderberry Shrub Clumps

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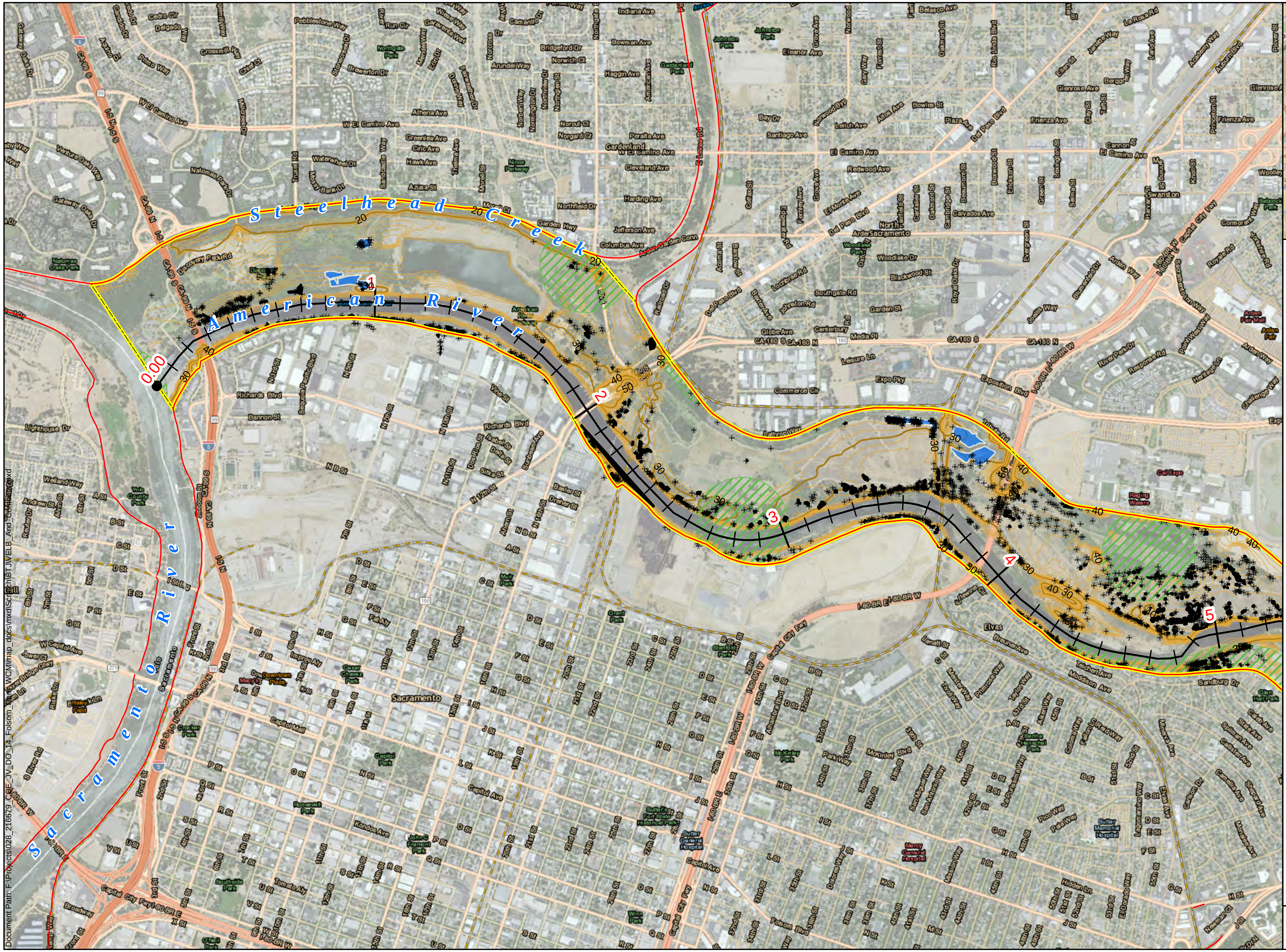

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Page 1 of 5

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1 inch = 2,000 feet

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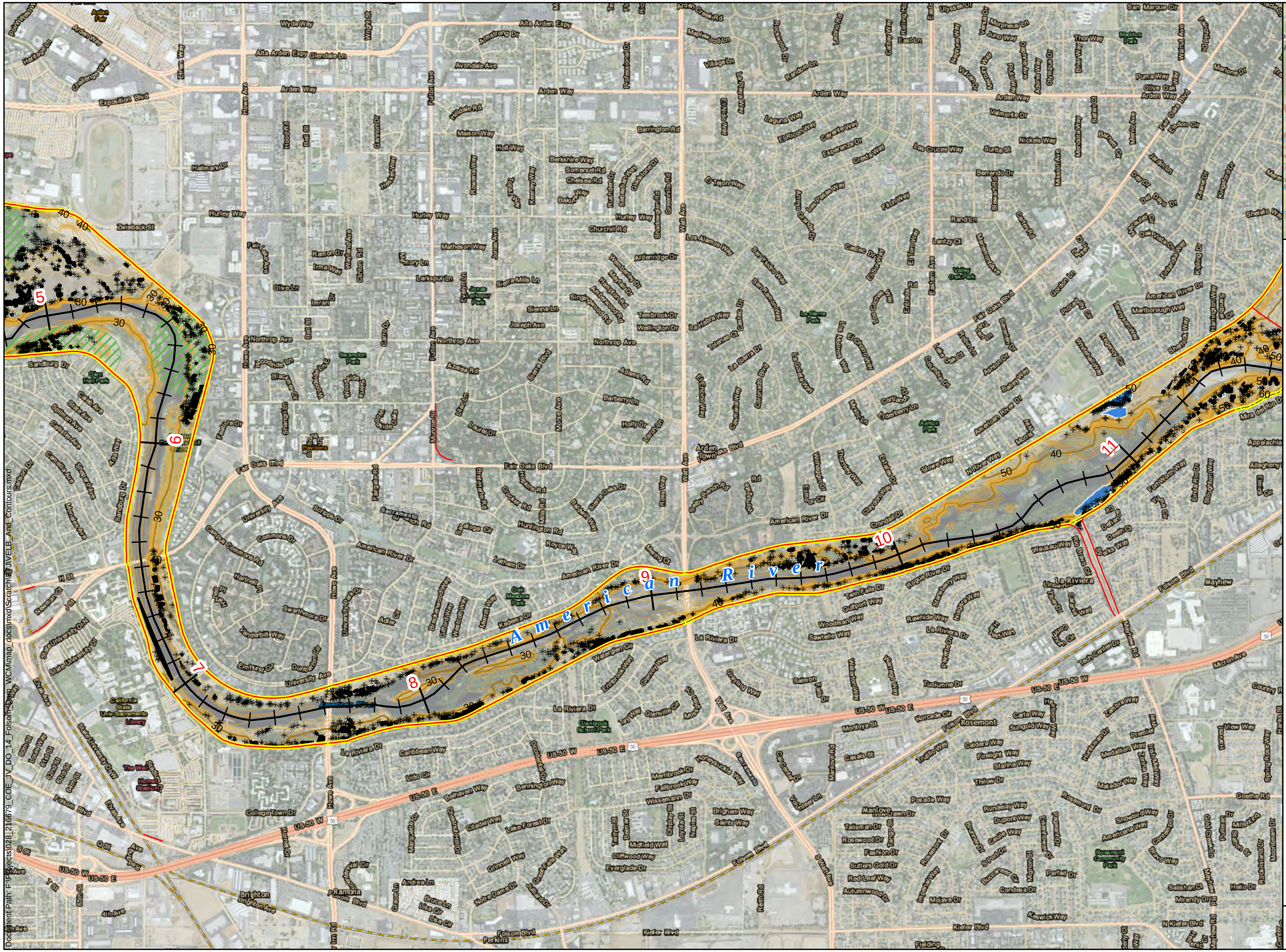
- River Mile
- CA Levee Database Levee Centerline
- Lower American River Study Area
- CNDDB VELB
- Sacramento County Mapped VELB
- Sacramento County Mapped VELB Clumbs
- Existing VELB Mitigation (2013)

Contours from USGS DEM (NGVD29)

- 1 Foot Contour
- 10 Foot Index Contour

Sources: Aerial Image -- Esri 2012; Levees -- DWR 2008; CNDDB -- CDFW March 2015



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1 inch = 2,000 feet

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1 ┼	River Mile
—	CA Levee Database Levee Centerline
▨	Lower American River Study Area
▨	CNDDB VELB
*	Sacramento County Mapped VELB
●	Sacramento County Mapped VELB Clumbs
●	Existing VELB Mitigation (2013)

Contours from USGS DEM (NGVD29)

—	1 Foot Contour
—	10 Foot Index Contour

Sources: Aerial Image -- Esri 2012; Levees -- DWR 2008; CNDDB -- CDFW March 2015

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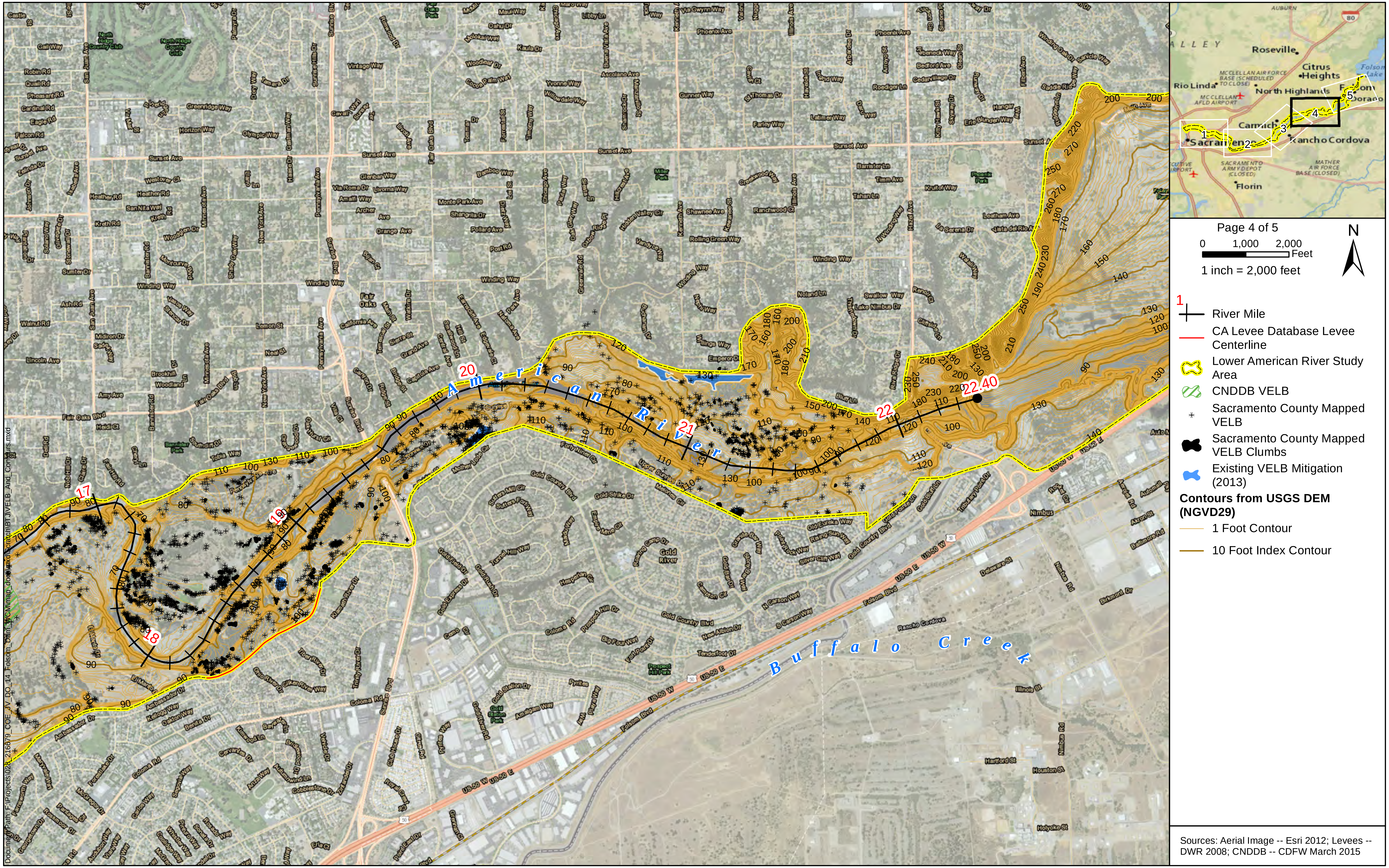

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1 inch = 2,000 feet

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- CA Levee Database Levee Centerline
- Lower American River Study Area
- CNDDB VELB
- * Sacramento County Mapped VELB
- Sacramento County Mapped VELB Clumbs
- Existing VELB Mitigation (2013)

Contours from USGS DEM (NGVD29)

- 1 Foot Contour
- 10 Foot Index Contour

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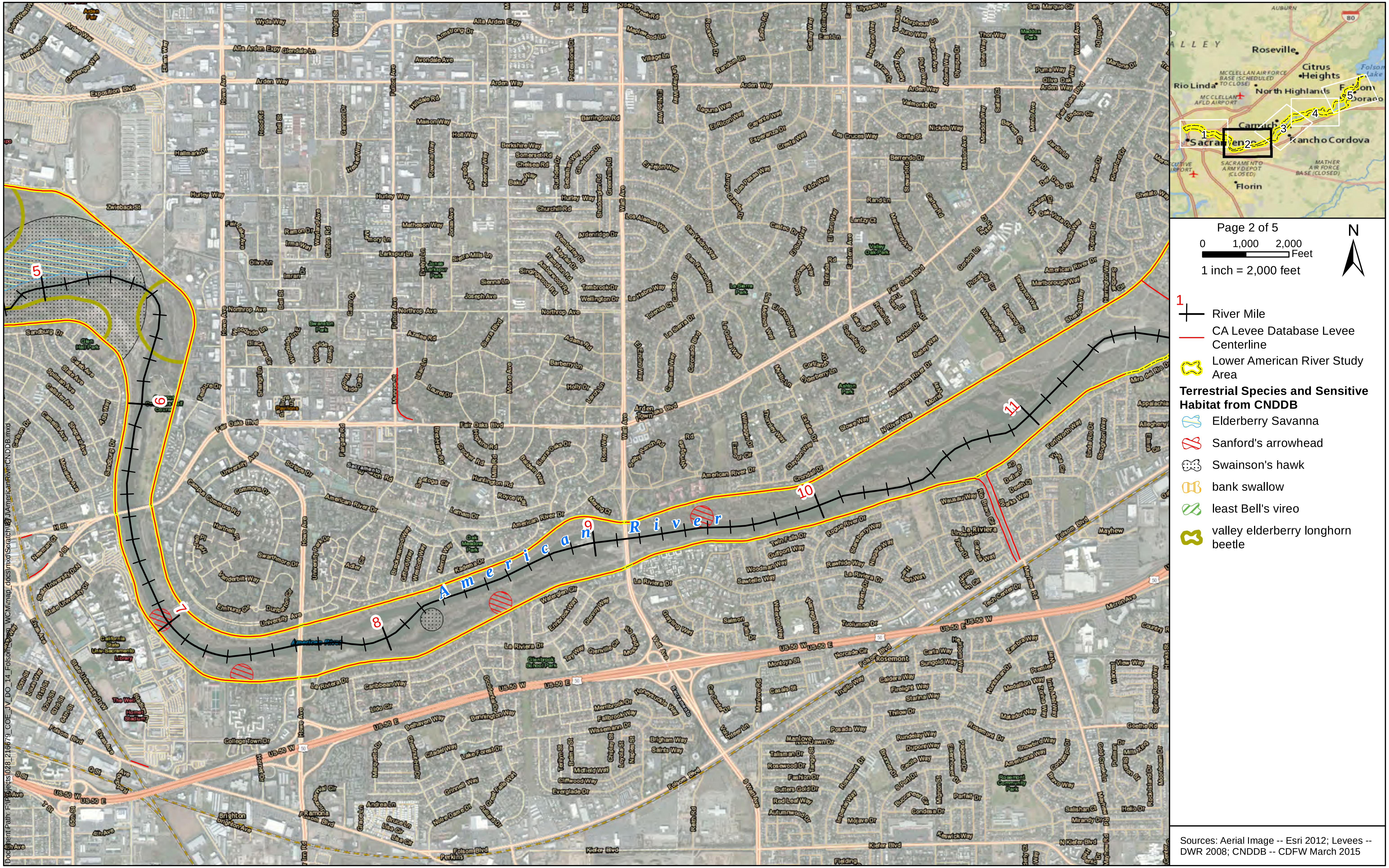

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1 inch = 2,000 feet

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- River Mile
- CA Levee Database Levee Centerline
- Lower American River Study Area

Terrestrial Species and Sensitive Habitat from CNDDB

- Elderberry Savanna
- Sanford's arrowhead
- Swainson's hawk
- bank swallow
- least Bell's vireo
- valley elderberry longhorn beetle

Sources: Aerial Image -- Esri 2012; Levees -- DWR 2008; CNDDB -- CDFW March 2015

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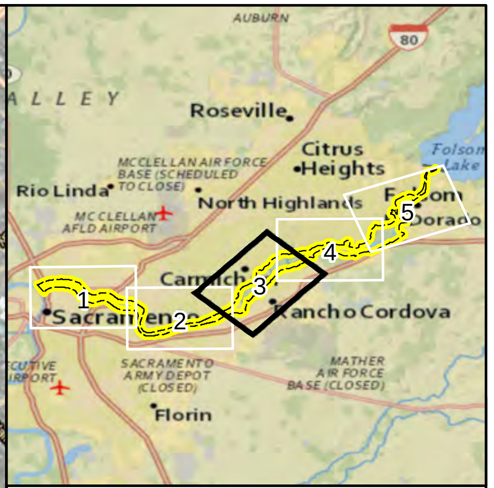

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1 inch = 2,000 feet

1 ┼ River Mile

— CA Levee Database Levee Centerline

Lower American River Study Area

Terrestrial Species and Sensitive Habitat from CNDDB

Elderberry Savanna

Sanford's arrowhead

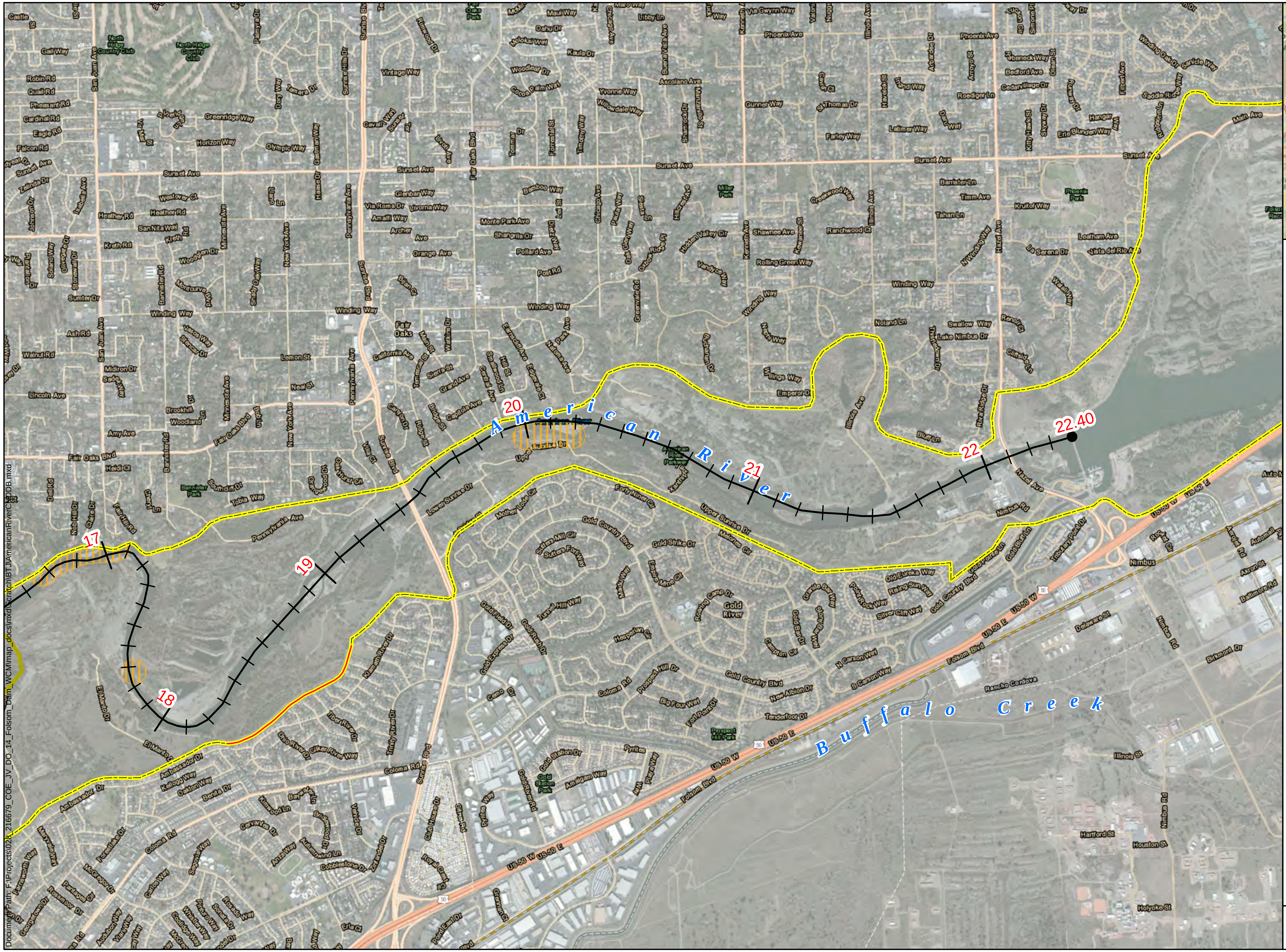
Swainson's hawk

bank swallow

least Bell's vireo

valley elderberry longhorn beetle

Sources: Aerial Image -- Esri 2012; Levees -- DWR 2008; CNDDB -- CDFW March 2015



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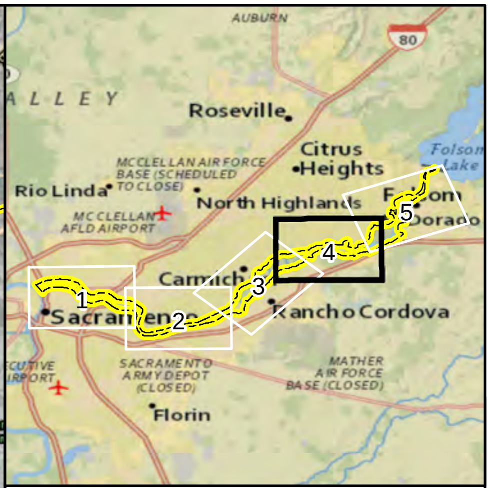

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1 inch = 2,000 feet

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1 ┼ River Mile

CA Levee Database Levee Centerline

Lower American River Study Area

Terrestrial Species and Sensitive Habitat from CNDDB

- Elderberry Savanna
- Sanford's arrowhead
- Swainson's hawk
- bank swallow
- least Bell's vireo
- valley elderberry longhorn beetle

Sources: Aerial Image -- Esri 2012; Levees -- DWR 2008; CNDDB -- CDFW March 2015

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1 inch = 2,000 feet

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1 River Mile

CA Levee Database Levee Centerline

Lower American River Study Area

Terrestrial Species and Sensitive Habitat from CNDDB

Elderberry Savanna

Sanford's arrowhead

Swainson's hawk

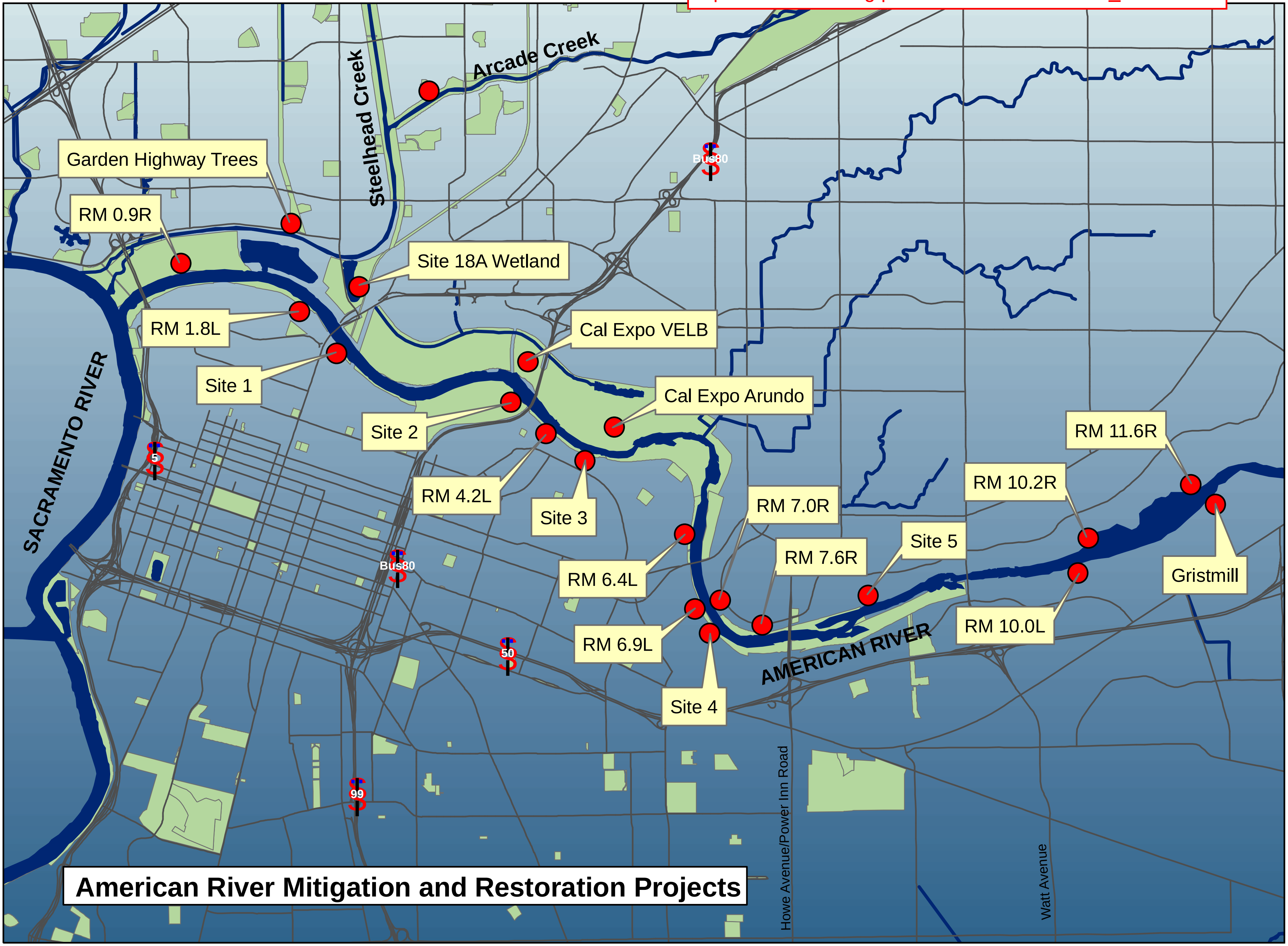
bank swallow

least Bell's vireo

valley elderberry longhorn beetle

Sources: Aerial Image -- Esri 2012; Levees -- DWR 2008; CNDDB -- CDFW March 2015

http://www.safca.org/protection/loweramerican_colab.html



American River Mitigation and Restoration Projects

Sources: Aerial Image -- Esri 2012; Habitat Data -- Sacramento County; Levees -- DWR 2008

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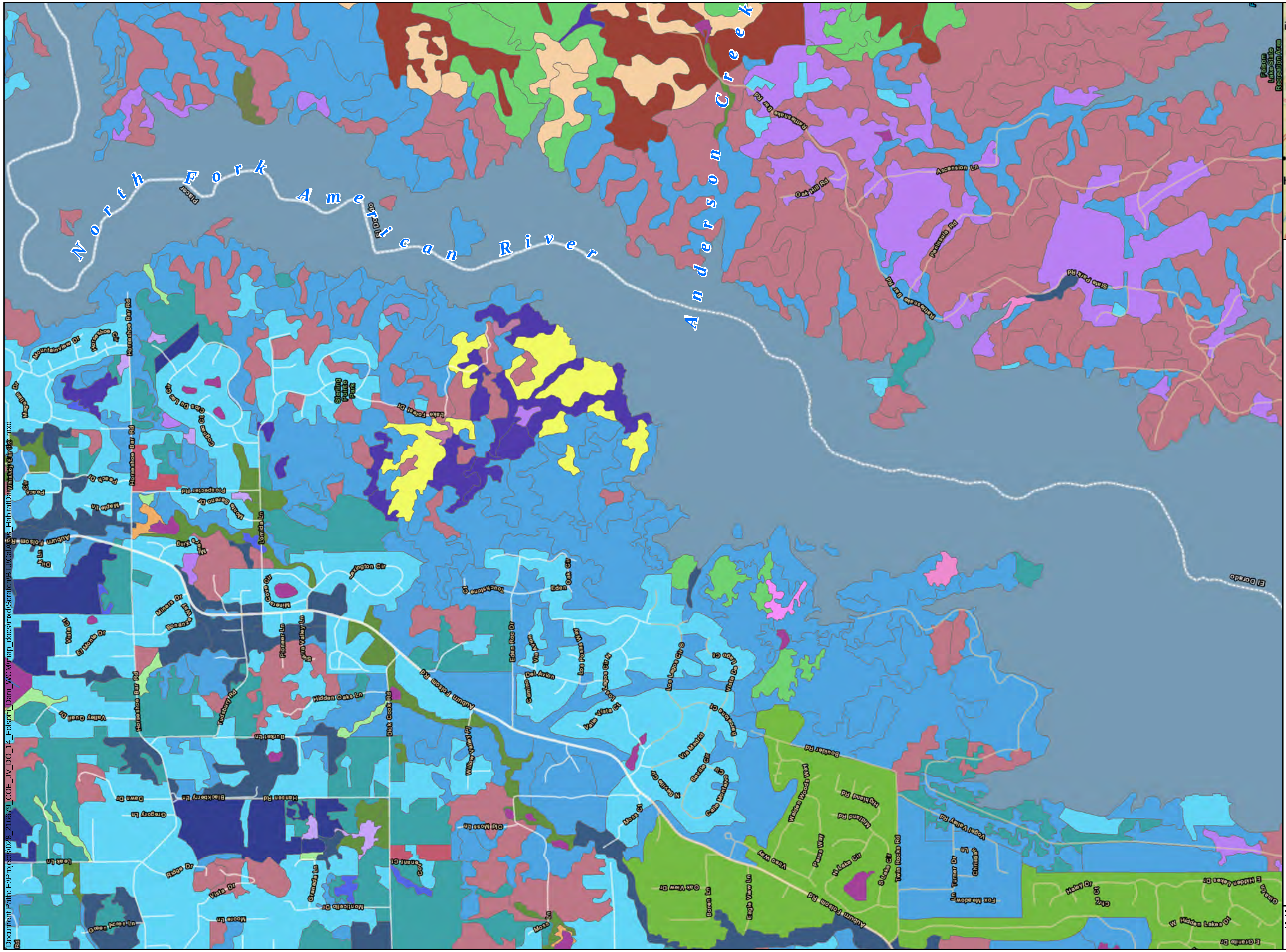

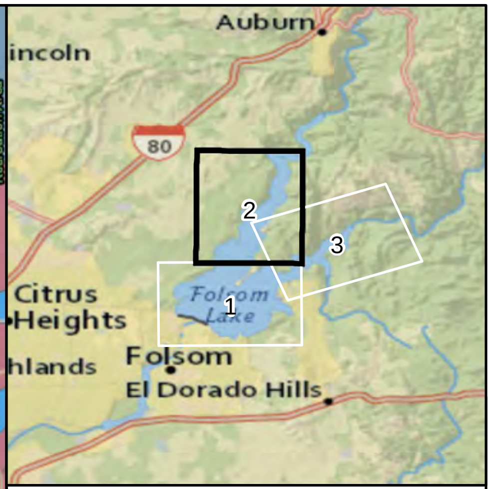

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1 inch = 2,000 feet

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Cal-Atlas Veg Mapping Foothills

- Adenostoma fasciculatum
- Aesculus californica
- Agriculture, excluding fallow and irrigated pasture
- Arctostaphylos viscida
- Arid West freshwater emergent marsh
- Built-up and Urban Disturbance
- California Annual and Perennial Grassland
- Californian Warm Temperate Marsh/Seep Group
- Ceanothus cuneatus
- Cliffs and Rock Outcroppings
- Heteromeles arbutifolia
- Irrigated Pasture Lands
- Mediterranean California naturalized annual and perennial grassland
- Pinus sabiniana
- Populus fremontii
- Quercus douglasii
- Quercus kelloggii
- Quercus lobata
- Quercus wislizeni
- Quercus wislizeni (shrub)
- Reservoirs
- Rubus armeniacus
- Salix exigua
- Salix laevigata
- Small Earthen Dam Ponds and Natural Lakes
- Toxicodendron diversilobum
- Urban Window

Sources: Aerial Image -- Esri 2012; Habitat Data -- Sacramento County; Levees -- DWR 2008

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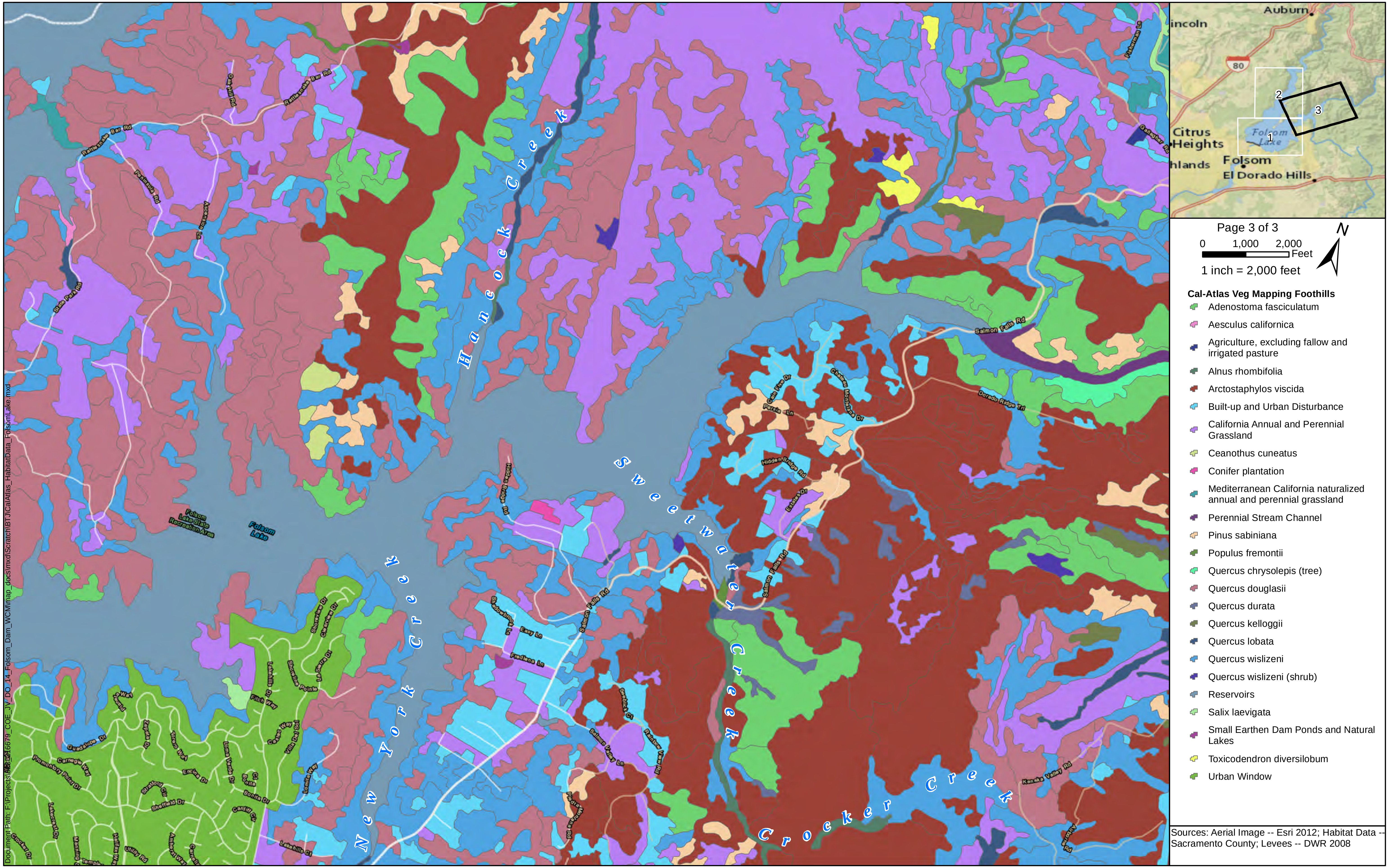

Sources: Aerial Image -- Esri 2012; Habitat Data -- Sacramento County; Levees -- DWR 2008

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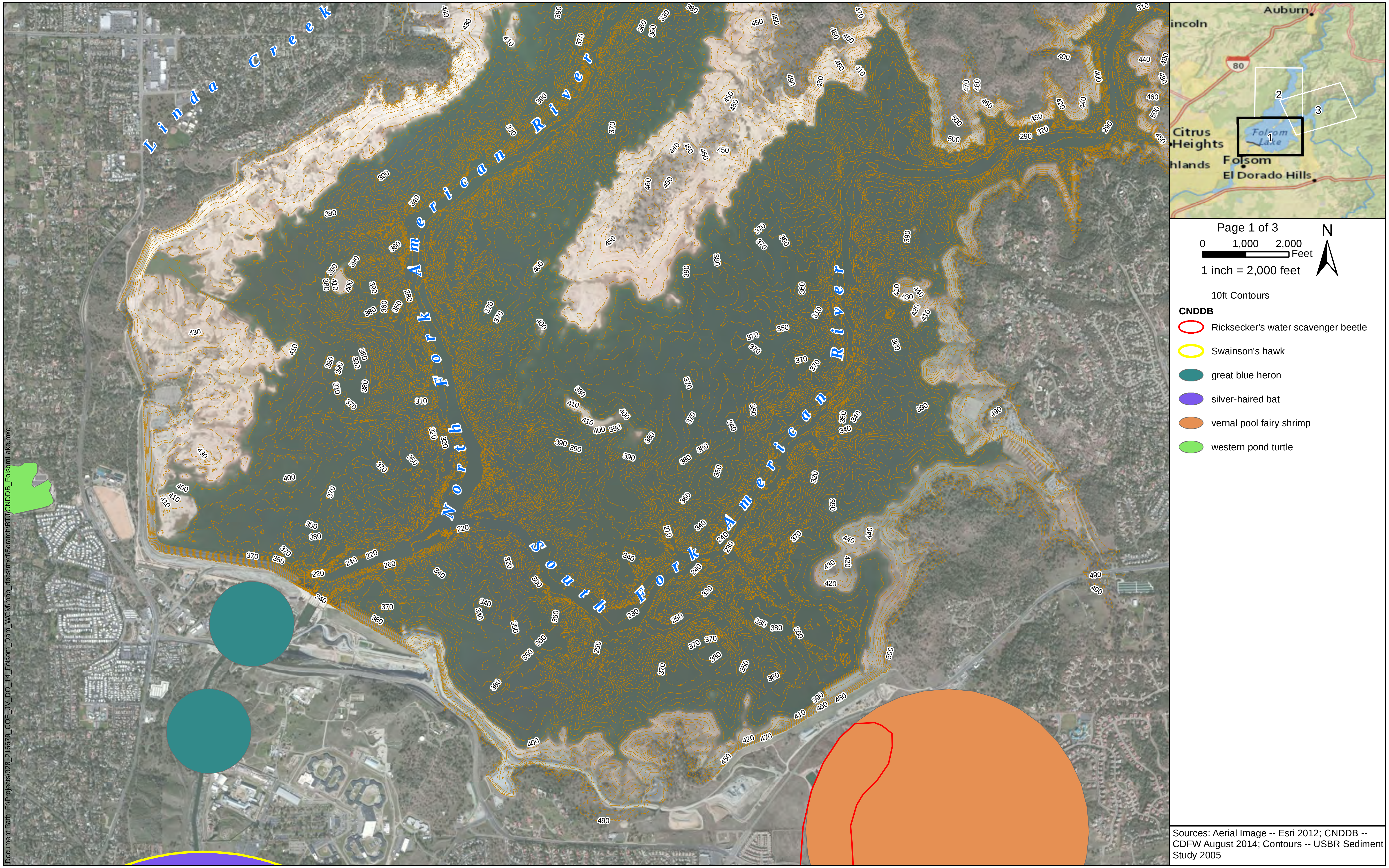
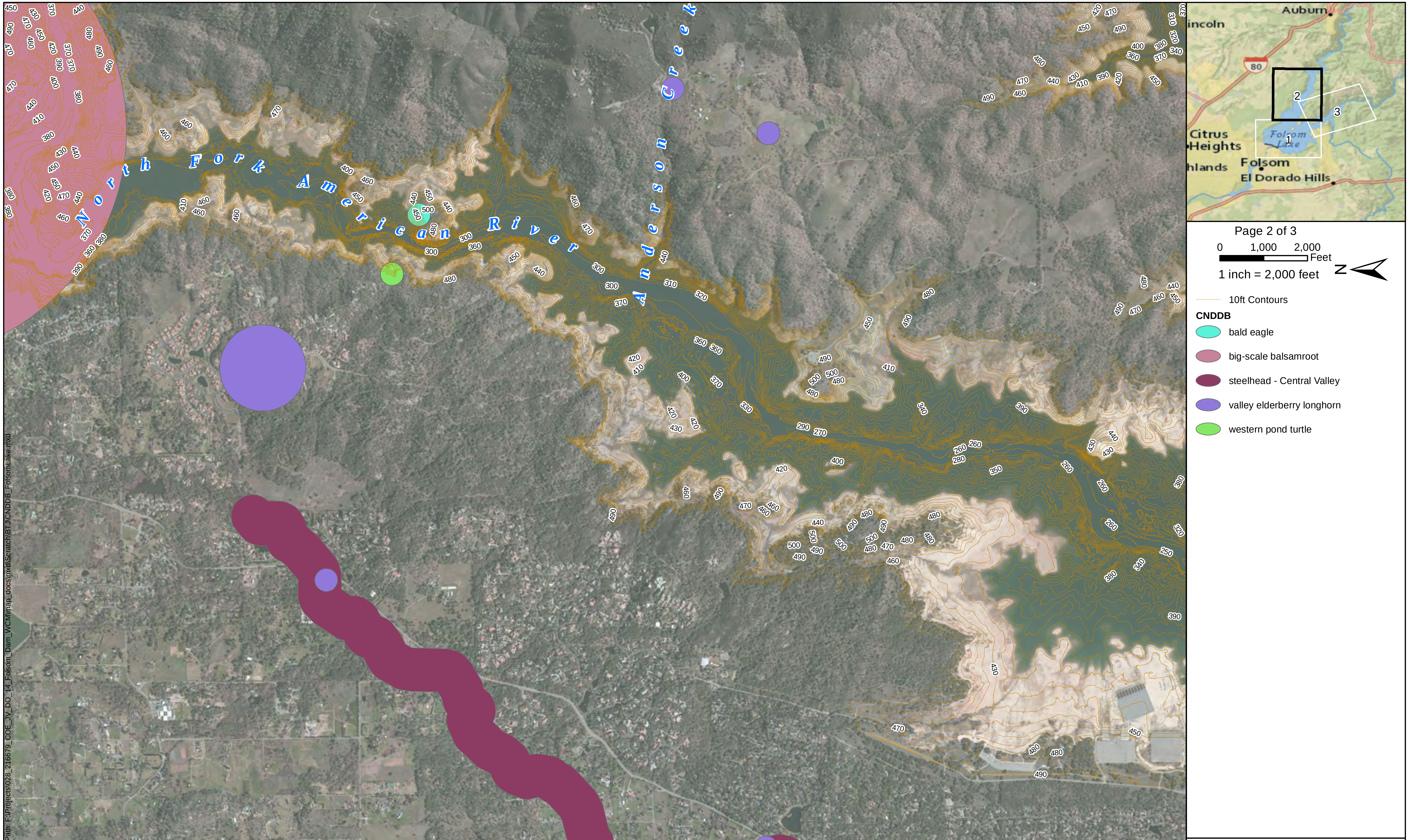


— 10ft Contours

CNDDB

- ○ Ricksecker's water scavenger beetle
- ○ Swainson's hawk
- ● great blue heron
- ● silver-haired bat
- ● vernal pool fairy shrimp
- ● western pond turtle

Sources: Aerial Image -- Esri 2012; CNDDB -- CDFW August 2014; Contours -- USBR Sediment Study 2005



Page 2 of 3

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1 inch = 2,000 feet

10ft Contours

CNDDB

- ● bald eagle
- ● big-scale balsamroot
- ● steelhead - Central Valley
- ● valley elderberry longhorn
- ● western pond turtle

Sources: Aerial Image -- Esri 2012; CNDDB -- CDFW August 2014; Contours -- USBR Sediment Study 2005

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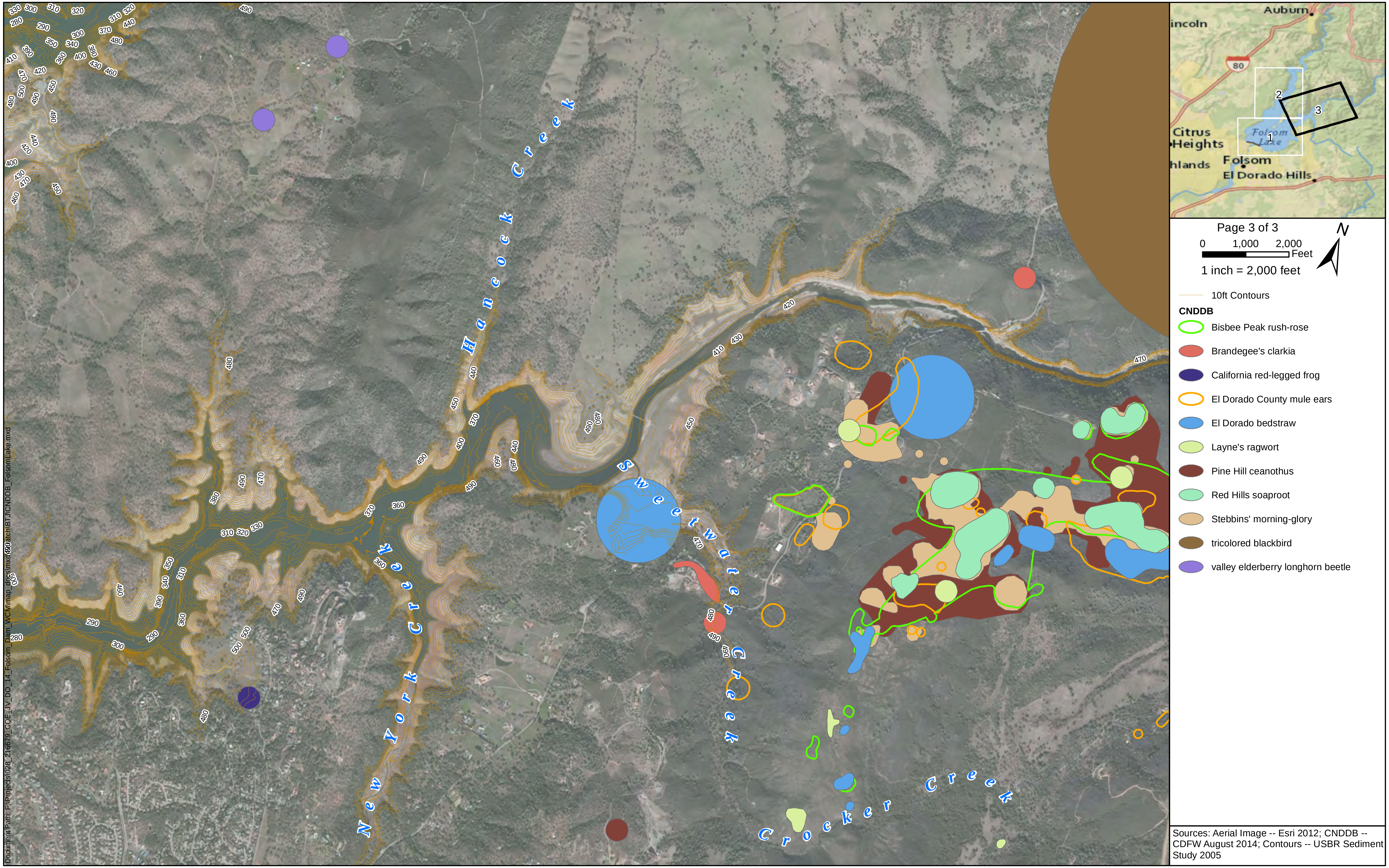

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Appendix D: Fisheries, Part 1

Note: References to Appendix 7A - 7G are included in Part 2 of this appendix

1. Fisheries

1.1 Introduction

Changes in Folsom Reservoir storage and Nimbus Dam flow release operations with the Folsom WCM alternatives could change the fisheries habitat conditions in the lower American River, relative to existing conditions and other baseline conditions. In addition, changes in Folsom Reservoir and Nimbus Dam release operations could alter the hydrologic and water temperature conditions in the Sacramento River below Keswick Dam and in the lower Feather River below the Fish Barrier Dam as a result of the coordinated State Water Project/Central Valley Project (SWP/CVP) operations between the Sacramento, Feather, and American Rivers. Further, changes in hydrologic conditions in the Sacramento River could alter the hydrologic and water quality conditions in the Sacramento–San Joaquin Delta and the Yolo Bypass.

The U.S. Army Corps of Engineers (USACE) evaluated the effects of the Folsom WCM alternatives on fish species and associated aquatic habitat by geographic region within the Project Area based on USACE's anticipated magnitude of changes in aquatic habitat conditions with the Folsom WCM alternatives and based on the types of modeling tools that were available for each geographic region. The geographic regions are the lower American River and the Far-Field study areas (Sacramento River, Feather River, Sacramento–San Joaquin Delta, and Yolo Bypass). Because the Folsom WCM alternatives are most likely to affect fisheries habitat conditions in the lower American River, USACE conducted more-detailed modeling and fisheries analyses for the lower American River than for other potentially affected areas within the Far-Field.

For each of the Folsom WCM study areas, USACE identified fish species of focused evaluation in potentially affected geographic regions in the study areas. Fish species of focused evaluation consist of special-status fish species (Federally and state listed threatened and endangered species, Federal candidate species and species of concern, and state species of special concern) as well as other recreationally important fish species.

Table 3-1 presents the special-status fish species that could occur in the Action Area and their Federal and state regulatory status, generally taken from CDFW (2014). Table 3-1 also presents non-special-status fish species of recreational or commercial importance. Table 3-2 indicates which species are evaluated in each waterbody in the Action Area.

Evaluating effects on fishery resources requires understanding fish species' life histories, spatial and temporal distributions, and lifestage-specific environmental requirements. Information regarding the legal status, life histories, spatial and temporal distributions, and habitat requirements of the fish species of focused evaluation is provided in the Fisheries Environmental Setting section (Appendix 7A).

Table 1-1. Special-status Fish Species and Species of Recreational or Commercial Importance in the Action Area.

Common Name	Status
• Sacramento River winter-run Chinook salmon evolutionarily significant unit (ESU)	Federally and state endangered
• Central Valley spring-run Chinook salmon ESU	Federally and state threatened
• Central Valley fall-/late fall-run Chinook salmon ESU	Federal species of concern State species of special concern
• Central Valley steelhead distinct population segment (DPS)	Federally threatened
• Southern DPS of North American green sturgeon	Federally threatened State species of special concern
• Delta smelt	Federally threatened State endangered
• Longfin smelt	Federal candidate[1] State threatened
• Hardhead	State species of special concern
• Pacific lamprey	Federal species of concern[2]
• River lamprey	State species of special concern
• Sacramento splittail	State species of special concern
• White sturgeon	Recreational and/or commercial importance
• American shad	Recreational and/or commercial importance
• Striped bass	Recreational and/or commercial importance

---

[1] Federal candidate status is for the San Francisco Bay-Delta DPS of longfin smelt.

[2] Although not referenced as a federal species of concern in CDFW (2014), the Oregon U.S. Fish and Wildlife Service (USFWS) office considers Pacific lamprey a species of concern. The Sacramento USFWS office does not maintain a species-of-concern list.

Table 1-2. Waterbodies and Fish Species of Focused Evaluation by Geographic Region.

	Lower American River	Sacramento River	Lower Feather River	Yolo Bypass	Delta
Sacramento River winter-run Chinook salmon ESU		✓		✓	✓
Central Valley spring-run Chinook salmon ESU	✓	✓	✓	✓	✓
Central Valley fall- and late fall-run Chinook salmon ESU	✓	✓	✓	✓	✓
Central Valley steelhead DPS	✓	✓	✓	✓	✓
North American green sturgeon (southern DPS)		✓	✓	✓	
Delta smelt*				✓	✓
Longfin smelt					✓
River lamprey	✓	✓	✓		
Pacific lamprey	✓	✓	✓		
Sacramento splittail				✓	
Hardhead	✓	✓	✓		
White sturgeon		✓	✓	✓	
American shad	✓	✓	✓		✓
Striped bass	✓	✓	✓		✓

1.2 Impact Assessment Methodology

This section summarizes the methodologies that USACE used to evaluate the effects of the Folsom WCM alternatives on fish species of focused evaluation and their habitats based on simulated changes in hydrology, water temperature, and fisheries habitat parameters relative to the California Environmental Quality Act (CEQA) Existing Condition and the National Environmental Protection Act (NEPA) No Action Alternative scenarios for regulatory compliance purposes.

The Fisheries Impact Assessment Methodology appendix (Appendix 7B) provides a detailed discussion of the fisheries impact assessment methodology, impact indicators, and significance criteria used to evaluate the effects of the Folsom WCM alternatives on fisheries resources, relative to basis of comparison.

1.2.1 Analytical Tools

The fisheries and aquatic habitat impact assessment relies on hydrologic modeling to provide a quantitative basis from which to assess the effects of the Folsom WCM alternatives on fish species of focused evaluation and aquatic habitats in the SWP/CVP system, relative to the basis of comparison. Specifically, hydrologic simulation results from CalSim II of mean monthly river flows provide a quantitative basis to assess the effects of operations on fish species for the Far-Field study area, while daily hydrologic output is used to assess effects of operations on fish species in the lower American River.

USACE used these simulated results as inputs to the U.S. Bureau of Reclamation's (Reclamation) Water Temperature Models (Reclamation 1997) for the Sacramento and Feather Rivers, which simulate mean monthly water temperature of the main river systems for the same simulation period. USACE used hydrologic simulation results for the lower American River as inputs to daily models to produce daily water temperature outputs.

USACE used simulated daily water temperatures for the lower American River as inputs to Reclamation's Mortality Model, as modified and updated by the Water Forum and USACE (2015), herein referred to as the LAR Mortality Model, to estimate annual mortality rates for the early lifestages (in-vivo eggs, incubating eggs, and pre-emergent fry) of fall-run Chinook salmon (*Oncorhynchus tshawytscha*) in the lower American River. USACE also used simulated flows as inputs to other analytical tools to calculate salmonid spawning habitat (weighted usable area, or WUA) for the upper Sacramento, lower Feather and lower American rivers, and salmonid redd dewatering for the lower American River, to quantify specific effects on specific lifestages.

Detailed information about specific modeling tools and the modeling assumptions used to characterize Project operations is presented in Appendix A.

1.2.2 Model Uncertainty

The physical habitat models used in the analyses, although mathematically precise, should be viewed as having inherent uncertainty because of limitations in the theoretical basis of the model and the scope of the formulation and function for which each model is designed. Nonetheless, physical habitat models developed for planning and impact-assessment purposes represent the best available information with which to conduct evaluations of proposed changes in SWP and CVP operations. Therefore, USACE used physical habitat models as analytical tools to identify changes in aquatic habitat variables (e.g., flows and water temperatures) as well as inputs to species specific analytical tools (e.g., LAR Mortality Model).

1.2.3 Application of Model Output

USACE used computer simulation models and post-processing tools to assess changes in hydrology and water quality, and associated changes in species-specific habitat conditions, that could occur under the Folsom WCM alternatives, relative to the basis of comparison. USACE used model assumptions and results for comparative purposes, rather than for absolute predictions, and the focus of the analysis is on differences in the results among comparative scenarios. All of the assumptions are the same for both the with-project and without-project model runs, with the exception of assumptions associated with the action itself, and the focus of the analysis is the differences in the results.

1.2.4 General Analytical Approach

USACE assessed effects on fish species of focused evaluation 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 7B for detailed descriptions of the types of model output and their application to the fisheries impact assessment.

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

Post-processing tools use monthly output (Far-Field) and daily output (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. USACE used monthly average simulated flows by water year type to compare differences between the basis of comparison and the alternatives. 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 that USACE expects to occur with the Folsom WCM alternatives, relative to the basis of comparison.

1.2.4.2 Flow Exceedance Distributions

USACE developed monthly flow exceedance distributions (or curves) from monthly (Far-Field) and daily (lower American River) output for the entire simulation periods. These distributions illustrate the distribution of simulated flows with the Folsom WCM alternatives 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.

1.2.4.3 Flow-Dependent Habitat Availability

1.2.4.3.1 Spawning WUA

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 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).

USACE applied spawning WUA-discharge relationships to simulated mean monthly flows (Far-Field) and to simulated mean daily flows (lower American River) for anadromous salmonids. Although USACE does not expect substantial flow changes in the Far-Field, because the relationships between flow and flow-dependent spawning habitat is not linear, USACE applied spawning WUA-discharge relationships to anadromous salmonids in the lower Feather River and the upper Sacramento River.

USACE used the resulting species-specific annual spawning WUA output 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 the Folsom WCM alternatives, relative to the basis of comparison.

Appendix 7D 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. Appendix 7E provides 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.

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.

1.2.4.4 Water Temperature Exceedance Distributions

USACE developed monthly water temperature exceedance distributions (or curves) from Reclamation's monthly water temperature model output (Far-Field) and from the daily water temperature modeling (lower American River) for the entire simulation periods. These distributions illustrate the distribution of simulated water temperatures with the Folsom WCM alternatives 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 are applied to species and lifestage-specific water temperature index (WTI) values with the Folsom WCM alternatives 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. USACE used species and lifestage-specific WTI values developed by Bratovich et al. (2012) as a means to assess the effects of the Folsom WCM alternatives, 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 describe development of the upper optimum (UO) WTI values and upper tolerable (UT) WTI values used for this assessment (Table 7-3).

- **Upper Optimum Temperature (UO).** 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.
- **Upper Tolerable Temperature (UT).** 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.

Table 1-3. 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

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 7C 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 the Folsom WCM alternatives, relative to the basis of comparison.

1.2.4.5 Chinook Salmon Early Lifestage Mortality

USACE also used the water temperature results for the lower American River as inputs to the updated 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:

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

Appendix 7G provides a detailed description of the updates and modifications made to the original mortality model.

USACE generated simulated annual total early lifestage mortality of fall-run Chinook salmon in the lower American River for the entire simulation period for the Folsom WCM alternatives 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.

1.2.5 Overview of Evaluation Criteria

Evaluation criteria for evaluating impact indicators are described in detail in Appendix 7B. USACE’s evaluation of impact indicators on fisheries resources included evaluating the net difference in habitat variables in relation to specific criteria for individual species and lifestages for each of the Folsom WCM alternatives, relative to a baseline condition. Depending on the lifestage and habitat variable (e.g., flow or water temperature), variables were evaluated over the entire modeled period of record (e.g., 82 years), by water year type (e.g., wet, above-normal, below-normal, dry and critical years), and/or during the driest 40 percent of years as defined by the exceedance probability distributions.

For the Far-Field, USACE's evaluations focused on comparisons of mean monthly flow and water temperature model output. The primarily purpose of the Far-Field fisheries evaluations was to determine whether additional, more-detailed modeling and/or analyses would be required to elucidate effects on fish species of focused evaluation. USACE's decision to conduct more-detailed impact evaluations was based on considering all flow and water temperature impact indicators for all lifestages for a particular species. Detailed evaluations were conducted for any given Folsom WCM alternative if the initial evaluation indicated that that alternative could adversely affect an individual species or run for its defined geographic area (e.g., upper Sacramento River, lower Feather River, etc.), in consideration of all evaluated impact indicators for all lifestages.

In general, USACE evaluated modeled flows and water temperatures at representative nodes for species of focused evaluation (i.e., net changes in mean monthly flow of 10 percent or more, and changes in the probability of exceeding lifestage-specific WTI values). Additional evaluation criteria were applied to habitat variables, as described in Appendix 7B.

In order to summarize and display comparative model results for flows and water temperatures in relation to evaluation criteria for key impact indicators with the Folsom WCM alternatives relative to the basis of comparison, USACE developed fisheries "summary tables" by species and waterbody. For flow, water temperature, and Delta parameters, the net change in the probability of exceedance under an alternative, relative to a baseline condition, was evaluated. The net change in the probability of exceedance was calculated by compiling the ranked and sorted model output data under a baseline condition and subtracting it from the analogous alternative data. This calculation represents the difference in the percentage of time that a specified value is exceeded under an alternative scenario, relative to a baseline scenario. In other words, the net change in the probability of exceedance represents the percentage of time that a criterion is exceeded more often or less often under an alternative scenario compared to a baseline scenario.

In the fisheries summary tables, shading helps elucidate more-suitable or less-suitable conditions. Specifically, blue shading indicates the potential for more-suitable habitat conditions under the alternative scenario, relative to the baseline scenario. Red shading indicates the potential for less-suitable habitat conditions. Net changes in exceedance are shaded in blue when the resulting difference values for the following parameters are positive and are shaded in red when they are negative: (1) riverine flow parameters; (2) Delta outflow; (3) water temperature ranges (i.e., frequency of occurring within the range); and (4) frequency of X2 occurring within a range or less than a specific criterion. Net changes in exceedance are shaded in red when the resulting difference values for the following parameters are positive and are shaded in blue when they are negative: (1) WTI values (i.e., exceedance of a specific WTI value); (2) general changes in X2; and (3) frequency of Old and Middle River (OMR) flows being more negative than a specified criterion.

These summary tables generally indicate simple absolute changes in the frequency of exceeding or being less than a specific value or occurring within a range of values; i.e., the difference in frequency of: (1) a WTI value or flow value being exceeded; (2) flow, water temperature, or X2 occurring within a specified range; (3) X2 or OMR flows less than a specific criterion; and (4) specified changes in X2. By contrast, based on the flow evaluation criteria applied in this analysis (see Appendix 7B), the resulting difference values displayed for riverine flow and Delta outflow actually show the "net change in 10 percent exceedance" under an alternative scenario, relative to a baseline scenario for that month.

The net change in 10 percent exceedance represents the percentage of time that flow is greater under the alternative scenario than the baseline scenario by 10 percent or more, minus the percentage of time that flow is greater under the baseline scenario than the alternative scenario by 10 percent or more. For example, a negative value for a given month indicates the net increase in the percentage of time that flows are reduced by 10 percent or more under an alternative scenario, relative to a baseline scenario, and would be shaded red. Likewise, a positive value indicates the net increase in the percentage of time that flows are increased by 10 percent or more under an alternative scenario, relative to a baseline scenario, and would be shaded blue.

Due to the complexity in interpreting fisheries habitat variables, including salmonid spawning WUA for the Far-Field and the lower American River and fall-run Chinook salmon early lifestage mortality in the lower American River, these parameters are not summarized in the fisheries summary tables. Results for these parameters are provided in separate appendices.

It should be emphasized that the fisheries summary tables are intended only to provide a comparative summary of some of the key flow and water temperature impact indicators under an alternative scenario relative to a baseline scenario, whereas conclusions drawn regarding overall changes in habitat suitability for each species are based on results shown in the fisheries summary tables, in addition to the suite of model output available, such as monthly probability of exceedance distributions and specific habitat variables, including spawning WUA and early lifestage mortality.

USACE relied on the following model output data for the fisheries impact assessment:

- Simulated riverine flows (GATAER Volume II Appendices)
- Simulated Delta hydrology and X2 location (GATAER Volume II Appendices)
- Simulated riverine water temperatures (GATAER Volume I Appendices)
- Summarized simulated hydrology and water temperature data (i.e., Fisheries Summary Tables – Appendix 7H through 7J)
- Simulated spawning WUA in the Sacramento River and Feather River (Appendix 7H)
- Simulated spawning WUA in the lower American River (Appendix 7I)
- Simulated fall-run Chinook salmon early lifestage mortality in the lower American River (Appendix 7J)

1.2.6 Impact Evaluation Synthesis

USACE determined expected changes in lifestage-specific and overall species suitabilities for each fish species of focused evaluation in each geographic region evaluated, under each alternative, relative to a baseline scenario.

USACE determined overall changes in lifestage-specific suitabilities for each fish species of focused evaluation for each geographic region evaluated (i.e., Sacramento River, Feather River, American River, and Delta) based on the flow, water temperature, and Delta-specific metrics presented in the fisheries summary tables, in addition to the suite of model output available, including monthly flow, water temperature, and Delta-specific output over the entire simulation period; spawning WUA for anadromous salmonids; and early lifestage mortality (for fall-run Chinook salmon in the lower American River).

USACE evaluated the aforementioned habitat variables and associated metrics in consideration of the specified spatial and temporal distributions for each lifestage as well as uncertainties associated with biological populations and modeling. When changes in physical habitat variables indicated different directional changes in suitability during different months of a particular lifestage period, reported peak lifestage timings based on fisheries surveys, and existing key stressors that affect a lifestage during particular months, were considered when determining the overall change in suitability for a lifestage.

Specifically, peak lifestage timings were used to emphasize changes in habitat variables during the peak months over other months in the lifestage period, and changes in habitat variables during months when a key stressor influences a lifestage (e.g., elevated water temperatures during the summer months of the steelhead juvenile rearing lifestage) were emphasized relative to other months of the lifestage period, to the extent that supporting information was available.

Peak timings for applicable lifestages, such as adult immigration, spawning, and juvenile outmigration for anadromous salmonids, are summarized in Appendix 7B to the extent that they were available. Fisheries surveys that have been conducted in the Project Area focus primarily on anadromous salmonids. Therefore, more-detailed life history information, such as peak lifestage timings, is available for anadromous salmonid species than for other fish species of focused evaluation. There is also more information related to key stressors and limiting population factors for anadromous salmonids in the Project Area because of the availability of focused studies, regulatory compliance documents that focus on Endangered Species Act–listed fish species, and recovery planning documents for anadromous salmonids prepared by Federal and state agencies.

Therefore, consideration of key stressors and limiting factors is generally applicable only to anadromous salmonids. In addition, key stressors and limiting factors are considered for anadromous salmonids only in the lower American River, because of the increased potential for changes in habitat conditions in the lower American River relative to the Far-Field study areas. If a more detailed evaluation is necessary in a Far-Field study area, consideration of key stressors and limiting factors would be incorporated into the more-detailed evaluation.

USACE determined the change in suitability for each species for each geographic region based on the lifestage-specific suitability conclusions for each species, as well as known key stressors and limiting factors, to the extent supporting information is readily available. Expected changes in suitability identified for each species in each geographic region were then used to identify the expected change in suitability for each species for the entire Project Area.

1.2.7 References

Fisheries

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2. J602F3 ELD Relative to E504 ELD

2.1 Far-Field Fisheries

As described in detail in Appendix 7B, Fisheries Impact Assessment Methodology, the species and lifestage-specific interpretive comparisons below are based on numerous output provided in the appendices, 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.

2.1.1 Sacramento River

For salmonid species, the U.S. Army Corps of Engineers (USACE) examined flow and water temperature model results for the Sacramento River 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, USACE examined model results for spawning habitat availability (weighted usable area, or WUA) for salmonid species. Modeling results for other fish species are described separately.

2.1.1.1 Winter-run Chinook Salmon

USACE examined flow model results for the Sacramento River below Keswick Dam, at Bend Bridge, at Red Bluff, at Verona, and at Freeport and examined water temperature model results for the Sacramento River below Keswick Dam, at Ball's Ferry, at Jelly's Ferry, at Bend Bridge, below the Feather River confluence, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration (November through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam, at Bend Bridge and at Verona, when flows are somewhat lower over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency at Verona (6.1 percent); and (4) generally equivalent monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

- Similar adult holding (November through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.5 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam and at Bend Bridge when flows are somewhat lower over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent at both locations; and (4) generally equivalent monthly probabilities of exceeding both UT and UO WTI values at both locations evaluated.

- Similar spawning (April through August) and embryo incubation (April through September) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.2 percent) and decreases (up to 1.5 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July, when flows are somewhat lower over about the lowest 10 percent of the distributions; (3) equivalent or similar net changes in flow of 10 percent or more during all months at both locations evaluated; (4) generally equivalent or similar long-term average spawning WUA and similar spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over most of the distribution, with slightly more spawning WUA over about 20 percent of the middle portion of the distribution and generally similar over the remainder of the distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, with slightly reduced exceedance probabilities at Jelly's Ferry during August, slightly increased exceedance probabilities at Bend Bridge during May and July, and slightly reduced exceedance probabilities at Bend Bridge during August and September.

- Similar juvenile rearing and downstream (July through March) movement conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam, at Bend Bridge and at Verona, when flows are somewhat lower over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 6.1 percent at Verona; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations.

In consideration of the general similarity of impact indicators to all life stages of winter-run Chinook salmon in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.2 Spring-run Chinook Salmon

USACE examined flow model results for the Sacramento River below Keswick Dam, at Bend Bridge, at Red Bluff, at Verona, and at Freeport and examined water temperature model results for the Sacramento River below Keswick Dam, at Ball's Ferry, at Jelly's Ferry, at Bend Bridge, at Red Bluff, below the Feather River confluence, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam, at Bend Bridge and at Verona, when flows are somewhat lower over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (6.1 percent) at Verona; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

- Similar adult holding (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.5 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam and at Bend Bridge, when flows are somewhat lower over about the lowest 10 percent of the distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent at both locations; and (4) generally equivalent or similar monthly probabilities of exceeding both UT and UO WTI values at both locations evaluated.

- Similar spawning (September and October) and embryo incubation (September through January) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.2 percent) and decreases (up to 1.7 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions during the evaluation period; (3) equivalent net changes in flow of 10 percent or more during both months at both locations; and (4) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, but with slightly increased exceedance probabilities at Jelly's Ferry and Bend Bridge during October with respect to the UT WTI values.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.7 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July, when flows are somewhat lower over about the lowest 10 percent of the distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 10 percent or more with somewhat higher frequency (6.1 percent) at Verona; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations during all months of the evaluation period.

- Generally equivalent smolt emigration (October through May) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions during the evaluation period; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values at all locations evaluated during all months of the evaluation period.

In consideration of the general similarity of impact indicators to all life stages of spring-run Chinook salmon in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.3 Fall-run Chinook Salmon

USACE examined flow model results for the Sacramento River below Keswick Dam, at Bend Bridge, at Red Bluff, at Verona, and at Freeport and examined water temperature model results for the Sacramento River below Keswick Dam, at Ball's Ferry, at Jelly's Ferry, at Bend Bridge, at Red Bluff, below the Feather River confluence, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration and staging (July through December) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.7 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July, when flows are somewhat lower over about the lowest 5–10 percent of the distributions below Keswick Dam, at Red Bluff, and at Verona; (3) during low-flow conditions, generally equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 6.1 percent) at Verona; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated, except for a slightly increased probability of exceedance during July at Red Bluff.

- Similar spawning (October through December) and embryo incubation (October through March) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.7 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during all months at both locations; (4) generally equivalent or similar long-term average spawning WUA and similar spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations.

- Similar juvenile rearing and downstream movement (December through July) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July, when flows are somewhat lower at Bend Bridge and Verona over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 10 percent or more with somewhat higher frequency (6.1 percent) at Verona; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations, but with slightly decreased UO WTI value exceedance probabilities at Freeport in April.

In consideration of the general similarity of impact indicators to all life stages of fall-run Chinook salmon in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.4 Late Fall-run Chinook Salmon

USACE examined flow model results for the Sacramento River below Keswick Dam, at Bend Bridge, at Red Bluff, at Verona, and at Freeport and examined water temperature model results for the Sacramento River below Keswick Dam, at Ball’s Ferry, at Jelly’s Ferry, at Bend Bridge, at Red Bluff, below the Feather River confluence, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration and staging (October through April) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

- Similar spawning (January through April) and embryo incubation (January through June) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.7 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during all months at both locations; (4) generally equivalent long-term average spawning WUA and equivalent or similar spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, except for a slightly increased probability of exceedance during May at Bend Bridge.

- Similar juvenile rearing and downstream movement (April through December) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.9 percent) and decreases (up to 1.7 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam and at Verona, when flows are somewhat lower over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 6.1 percent) at Verona; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations, except for a slightly reduced probability of exceedance at Freeport during April.

In consideration of the general similarity of impact indicators to all life stages of late fall-run Chinook salmon in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.5 Steelhead

USACE examined flow model results for the Sacramento River below Keswick Dam, at Bend Bridge, at Red Bluff, at Verona, and at Freeport and examined water temperature model results for the Sacramento River below Keswick Dam, at Ball’s Ferry, at Jelly’s Ferry, at Bend Bridge, at Red Bluff, below the Feather River confluence, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

- Similar adult holding (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent or similar net changes in flow of 10 percent or more during all months at both locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

- Similar spawning (December through April) and embryo incubation (December through May) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 2.1 percent) and decreases (2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during both months at both locations; (4) generally equivalent long-term average spawning WUA and spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, except for a slightly reduced probability of exceedance at Bend Bridge during May.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July, when flows are somewhat lower over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 6.1 percent) at Verona; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations.

- Similar smolt emigration (January through June) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values at all locations evaluated during all months of the evaluation period, except for a slightly decreased probability of exceedance during March at Freeport.

In consideration of the general similarity of impact indicators to all life stages of steelhead in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.6 Green Sturgeon

USACE examined flow model results for the Sacramento River below Keswick Dam, at Red Bluff, at Wilkins Slough, and at Freeport and examined water temperature model results for the Sacramento River below Keswick Dam, at Red Bluff, at Wilkins Slough, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration and holding (February through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough, slightly increased average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam and at Red Bluff, when flows are somewhat lower over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated, except for a slightly decreased probability of exceedance at Freeport during April.

- Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.9 percent) and decreases (up to 5.3 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July, when flows are somewhat lower over about the lowest 10–15 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 3 percent) at Freeport during July; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

- Similar adult post-spawning holding and emigration (July through November) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 1.7 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam and at Red Bluff, when flows are somewhat lower over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough, slightly increased monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July at Red Bluff and Wilkins Slough, when flows are somewhat lower over about the lowest 10–15 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 3 percent) at Wilkins Slough; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

In consideration of the general similarity of impact indicators to all life stages of green sturgeon in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.7 White Sturgeon

USACE examined flow model results for the Sacramento River at Red Bluff, at Wilkins Slough, at Verona and at Freeport and examined water temperature model results for the Sacramento River at Red Bluff, at Wilkins Slough, below the Feather River confluence, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration and holding (November through May) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated except for slightly reduced average monthly flow during July at Wilkins Slough, slightly increased average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (2.1 percent) and decreases (2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

- Similar spawning and embryo incubation (February through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated except for increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough, slightly increased average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July at Wilkins Slough and Verona, when flows are somewhat lower over about the lowest 5–15 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency at Wilkins Slough (3.0 percent) and at Verona (6.1 percent); and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

In consideration of the general similarity of impact indicators to all life stages of white sturgeon in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.8 River Lamprey

USACE examined flow model results for the Sacramento River below Keswick Dam, at Red Bluff, at Wilkins Slough, and at Freeport and examined water temperature model results for the Sacramento River below Keswick Dam, at Red Bluff, at Wilkins Slough, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration (September through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated except for slightly reduced average monthly flow during July at Wilkins Slough, slightly increased average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, except for a slight increase in the probability of occurring within the specified range at Wilkins Slough in October and at Freeport during October and April.

- Similar spawning and embryo incubation (February through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.2 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July, when flows are somewhat lower over about the lowest 10–15 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July at Wilkins Slough when flows are lower by 10 percent or more with somewhat higher frequency (about 3 percent); and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified ranges at all locations evaluated, except for a slightly higher probability of occurring within the specified range during March below Keswick Dam, and a slightly lower probability of occurring within the specified range during July at Red Bluff.

- Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated except for slightly reduced average monthly flow during July at Wilkins Slough, slightly increased average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam and at Wilkins Slough, when flows are somewhat lower over about the lowest 10–15 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 3 percent) at Wilkins Slough; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

In consideration of the general similarity of impact indicators to all life stages of river lamprey in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.9 Pacific Lamprey

USACE examined flow model results for the Sacramento River below Keswick Dam, at Red Bluff, at Wilkins Slough, and at Freeport and examined water temperature model results for the Sacramento River below Keswick Dam, at Red Bluff, at Wilkins Slough, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration (January through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough, slightly increased average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range at all locations evaluated except for a slight increase in the probability of occurring within the range at Freeport in April.

- Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.8 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July, when flows are somewhat lower over about the lowest 5–15 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 3 percent) at Wilkins Slough; and (4) generally equivalent or similar monthly probabilities water temperatures occurring within the specified range at all locations evaluated, except for a slightly higher probability of occurring within the specified range during March below Keswick Dam, and a slightly lower probability of occurring within the specified range during July at Red Bluff.

- Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough, slightly increased average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam and at Wilkins Slough, when flows are somewhat lower over about the lowest 10–15 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 3 percent) at Wilkins Slough; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

In consideration of the general similarity of impact indicators to all life stages Pacific lamprey in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.10 Hardhead

USACE examined flow model results for the Sacramento River below Keswick Dam, at Wilkins Slough, at Verona and at Freeport and examined water temperature model results for the Sacramento River below Keswick Dam, at Wilkins Slough, below the Feather River confluence, and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult and other lifestage (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July below Keswick Dam and at Verona, when flows are somewhat lower over about the lowest 5–10 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 6.1 percent) at Verona; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, except during April at Freeport when water temperatures occur within the specified range slightly less often.

- Similar spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough, slightly increased average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at all locations evaluated.

In consideration of the general similarity of impact indicators to all life stages of hardhead in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.11 American Shad

USACE examined flow model results for the Sacramento River at Red Bluff, at Wilkins Slough, at Verona and at Freeport and examined water temperature model results for the Sacramento River at Red Bluff, at Wilkins Slough, below the Feather River confluence and at Freeport.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration and spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly increased average monthly flow during April at Freeport and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, except during April when water temperatures occur within the specified range slightly more often at Freeport.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly lower average monthly flow during July at Wilkins Slough, higher average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 2.0 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July at Wilkins Slough and Verona, when flows are somewhat lower over about the lowest 5–15 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows decrease by 10 percent or more with somewhat higher frequency (about 3–6.1 percent) at Wilkins Slough and Verona; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, except for a slightly higher probability of occurring within the specified range during September at Wilkins Slough.

In consideration of the general similarity of impact indicators to all life stages of American shad in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.1.12 Striped Bass

USACE examined flow model results for the Sacramento River at Wilkins Slough and Verona and examined water temperature model results for the Sacramento River at Wilkins Slough and below the Feather River confluence.

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration and spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at both locations evaluated, except for slightly reduced average monthly flow during July at Wilkins Slough and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.8 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at both locations evaluated; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range at both locations evaluated.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at both locations evaluated, except for slightly lower average monthly flow during July at Wilkins Slough, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.8 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions, except during July at Wilkins Slough and Verona, when flows are somewhat lower over about the lowest 5–15 percent of the distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at both locations evaluated, except during July when flows decrease by 10 percent or more with somewhat higher frequency (about 3–6.1 percent) at both locations; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at both locations evaluated, but with slightly decreased exceedance probabilities at Verona during June (1.3 percent).

In consideration of the general similarity of impact indicators to all life stages of striped bass in the Sacramento River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2 Feather River

USACE examined flow and water temperature model results for the Feather River below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River. In addition to flow and water temperature modeling, USACE examined model results for spawning habitat availability (WUA) for salmonid species.

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 the appendices to this section, 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 Existing Condition and No Action scenarios. Although these results are not repeated for the discussions below, USACE considered the model results for the Low Flow Channel below the Fish Barrier Dam along with the information presented below and incorporated them into the impact determinations for spring-run Chinook salmon, fall-run Chinook salmon, steelhead, river lamprey, Pacific lamprey, and hardhead.

2.1.2.1 Spring-run Chinook Salmon

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Generally similar adult immigration (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, and generally equivalent or similar average monthly flows by water year type most of the time during all water year types, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with somewhat higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet and June at the mouth and with higher flows by 10 percent or more with slightly higher frequency during August (3 percent) at the mouth and higher frequency (3 percent) during June and August below the Thermalito Afterbay Outlet; and (4) generally equivalent monthly probabilities of exceeding both UO and UT WTI values, except for a slightly increased probability of exceedance of UO WTI values below the Thermalito Afterbay Outlet during September.

- Similar adult holding (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, and generally equivalent or similar average monthly flows by water year type most of the time during all water year types, but with some increases (up to 16.3 percent) and decreases (up to 2.8 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with somewhat higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet, and with higher flows by 10 percent or more with slightly higher frequency during June and August below the Thermalito Afterbay Outlet; and (4) generally equivalent monthly probabilities of exceeding both UO and UT WTI values, except for a slightly increased probability of exceedance of UO WTI values below the Thermalito Afterbay Outlet during September.
- Similar spawning (September through October) and embryo incubation (September through February) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period, and generally equivalent or similar average monthly flows during all water year types, but with some increases (up to 1.5 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) generally equivalent net changes in flow of 10 percent or more at both locations; (4) generally equivalent long-term average spawning WUA, and equivalent or similar average spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally similar spawning WUA over the entire distribution, with spawning WUA always above 80 percent of maximum under both E504 ELD and J602F3 ELD; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values.
- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with slightly higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet and June at the mouth and with higher flows by 10 percent or more with slightly higher frequency during August (3 percent) at the mouth and with higher frequency (about 3 percent) during June and August below the Thermalito Afterbay Outlet; and (4) generally equivalent monthly probabilities of exceeding both UO and UT WTI values, except for a slightly increased probability of exceedance of UO WTI values below the Thermalito Afterbay Outlet during September.

- Similar smolt emigration (October through June) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with somewhat higher frequency (about 3 percent) during June at the mouth, and higher flows during June below the Thermalito Afterbay Outlet by 10 percent or more with higher frequency (3 percent); and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months of the evaluation period.

In consideration of the general similarity of impact indicators to all life stages of spring-run Chinook salmon in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2.2 Fall-run Chinook Salmon

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Generally similar adult immigration and staging (July through December) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 1.5 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with higher flows by 10 percent or more with higher frequency (3.0 percent) during August at both locations and slightly lower frequency (3.0 percent) below the Thermalito Afterbay Outlet during July; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values, except for a slightly higher probability (2.4 percent) of exceedance of UO WTI values in September.
- Similar spawning (October through December) and embryo incubation (October through March) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and equivalent or similar average monthly flows during all water year types, but with some decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with slightly lower frequency (3.0 percent) below the Thermalito Afterbay Outlet during November; (4) generally equivalent long-term average spawning WUA and average spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over the entire distribution, with spawning WUA always above 80 percent of maximum under both E504 ELD and J602F3 ELD; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values.
- Similar juvenile rearing and downstream movement (November through June) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally

equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time but with lower flows by 10 percent or more with somewhat higher frequency (3 percent) during June at the mouth and higher flows by 10 percent or more with higher frequency (3 percent) during June below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values.

In consideration of the general similarity of impact indicators to all life stages of fall-run Chinook salmon in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2.3 Steelhead

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Generally similar adult immigration (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 2.6 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with higher flows by 10 percent or more with higher frequency (3.0 percent) during August at both locations; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values, except for a slight increase in exceedance (2.4 percent) below the Thermalito Afterbay Outlet in September.

- Similar adult holding (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 2.6 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with higher flows by 10 percent or more with higher frequency (3.0 percent) during August at both locations; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values, except for a slight increase in exceedance (1.3 percent) below the Thermalito Afterbay Outlet in September.

- Similar spawning (January through April) and embryo incubation (January through May) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more; (4) generally equivalent long-term average spawning WUA and equivalent or similar average spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar amounts of spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time but with lower flows by 10 percent or more with higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet, and with higher flows by 10 percent or more with higher frequency (3 percent) during June and August below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values, except for slightly reduced probabilities (1.3 percent) of exceedance during September below the Thermalito Afterbay Outlet.

- Similar smolt emigration (October through April) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values.

In consideration of the general similarity of impact indicators to all life stages steelhead in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2.4 Green Sturgeon

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration and holding (February through November) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with somewhat higher frequency (about 3 percent) at the mouth during June and below the Thermalito Afterbay Outlet during July, and higher flows of 10 percent or more with higher frequency (3.0 percent) at both locations during August and below the Thermalito Afterbay Outlet during June; and (4) generally equivalent or similar monthly probabilities of exceeding both the specified WTI value.

- Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with an increase of 16.3 percent in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 3 percent) and flows are higher by 10 percent or more with higher frequency (3 percent) below the Thermalito Afterbay Outlet during

June and August; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time but with lower flows by 10 percent or more with higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet and during June at the mouth, and with higher flows by 10 percent or more with higher frequency (3 percent) during June and August below the Thermalito Afterbay Outlet and during August at the mouth; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value.

In consideration of the general similarity of impact indicators to all life stages green sturgeon in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2.5 White Sturgeon

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration and holding (November through May) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 16.3 percent) and decreases (up to 2 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at both locations evaluated; and (4) generally equivalent monthly probabilities of exceeding the specified WTI value at both locations evaluated.
- Similar spawning and embryo incubation (February through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with an increase of 16.3 percent in average monthly flow during May of below-normal water years; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months evaluated, except during June when flows are higher by 10 percent or more with higher frequency (3 percent); and (4) generally equivalent monthly probabilities of exceeding the specified WTI value.
- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more

most of the time but with lower flows by 10 percent or more with higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet and during June at the mouth, and with higher flows by 10 percent or more with higher frequency (3 percent) during June and August below the Thermalito Afterbay Outlet and during August at the mouth; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value.

In consideration of the general similarity of impact indicators to all life stages of white sturgeon in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2.6 River Lamprey

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration (September through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some increases (up to 16.3 percent) and some decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with somewhat higher frequency (3 percent) at the mouth during June, and higher flows of 10 percent or more with higher frequency (3.0 percent) below the Thermalito Afterbay Outlet during June; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range, except for a slight increase in the probability of occurring within the specified range below the Thermalito Afterbay Outlet in May.
- Similar spawning and embryo incubation (February through July) conditions due to: (1) generally equivalent long-term average monthly flows and generally equivalent or similar average monthly flows most of the time during all water year types, but with increases of 16.3 percent in average monthly flow during May in below-normal water years; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below the Thermalito Afterbay Outlet and during June when flows are higher by 10 percent or more with higher frequency (3 percent) below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.
- Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time but with lower flows by 10 percent or more with slightly higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet and

during June at the mouth, and with higher flows by 10 percent or more with higher frequency (3 percent) during June and August below the Thermalito Afterbay Outlet and during August at the mouth; and (4) generally equivalent monthly probabilities of exceeding the specified WTI value at both locations evaluated, except for a slight increase (1.3 percent) in the probability of exceedance during August at the mouth.

In consideration of the general similarity of impact indicators to all life stages of river lamprey in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2.7 Pacific Lamprey

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration (January through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with an increase of 16.3 percent and some decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with somewhat higher frequency (3 percent) at the mouth during June and higher flows of 10 percent or more with higher frequency (3 percent) below the Thermalito Afterbay Outlet during June; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.
- Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows and generally equivalent or similar average monthly flows most of the time during all water year types, but with a slight increase of 16.3 percent in average monthly flow during below-normal water year types; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below the Thermalito Afterbay Outlet and during June and August when flows are higher by 10 percent or more with higher frequency (3 percent) below the Thermalito Afterbay Outlet; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range.
- Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet and during June at the mouth, and with higher flows by 10 percent or more with higher frequency (3 percent) during June and August below the Thermalito Afterbay Outlet and during August at the mouth;

and (4) generally equivalent monthly probabilities of exceeding the specified WTI value at both locations evaluated, except a slight increase (1.3 percent) in the probability of exceedance in August at the mouth.

In consideration of the general similarity of impact indicators to all life stages of Pacific lamprey in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2.8 Hardhead

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult and other lifestage (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time but with lower flows by 10 percent or more with higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet and during June at the mouth, and with higher flows by 10 percent or more with higher frequency (3 percent) during June and August below the Thermalito Afterbay Outlet and during August at the mouth; and (4) generally equivalent monthly probabilities of exceeding the specified WTI value at both locations evaluated.
- Similar spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at both locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with an increase of 16.3 percent in average monthly during below-normal water year types; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, except for an increase in flow by 10 percent or more with higher frequency (3 percent) during June below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.

In consideration of the general similarity of impact indicators to all life stages of hardhead in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2.9 American Shad

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult immigration and spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at both locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with an increase of 16.3 percent in average monthly flow during below-normal water year types; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, except for a reduction in flow by 10 percent or more with somewhat higher frequency (3 percent) during June at the mouth and an increase in flow by 10 percent or more with higher frequency (3 percent) during June below the Thermalito Afterbay Outlet; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time but with lower flows by 10 percent or more with higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet and during June at the mouth, and with higher flows by 10 percent or more with higher frequency (3 percent) during June and August below the Thermalito Afterbay Outlet and during August at the mouth; and (4) generally equivalent monthly probabilities of exceeding the specified WTI value at both locations evaluated.

In consideration of the general similarity of impact indicators to all life stages of American shad in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.2.10 Striped Bass

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Generally similar adult immigration and spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at both locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with an increase of 16.3 percent in average monthly flow during below-normal water year types; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, except for a reduction in flow by 10 percent or more with slightly higher frequency (3 percent) during June at the mouth and an increase in flow by 10 percent or more with higher frequency (3 percent) during June below the Thermalito Afterbay Outlet; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range.
- Generally similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 16.3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time but with lower flows by 10 percent or more with higher frequency (about 3 percent) during July below the Thermalito Afterbay Outlet and during June at the mouth, and with higher flows by 10 percent or more with higher frequency (3 percent) during September and June and August below the Thermalito Afterbay Outlet and during August

at the mouth; and (4) generally equivalent monthly probabilities of exceeding the specified WTI value at both locations evaluated, except a slight decrease (1.3 percent) in the probability of exceedance in May below the Thermalito Afterbay Outlet.

In consideration of the general similarity of impact indicators to all life stages of striped bass in the Feather River under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3 Sacramento–San Joaquin Delta and Yolo Bypass

USACE examined model results for Old and Middle River (OMR) flows and X2 location for delta smelt and longfin smelt. USACE also examined Delta outflow and water temperatures in the Sacramento River at Freeport for delta smelt.

USACE examined model results for Sacramento River flows at Rio Vista, Yolo Bypass outflow, Delta outflow, and OMR flows for all runs of Central Valley Chinook salmon and Central Valley steelhead. USACE also examined OMR flows for adult San Joaquin River fall- and late fall-run Chinook salmon.

In addition, USACE examined Yolo Bypass outflow for delta smelt, splittail, green sturgeon, and white sturgeon and examined X2 location for American shad and striped bass.

USACE examined model results for exports at the State Water Project (SWP) and Central Valley Project (CVP) export facilities year-round. 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.

2.1.3.1 Delta Smelt in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult conditions due to: (1) equivalent or similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range (December through May); (2) similar or reduced probabilities of X2 occurring between 74 and 81 RKm during wet and above-normal water years (September through November); and (3) generally equivalent monthly probabilities of OMR flows being more negative than –5,000 cfs (December through February).
- Similar adult spawning conditions in the Yolo Bypass (December through May) due to: (1) generally equivalent net changes in Yolo Bypass outflow of 10 percent or more during the evaluation period, with the exception of January when flows are reduced by 10 percent or more with a higher (8.5 percent) frequency. However, all of the 10 percent or greater reductions in flow over the exceedance distribution occur when Yolo Bypass outflow is less than 40 cfs, therefore, these reductions are not expected to affect inundation extent or frequency in the Yolo Bypass.

- Similar egg and embryo conditions (February through May) due to: (1) equivalent or similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range.
- Similar larvae conditions (March through June) due to: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; (2) during March through June of dry and critical water years, generally equivalent probabilities of mean monthly OMR flows being more negative than –1,500 cfs except for a slight decrease in probability of 3.3 percent during June; and (3) and generally equivalent net changes of 10 percent or more in mean monthly Delta outflow.
- Similar juvenile conditions (May through July) due to: (1) generally equivalent monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; and (2) between RKm 65 and 80, X2 location moves upstream by 0.5RKm or more with generally similar or lower frequency (up to 8.5 percent more often).

In consideration of the general similarity of impact indicators to all life stages of delta smelt in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.2 Longfin Smelt in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult conditions (December through March) due to: (1) generally equivalent monthly probabilities of OMR flows being more negative than –5,000 cfs.
- Generally similar larvae and juvenile conditions due to: (1) during April and May of dry and critical water years, the probabilities of mean monthly OMR flows being more negative than –1,500 cfs are generally equivalent, and the probabilities of mean monthly OMR flows being less than 0 are generally equivalent; (2) for all water years during January through June, mean monthly X2 location occurs downstream of 75 RKm with generally similar frequency during all months evaluated; and (3) for dry and critical water years only during January through June, mean monthly X2 location occurs downstream of 75 RKm with generally equivalent frequencies during all months evaluated.

In consideration of the general similarity of impact indicators to all life stages of longfin smelt in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.3 Winter-run Chinook Salmon in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar juvenile and emigration conditions (November through May) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more; (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during January and November when flows are lower by 10 percent or more with higher frequency (see previous discussion for delta smelt); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more; and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

In consideration of the general similarity of impact indicators to all life stages of winter-run Chinook salmon in the Delta under the J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.4 Spring-run Chinook Salmon in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar juvenile and emigration conditions (November through June) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more; (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during January when flows are lower by 10 percent or more with higher frequency (see previous discussion for delta smelt); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more; and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

In consideration of the general similarity of impact indicators to all life stages of spring-run Chinook salmon in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.5 Fall-run and Late Fall-run Chinook Salmon in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar juvenile and emigration conditions (November through June) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more; (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during January and November when flows are lower by 10 percent or more with higher frequency (8.5 percent; see previous discussion for delta smelt); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more; and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.
- Generally similar San Joaquin River adult fall-run Chinook salmon conditions (December through February) due to generally similar probabilities of OMR flows being more negative than –5000 cfs.

In consideration of the general similarity of impact indicators to all life stages of fall-run and late fall-run Chinook salmon in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.6 Steelhead in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar juvenile and emigration conditions (October through July) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more; (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during January and November when flows are lower by 10 percent or more with higher frequency (8.5 percent; see previous discussion for delta smelt); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more; and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

In consideration of the general similarity of impact indicators to all life stages of steelhead in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.7 Green Sturgeon in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Generally similar juvenile rearing and emigration conditions (year-round) due to generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during January and November when flows are lower by 10 percent or more with higher frequency (8.5 percent; see previous discussion for delta smelt) and during September when flows are higher by 10 percent or more with a slightly higher frequency (3.7 percent).

In consideration of the general similarity of impact indicators to all life stages of green sturgeon in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.8 White Sturgeon in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Generally similar juvenile rearing and emigration conditions (April through June) due to generally equivalent net changes in mean monthly Yolo Bypass outflow of 10 percent or more.

In consideration of the general similarity of impact indicators to all life stages of white sturgeon in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.9 Splittail in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Similar adult spawning and embryo incubation conditions (February through May) due to generally equivalent net changes in mean monthly Yolo Bypass outflow of 10 percent or more.
- Similar juvenile rearing and emigration conditions (April through July) due to generally equivalent net changes in mean monthly Yolo Bypass outflow of 10 percent or more.

In consideration of the general similarity of impact indicators to all life stages of splittail in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.10 American Shad in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Generally similar egg and larval conditions (April through June) due to generally equivalent or similar net changes, except during June with a lower frequency (3.7 percent) of 1RKm or more in X2 location.

In consideration of the general similarity of impact indicators to all life stages of American shad in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

2.1.3.11 Striped Bass in the Delta Region

Relative to E504 ELD, USACE expects J602F3 ELD to provide:

- Generally similar egg and larval conditions (April through June) due to generally equivalent or similar net changes, except during June with a lower frequency (3.7 percent) of 1RKm or more in X2 location.

In consideration of the general similarity of impact indicators to all life stages of striped bass in the Delta under J602F3 ELD relative to E504 ELD, no further evaluations are necessary.

3 J602F3 ELD Relative to E504 ELD

3.1 Lower American River

For salmonid and other fish species, daily flow and water temperature model results on a monthly basis 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.

A discussion of general changes in simulated water temperatures in the lower American River under J602F3 ELD relative to E504 is provided in the Water Temperature section (Chapter 4), and is summarized below. 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), are slightly lower over portions of the monthly distributions during May, June, August, September, and October, and are slightly lower and higher with similar frequencies during July.

A summary of general changes in flows in the lower American River below Nimbus Dam under J602F3 ELD relative to E504 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, lower more often during through January, February, July, and August, and higher and lower with similar frequency during 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 J602F3 ELD relative to E504 are generally slightly lower during November through February and August, and slightly higher during March through June, September, and October (Table 3.1-1). 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 (see Appendix 7A).

Table 3.1-1. Average Monthly Flows below Nimbus Dam under J602F3 ELD and E504

Long-term and Water Year Type Average Lower American River Flow below Nimbus Dam Under E504 ELD and J602F3 ELD Conditions

Analysis Period	Flow (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
					Long-term							
Full Simulation Period[2]												
E504 ELD	2,119	3,162	3,597	4,867	5,394	3,963	3,273	3,609	3,555	3,451	2,462	2,552
J602F3 ELD	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[1]							
Wet												
E504 ELD	2,299	4,008	6,097	9,088	9,212	6,264	5,114	6,134	6,048	3,558	3,439	3,815
J602F3 ELD	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												
E504 ELD	2,085	3,885	3,561	6,254	7,224	5,457	3,280	3,368	2,728	4,169	2,252	3,728
J602F3 ELD	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												
E504 ELD	2,013	2,588	2,402	2,376	4,315	2,753	3,105	3,079	2,641	4,352	1,978	1,776
J602F3 ELD	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												
E504 ELD	2,174	2,584	1,956	1,774	1,860	2,299	1,867	1,690	2,124	3,161	2,088	1,511
J602F3 ELD	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												
E504 ELD	1,751	2,066	1,557	1,251	1,257	1,106	1,130	1,270	1,546	1,826	1,438	1,014
J602F3 ELD	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

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

2 Based on the entire simulation period

3 Relative difference of the monthly average

Monthly flow exceedance distributions for J602F3 ELD and E504 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 J602F3 ELD (Figure 7.1-1 through Figure 7.1-12). 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.

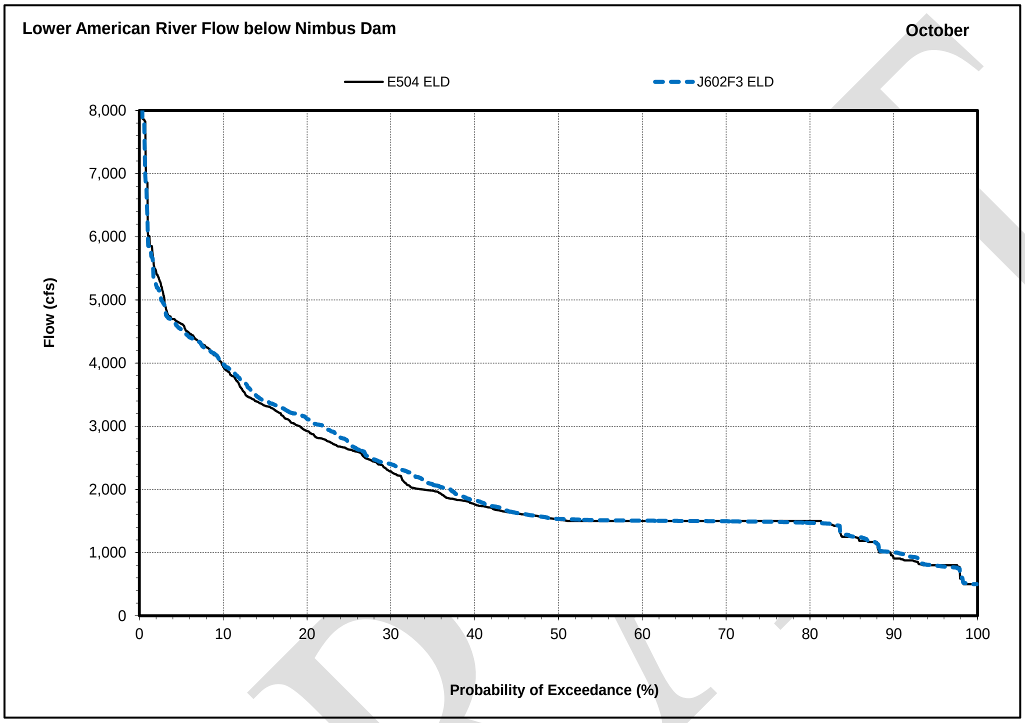

Figure 7.1-1. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for October under J602F3 ELD and E504 ELD

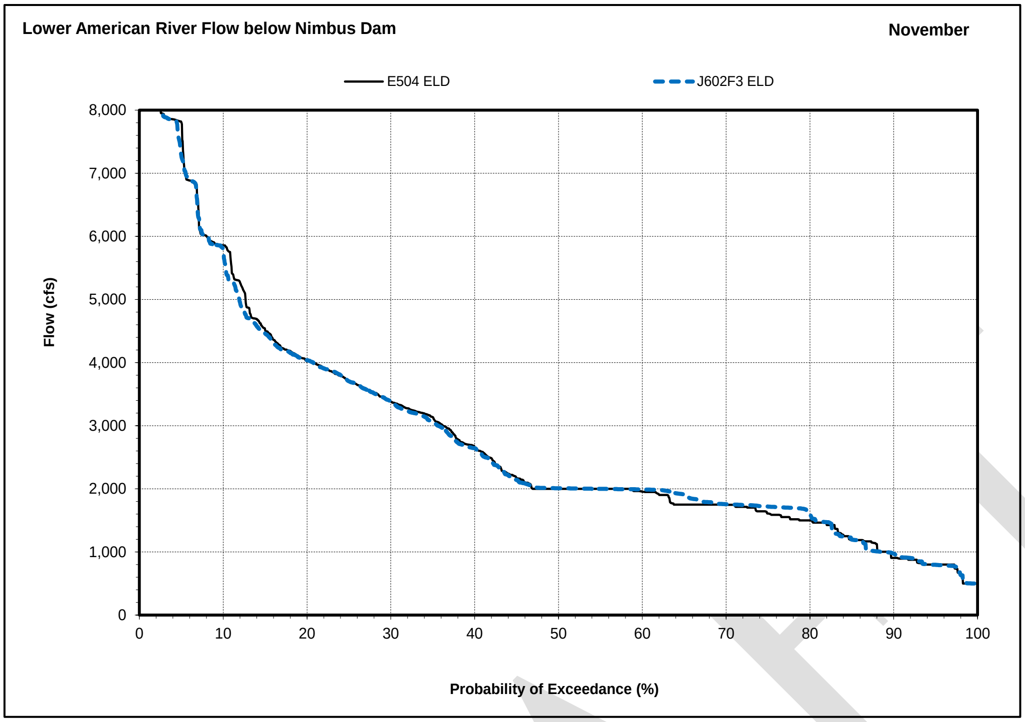

Figure 7.1-2. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for November under J602F3 ELD and E504 ELD

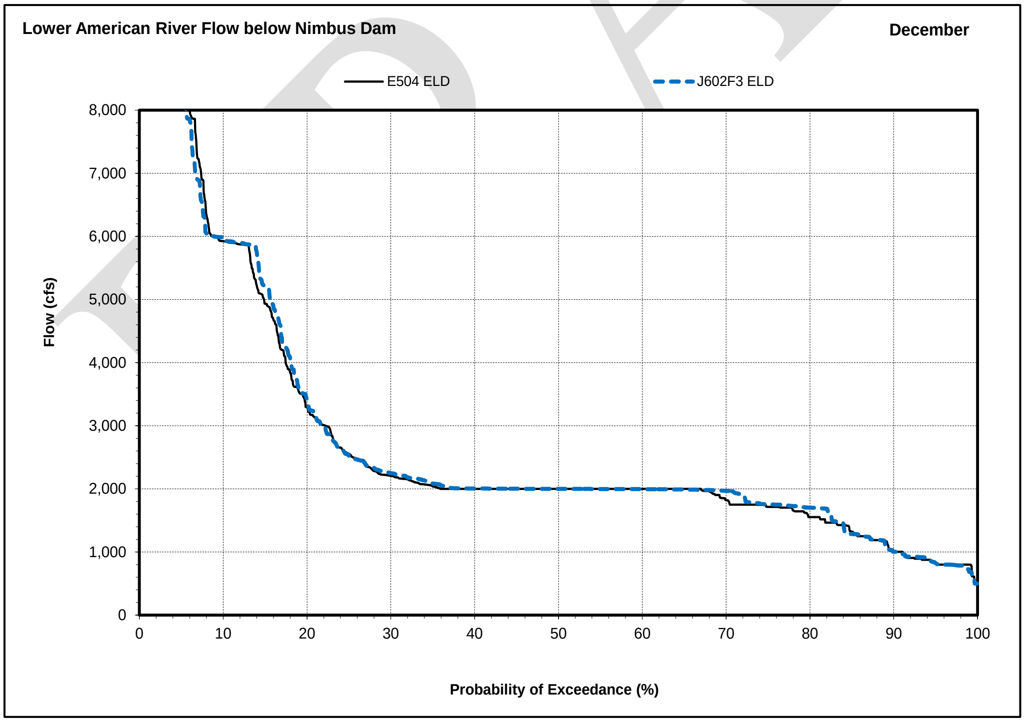

Figure 7.1-3. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for December under J602F3 ELD and E504 ELD

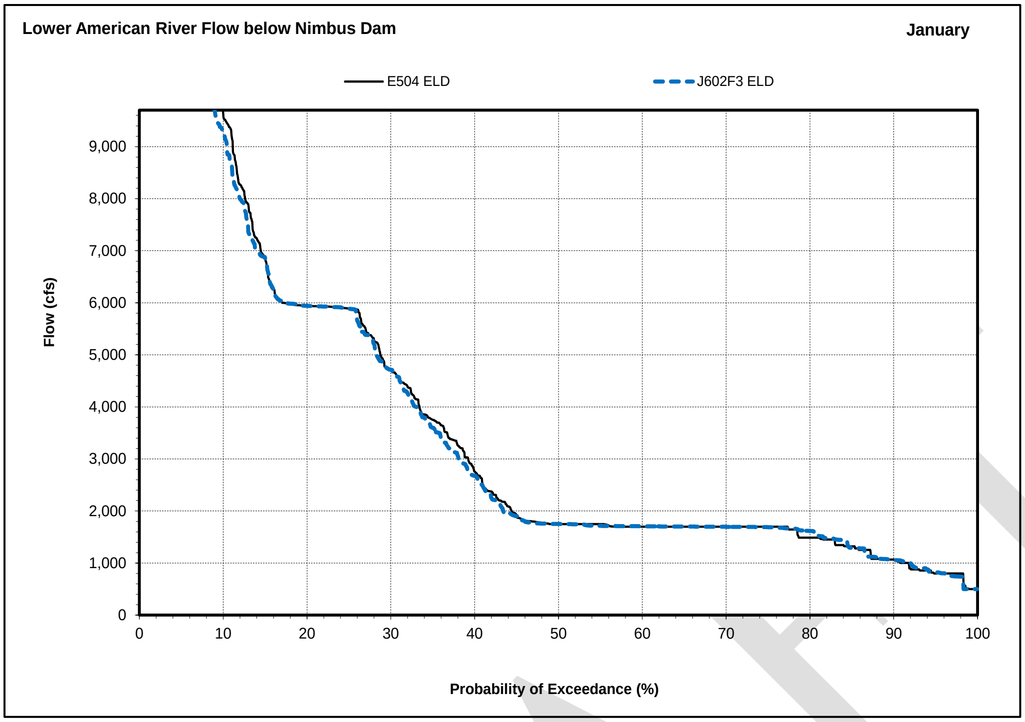

Figure 7.1-4. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for January under J602F3 ELD and E504 ELD

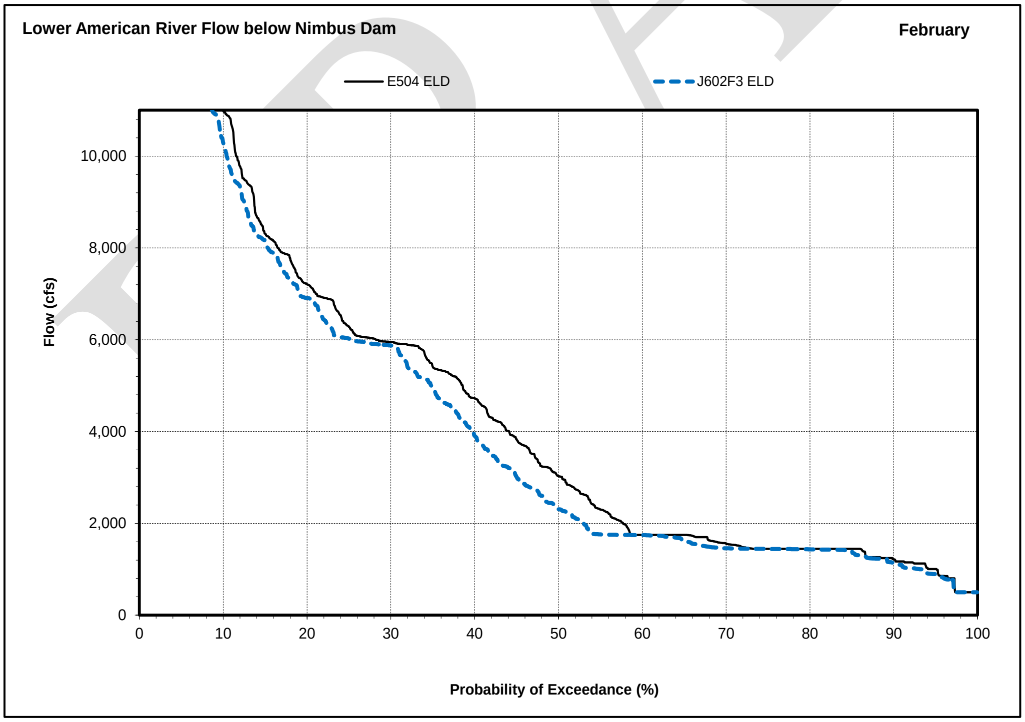

Figure 7.1-5. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for February under J602F3 ELD and E504 ELD

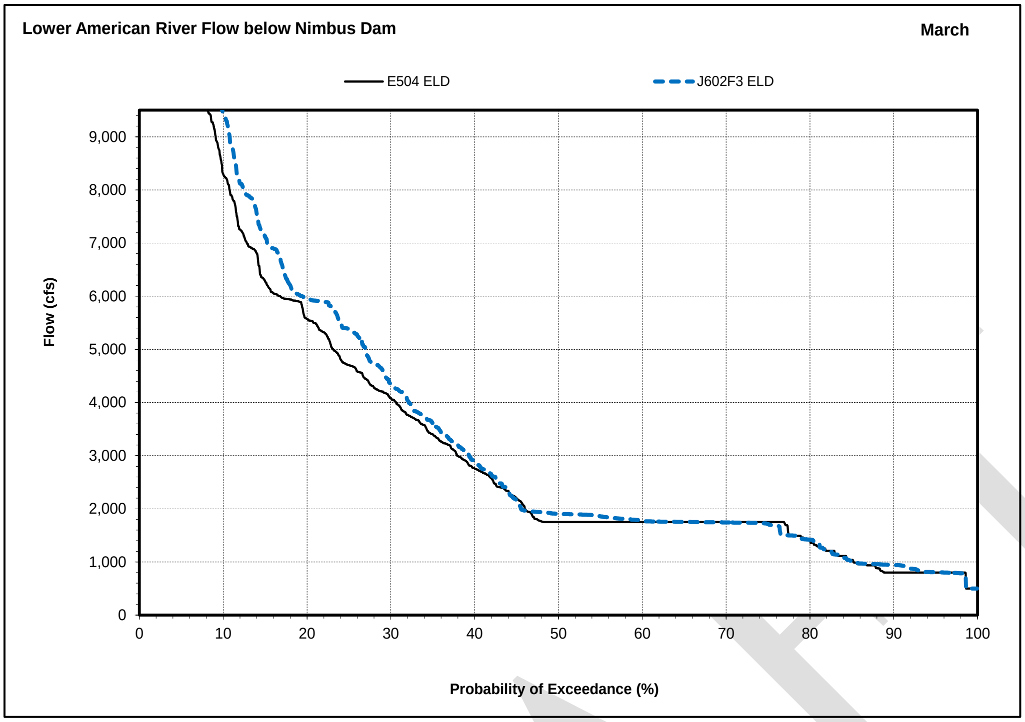

Figure 7.1-6. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for March under J602F3 ELD and E504 ELD

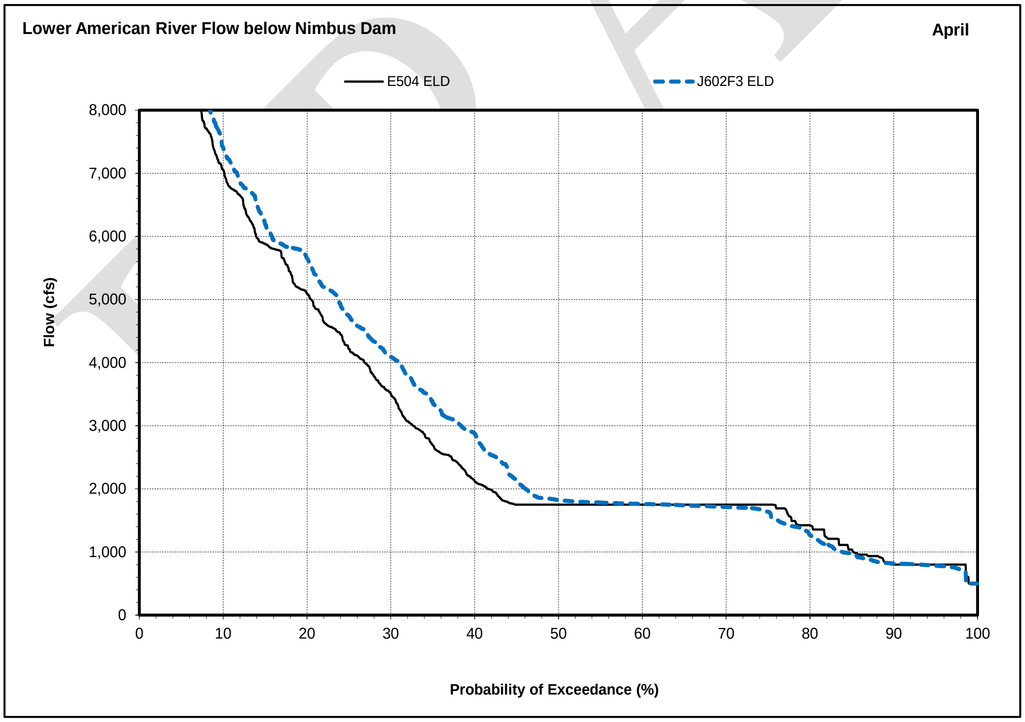

Figure 7.1-7. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for April under J602F3 ELD and E504 ELD

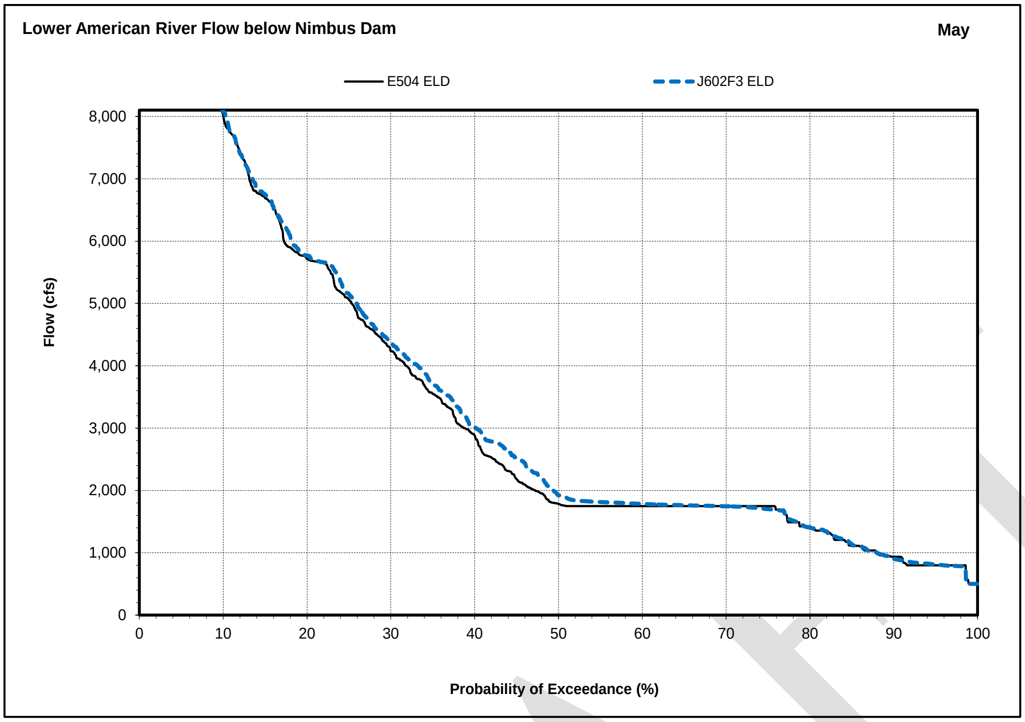

Figure 7.1-8. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for May under J602F3 ELD and E504 ELD

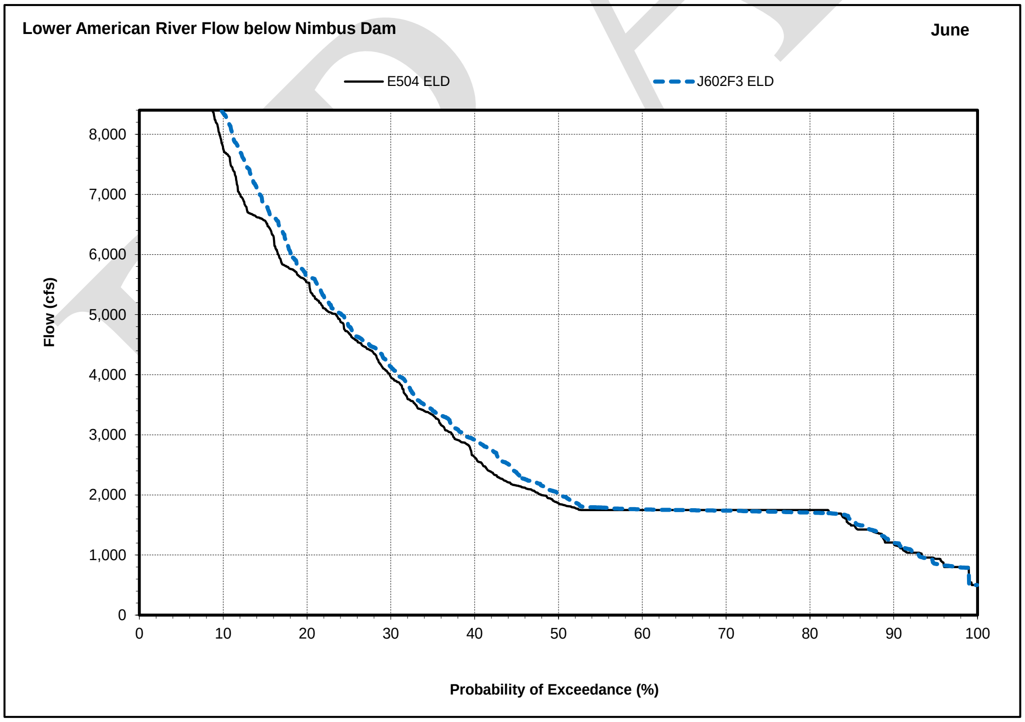

Figure 7.1-9. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for June under J602F3 ELD and E504 ELD

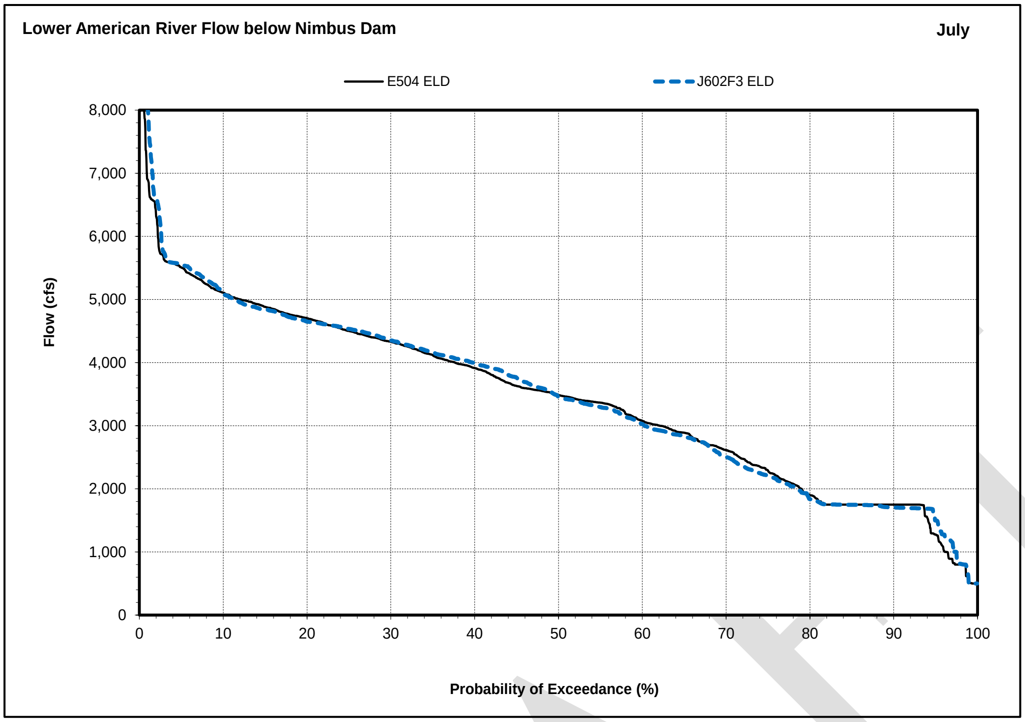

Figure 7.1-10. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for July under J602F3 ELD and E504 ELD

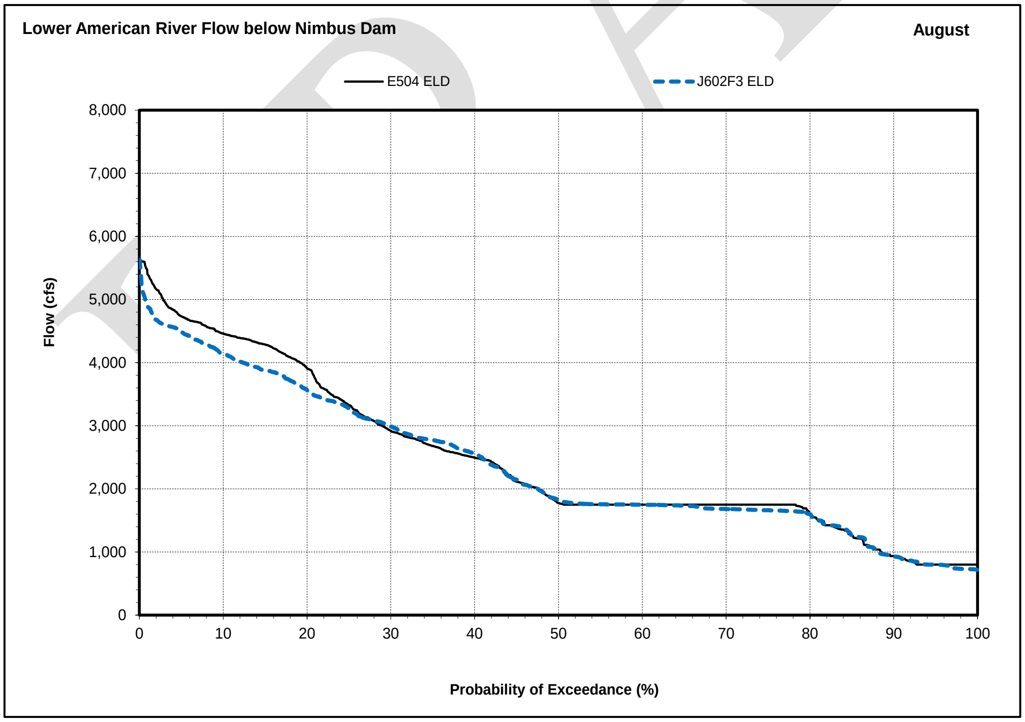

Figure 7.1-11. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for August under J602F3 ELD and E504 ELD

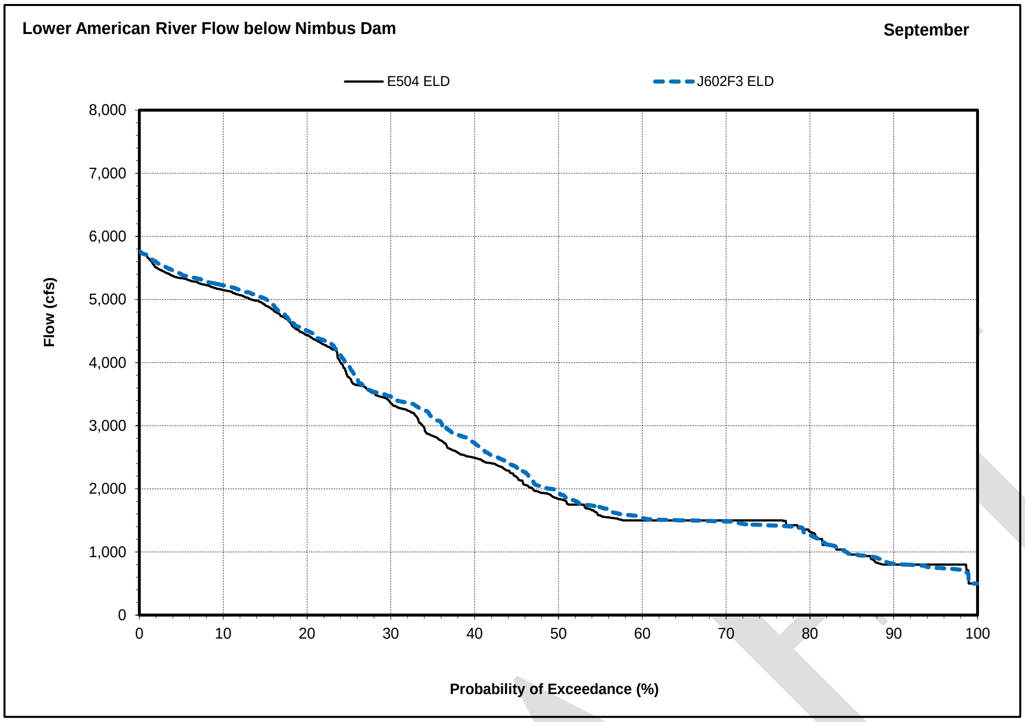

Figure 7.1-12. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for September under J602F3 ELD and E504 ELD

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 (see Appendix 7A).

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) (refer to the Fisheries Impact Assessment Methodology, Appendix 7B). 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.

Under J602F3 ELD relative to E504, net changes in flow at all three locations of 10 percent or more over the entire monthly distributions are generally similar (i.e., less than 5 percent) during July through December (Table 3.1-2). Flows decrease by 10 percent or more with higher frequency during January and August, and with substantially higher frequency (i.e., 10 percent or more) during February. In contrast, flows increase by 10 percent or more with higher frequency during May through July, and with substantially higher frequency during March and April.

Net changes in flow of 10 percent or more during low-flow conditions are generally similar (i.e., less than 5 percent) during most months of the year, including May, June, and August through January (Table 3.1-3). 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 (at Nimbus Dam and Watt Avenue) under J602F3 ELD relative to E504.

Table 3.1-2. 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 J602F3 ELD relative to E504 ELD											
	Description	%		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 Avenue	10	All Years	2	-1	-1	-7	-32	21	23	8	5	5	-4	2
	Mouth of the American River (RM 1)	10	All Years	2	-1	-1	-5	-29	19	24	9	4	5	-5	1

Table 3.1-3. 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 J602F3 ELD relative to E504 ELD											
	Description	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean Daily Flow (cfs)	American River below Nimbus Dam	10	Lower 40%	2	5	6	-1	-13	7	-16	0	-1	10	0	-2
	American River at Watt Avenue	10	Lower 40%	3	2	5	0	-11	6	-16	0	-1	10	0	-2
	Mouth of the American River (RM 1)	10	Lower 40%	3	2	3	-1	-9	9	-13	0	0	9	0	-1

Based on the general changes in flows (described above) and water temperatures (see the Water Temperature section), as well as fish species and lifestage-specific flow and water temperature–related impact indicators presented below, potential changes in species and lifestage-specific suitabilities under J602F3 ELD relative to E504 are described in the following sections.

3.1.1 Steelhead

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) (Table 3.1-4). Additional flow and water temperature nodes were used to simulate potential redd dewatering (i.e., daily water temperatures by river mile).

Relative to E504, J602F3 ELD would be expected to provide:

- Similar adult immigration (November through March [peaking during January]) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher and lower flows with similar monthly frequency over the evaluation period; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher frequency during January and with substantially higher frequency at both locations during February, and are higher by 10 percent or more with substantially higher frequency during March; (3) during low-flow conditions, flows are higher with slightly higher frequency during most months of the evaluation period, but are lower by 10 percent or more with higher or substantially higher frequency at both locations during February; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during all months of the evaluation period; and

(5) equivalent monthly probabilities of exceeding both UO and UT WTI values at both locations evaluated.

- Similar adult holding (November through March [peaking during January]) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher and lower flows with similar monthly frequency over the evaluation period; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher frequency during January and with substantially higher frequency during February, and are higher by 10 percent or more with substantially higher frequency during March; (3) during low-flow conditions, flows are higher with slightly higher frequency during most months of the evaluation period, but are lower by 10 percent or more with substantially higher frequency at both locations during February; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during all months of the evaluation period; and (5) equivalent monthly probabilities of exceeding both UO and UT WTI values at both locations evaluated.

- More suitable spawning (January through mid-April [peaking during February]) conditions due to: (1) slightly higher long-term average spawning WUA and similar or slightly higher average spawning WUA during all water year types (Table 3.1-5); (2) over the annual spawning WUA exceedance distribution, similar probability of spawning WUA equal to or greater than 80 percent of maximum spawning WUA, and generally slightly higher spawning WUA over the distribution when spawning WUA is less than 80 percent of maximum under both scenarios (Figure 7.1-13); (3) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during all months of the evaluation period; and (4) similar probabilities of exceeding WTI values at both locations during all months, except for an increase in the probability of exceedance of the UT WTI value during the first half of April. Although there is an increase in the probability of exceedance during the first half of April, less than 1 percent of steelhead spawning is expected to occur during April (see Appendix 7E, Analysis of Weighted Usable Area for Lower American River Salmonids). Therefore, water temperature conditions are expected to be generally similar overall for steelhead spawning.

- More suitable embryo incubation (January through May [peaking during March]) conditions due to: (1) lower long-term average annual redd dewatering index and slightly lower or similar average redd dewatering index during all water year types (Table 3.1-6); (2) lower annual redd dewatering index over most of the exceedance distribution (Figure 7.1-14); (3) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during all months of the evaluation period, but with slightly lower temperatures over the entirety of the distribution during May; and (4) similar most of the time but with a slight increase in exceedance of the UO WTI value during April below Nimbus Dam, and a slight decrease in exceedance of the UT WTI value during April and May below Nimbus Dam and during May at Watt Avenue.

- Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) over the monthly flow exceedance distributions, similar flows during most months of the evaluation period, but with higher flows more often during April and May, and lower flows more often during February; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher frequency during January and with substantially higher frequency during

February, and are higher by 10 percent or more with higher frequency during May through July and with substantially higher frequency during March and April; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during February and April, and are higher by 10 percent or more with higher or substantially higher frequency during March and July; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures over most of the distributions during most months of the evaluation period; and (5) generally similar probabilities of exceeding UO and UT WTI values at all locations during most months, but with some slight increases in exceedance probabilities during July and August at the mouth, and slight decreases in exceedance during June through September below Nimbus Dam, during May and June at Watt Avenue, and during May, June, August, and September at the mouth.

- Slightly less suitable smolt emigration (December through April [peaking during January]) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often during most months of the evaluation period, but with lower flows more often during February; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with similar or higher frequency during January, and with substantially higher frequency during February, and are higher by 10 percent or more with substantially higher frequency during March and April (no net difference in flow changes of 10 percent or more occur during December); (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during February and April, and are higher by 10 percent or more with higher or substantially higher frequency during March and December (no net differences in flow changes of 10 percent or more occur during January); (4) over the monthly water temperature exceedance distributions, generally similar water temperatures during all months of the evaluation period; and (5) similar probabilities of exceeding UO and UT WTI values during all months at both locations, with the exception of a slight increase in the probability of exceeding the UO WTI value during April at Watt Avenue.
- 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 slightly more suitable for steelhead under J602F3 ELD relative to E504. 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 J602F3 ELD relative to E504.

Table 3.1-4. Net Difference in Water Temperature Index Value Exceedance Probabilities for Steelhead

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under J602F3 ELD relative to E504 ELD											
			Description	Value (°F)	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	November through March	Mean Daily Water Temperature (°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 Temperature (°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 Temperature (°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 Temperature (°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 Temperature (°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 Temperature (°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 3.1-5. Long-term Average and Average by Water Year Type Steelhead Spawning WUA

Lower American River Steelhead Annual Spawning WUA Averages (% of Maximum WUA)			
Water Year Type Category	**J602F3 ELD**	**E504**	**Difference**
All Water Years	72.4%	71.6%	0.8%
Wet	53.3%	51.7%	1.6%
Above Normal	65.9%	64.4%	1.5%
Below Normal	82.5%	81.8%	0.7%
Dry	89.6%	89.4%	0.2%
Critical	82.0%	82.5%	–0.5%

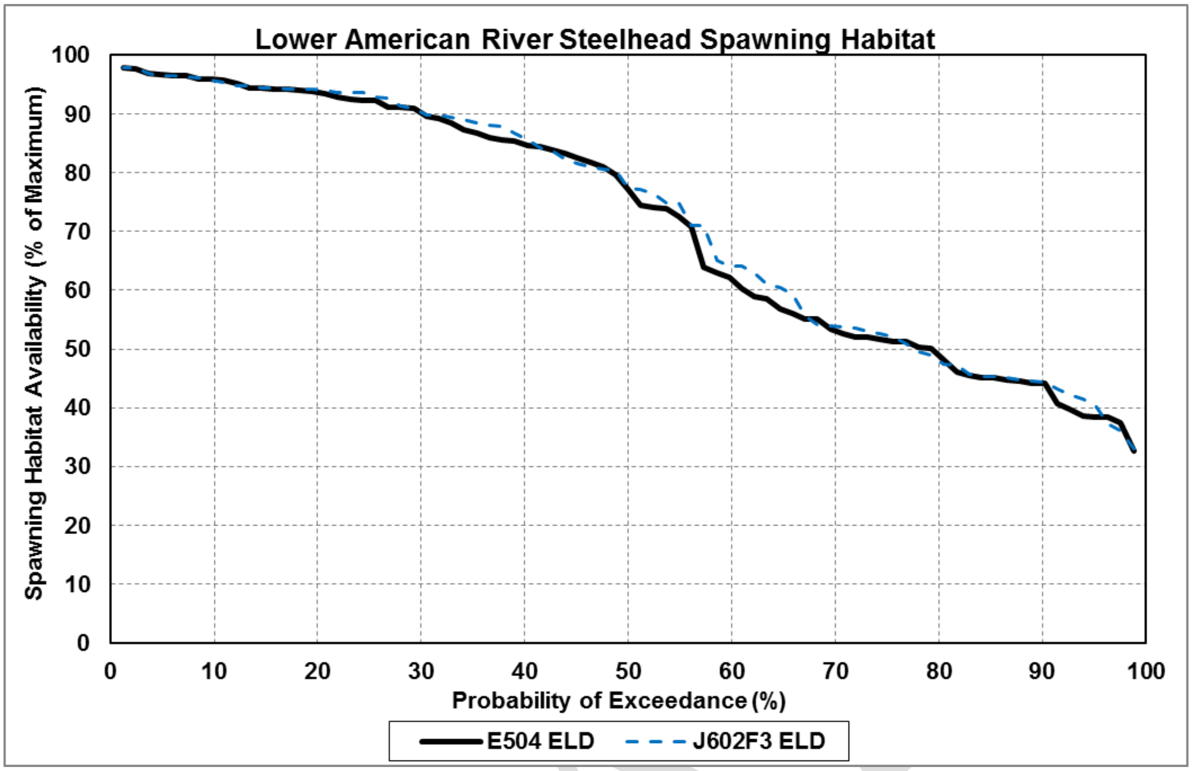

Figure 7.1-13. Steelhead Spawning WUA Exceedance Distribution

Table 3.1-6. Long-term Average and Average by Water Year Type Steelhead Redd Dewatering Index

Lower American River Steelhead Annual Redd Dewatering Index Averages (%)			
Water Year Type Category	**J602F3 ELD**	**E504**	**Difference**
All Water Years	25.2%	27.3%	–2.1%
Wet	45.2%	49.2%	–4.0%
Above Normal	43.6%	45.6%	–2.0%
Below Normal	15.1%	17.5%	–2.4%
Dry	4.8%	5.1%	–0.3%
Critical	2.6%	2.5%	0.1%

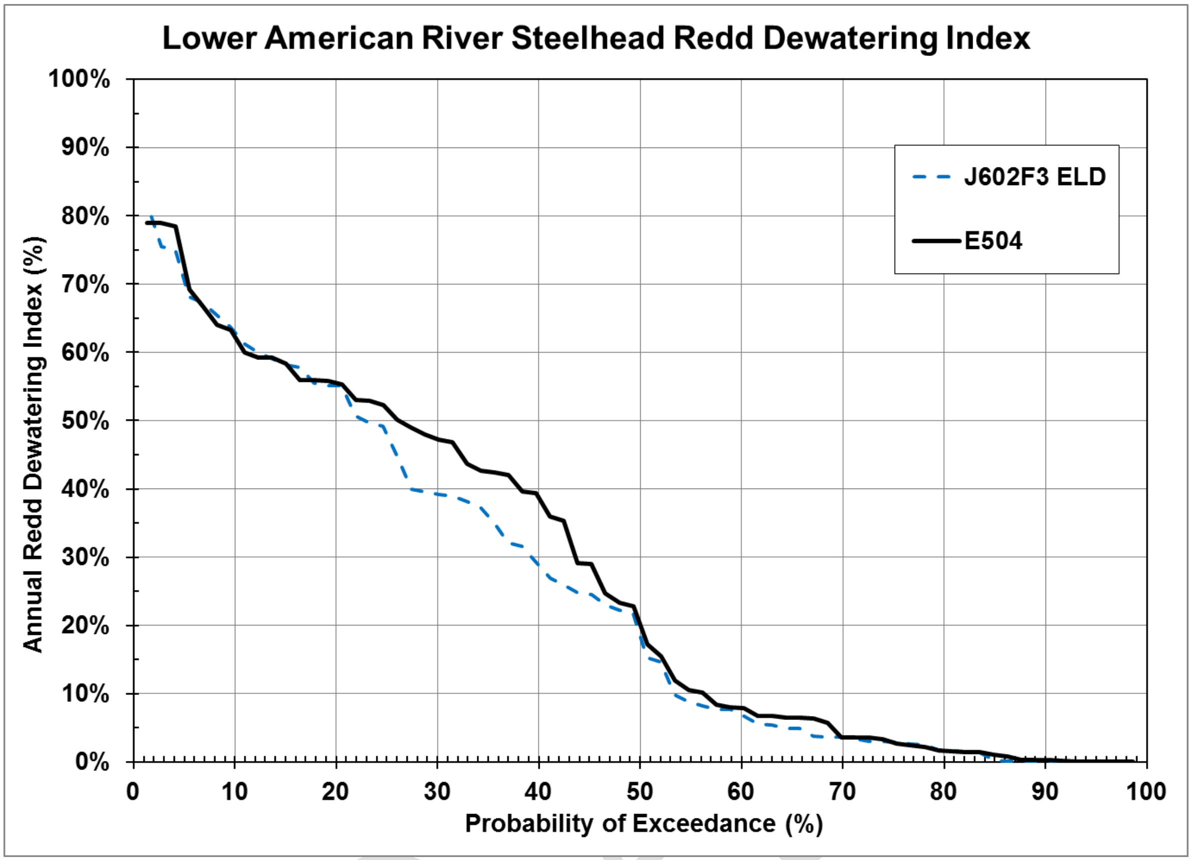

Figure 7.1-14. Steelhead Redd Dewatering Index Exceedance Distribution

3.1.2 Fall-run Chinook Salmon

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) (Table 3.1-7). Additional flow and water temperature nodes were used to simulate potential redd dewatering (i.e., daily water temperatures by river mile).

Relative to E504, J602F3 ELD would be expected to provide:

- Similar adult immigration and staging (August through December [peaking during November]) conditions due to: (1) over the monthly flow exceedance distributions, similar flows most of the time over the evaluation period; (2) over the entire flow exceedance distributions, minor net differences in flow changes of 10 percent or more during all months at most locations; (3) during low-flow conditions, flows are higher by 10% or more with higher frequency during December below Nimbus Dam but with minor net differences in flow changes of 10 percent or more during the remaining months at all locations; (4) over the monthly water temperature exceedance distributions, generally similar or slightly lower temperatures over the evaluation period; and (5) similar monthly probabilities of exceeding both UO and UT WTI values at all locations, but with some slight reductions in exceedance of the UO WTI value during October at all three locations, the UO WTI value during August below Nimbus Dam, and the UT WTI value at the mouth during August and September, and a slight increase in exceedance of the UO WTI value during August at the mouth.

- Similar spawning (mid-October through December [peaking during November]) conditions due to: (1) generally equivalent long-term average spawning WUA and average spawning WUA by water year type (Table 3.1-8); (2) over the annual spawning WUA exceedance distribution, similar probability of spawning WUA equal to or greater than 80 percent of maximum spawning WUA, and generally similar spawning WUA when spawning WUA is less than 80 percent of maximum (Figure 7.1-15); (3) over the monthly water temperature exceedance distributions, similar water temperatures during all months, including during relatively warm water temperature conditions (e.g., above 60°F); and (4) similar probabilities of exceeding both UO and UT WTI values during all months evaluated at both locations.
- Similar embryo incubation conditions (mid-October through March) due to: (1) generally equivalent long-term average annual redd dewatering index and similar average redd dewatering index during most water year types, except for a slight (1.6-percent) increase during critical water years (Table 3.1-9); (2) similar annual redd dewatering index over most of the exceedance distribution (Figure 7.1-16); (3) over the monthly water temperature exceedance distributions, similar water temperature over most of the monthly distributions, but with slightly lower temperatures more often during October at all locations, and slightly higher temperatures during March below Nimbus Dam; and (4) similar probabilities of exceeding both UO and UT WTI values during all months evaluated at both locations.
- Similar early lifestage mortality due to: (1) generally equivalent annual long-term average early lifestage mortality and average annual early lifestage mortality by water year type (Table 3.1-10); and (2) similar early lifestage annual mortality over the entire exceedance distribution (Figure 7.1-17).
- Similar juvenile rearing and downstream movement (January through May [peaking during February]) conditions due to: (1) over the monthly flow exceedance distributions, lower flows during February, but higher or similar flows more often during the remainder of the evaluation period; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher frequency during January and with substantially higher frequency during February, and are higher by 10 percent or more with higher frequency during May and with substantially higher frequency during March and April; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during February and April, and are higher by 10 percent or more with higher or substantially higher frequency during March; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures more often over the evaluation period; and (5) similar probabilities of exceeding UO and UT WTI values most of the time at all locations, but with slightly lower probabilities of exceedance during May at all locations.
- 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

salmonids in the lower American River, habitat conditions are expected to be generally similar for fall-run Chinook salmon under J602F3 ELD relative to E504. Although flows decrease during some months of the rearing and emigration lifestage, spawning habitat availability, the probability of redd dewatering, and early lifestage mortality are similar under both scenarios. In addition, there are some slight reductions in water temperatures during the warmest periods of some lifestages, such as during October of the adult immigration lifestage and during May of the juvenile rearing and emigration lifestage under J602F3 ELD.

Table 3.1-7. Net Difference in Water Temperature Index Value Exceedance Probabilities for Fall-run Chinook Salmon

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under J602F3 ELD relative to E504 ELD											
			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 3.1-8. Long-term Average and Average by Water Year Type Fall-run Chinook Salmon Spawning WUA

Lower American River Fall-run Chinook Salmon Annual Weighted WUA Averages (%)			
Water Year Type Category	**J602F3 ELD**	**E504**	**Difference**
All Water Years	84.4%	84.2%	0.2%
Wet	81.3%	80.7%	0.6%
Above Normal	81.1%	80.8%	0.3%
Below Normal	88.1%	88.5%	–0.4%
Dry	85.3%	85.1%	0.2%
Critical	88.3%	88.4%	–0.1%

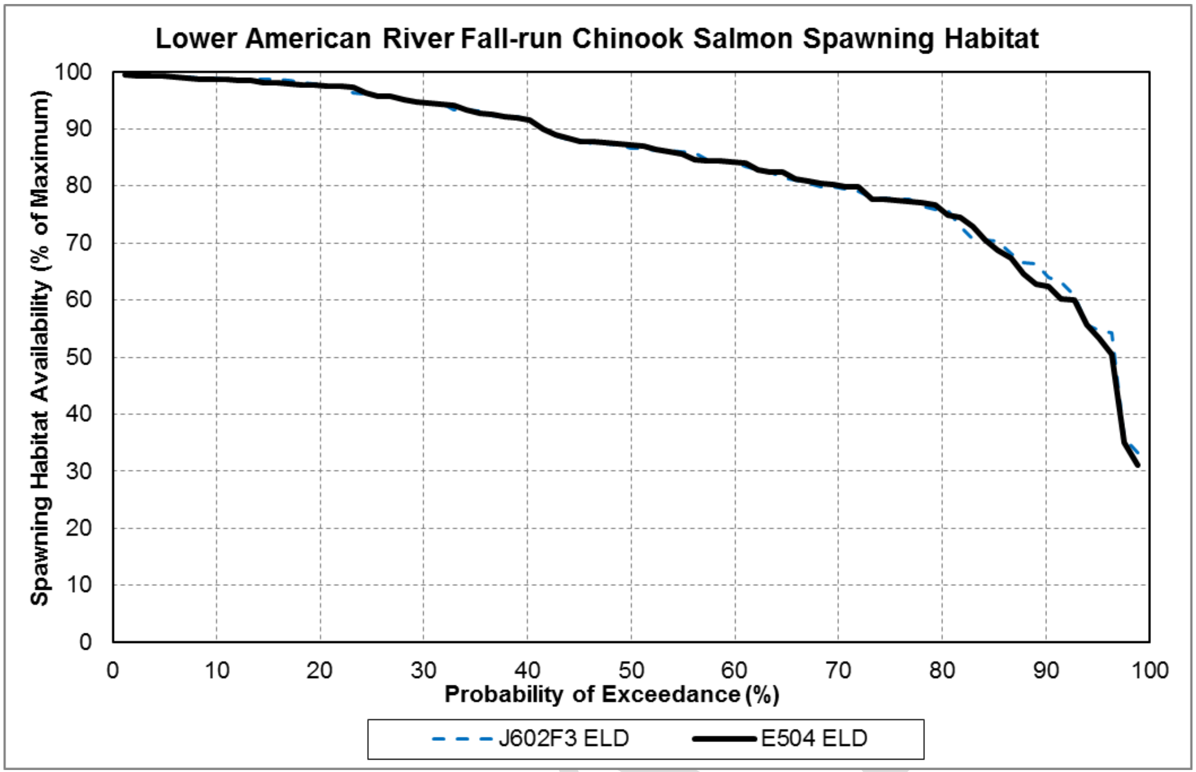

Figure 7.1-15. Fall-run Chinook Salmon Spawning WUA Exceedance Distribution

Table 3.1-9. 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 (%)			
Water Year Type Category	**J602F3 ELD**	**E504**	**Difference**
All Water Years	10.0%	10.1%	0.0%
Wet	12.4%	13.0%	–0.6%
Above Normal	6.6%	7.6%	–0.9%
Below Normal	6.2%	5.8%	0.4%
Dry	7.5%	7.5%	0.0%
Critical	15.8%	14.2%	1.6%

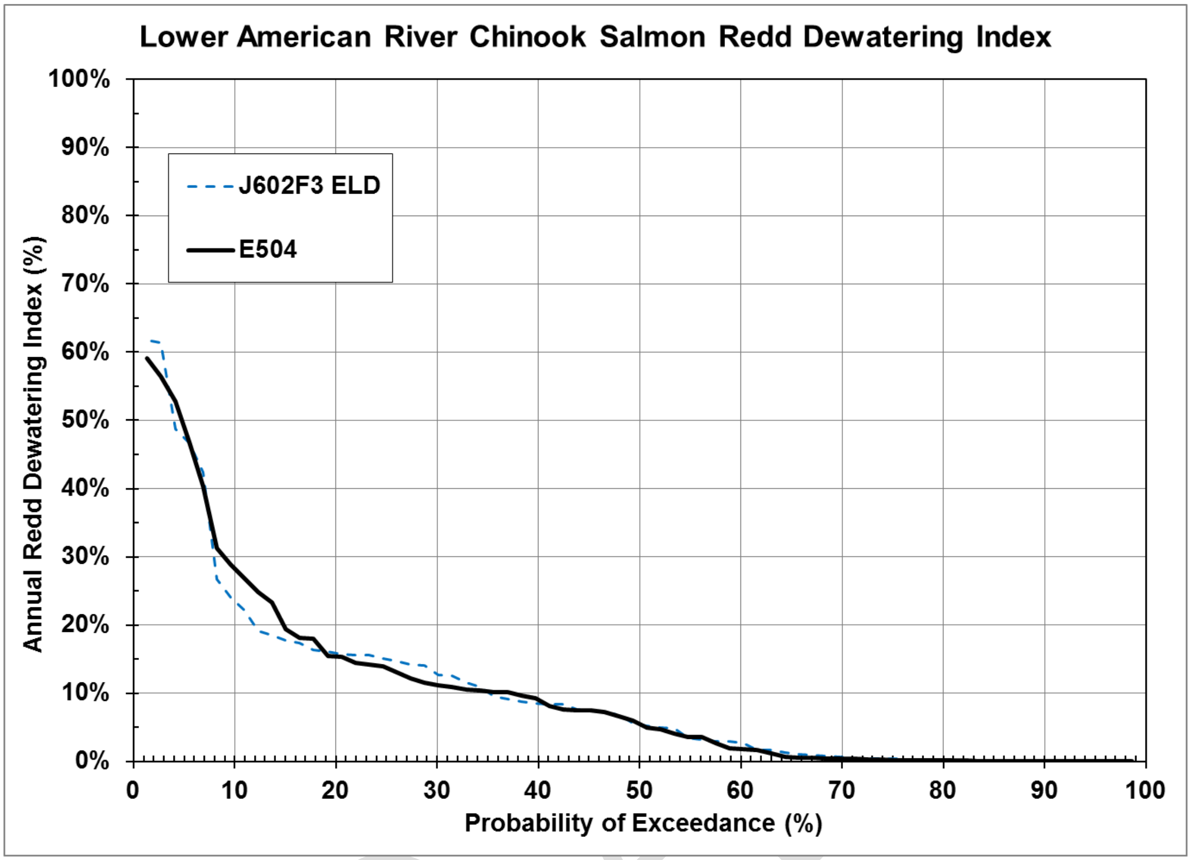

Figure 7.1-16. Fall-run Chinook Salmon Redd Dewatering Index Exceedance Distribution

Table 3.1-10. Long-term Average and Average by Water Year Type Fall-run Chinook Salmon Early Lifestage Mortality

Lower American River Fall-run Chinook Salmon Annual Early Lifestage Mortality Averages (%)			
Water Year Type Category	**J602F3 ELD**	**E504**	**Difference**
All Water Years	7.5%	7.7%	–0.2%
Wet	4.6%	4.6%	0.0%
Above Normal	4.1%	4.1%	–0.1%
Below Normal	4.9%	5.1%	–0.2%
Dry	10.9%	11.6%	–0.6%
Critical	14.9%	14.8%	0.1%

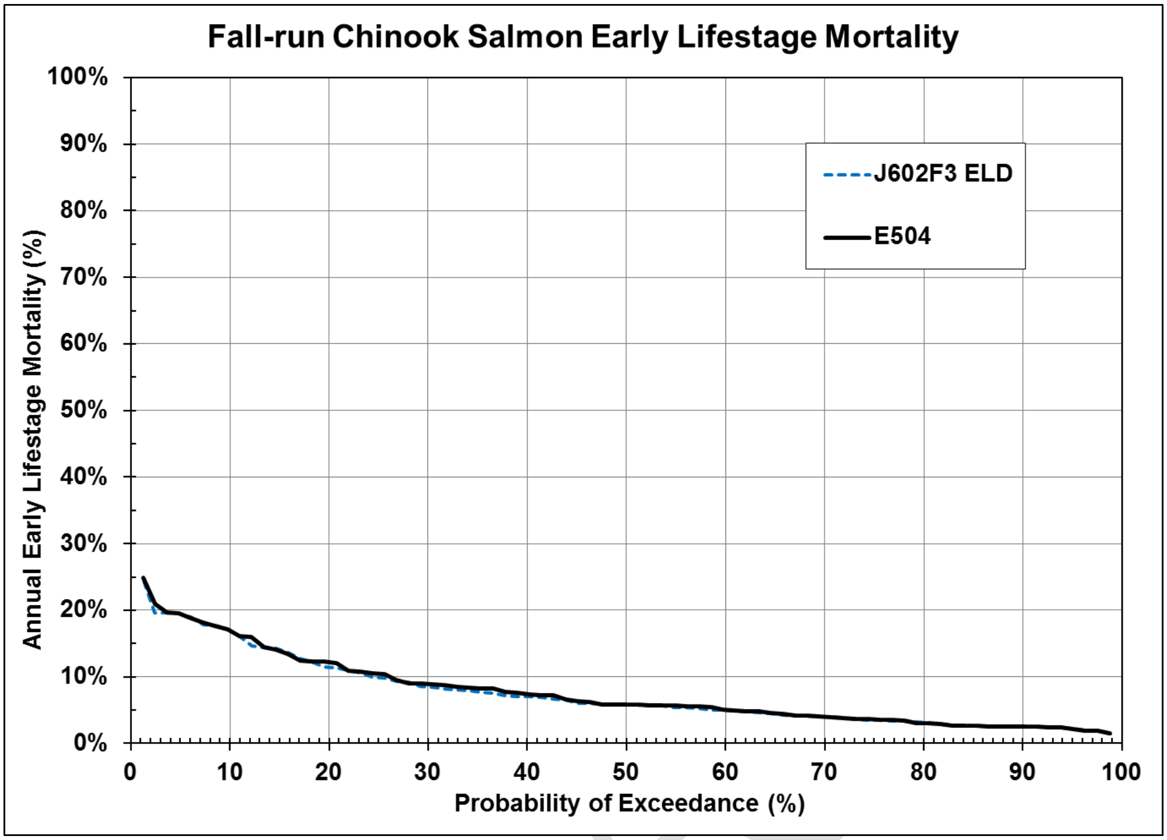

Figure 7.1-17. Fall-run Chinook Salmon Annual Early Lifestage Mortality Exceedance Distribution

3.1.3 Spring-run Chinook Salmon (Non-natal Juvenile Rearing)

Flow and water temperature model results were examined for the lower American River near the mouth of the lower American River (i.e., RM 1) for non-natal juvenile rearing (Table 3.1-11).

Relative to E504, J602F3 ELD would be expected to provide:

- Similar non-natal juvenile rearing (November through April) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often during most months of the evaluation period, but with lower flows during February; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher frequency during January and with substantially higher frequency during February, and are higher by 10 percent or more with substantially higher frequency during March and April; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during February and April, and are higher by 10 percent or more with higher or substantially higher frequency during March; (4) over the monthly water temperature exceedance distributions, similar temperatures over most of the evaluation period; and (5) similar probabilities of exceeding UO and UT WTI values during all months evaluated.

- Overall, in consideration of all flow and water temperature–related impact indicators, habitat conditions are expected to be similar for spring-run Chinook salmon under J602F3 ELD relative to E504. Although flows decrease during a portion of the evaluation period, water temperature index values are exceeded with similar frequency. 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 3.1-11. Net Difference in Water Temperature Index Value Exceedance Probabilities for Spring-run Chinook Salmon

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under J602F3 ELD relative to E504 ELD											
			Description	Value (°F)	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	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					

3.1.4 River Lamprey

Flow and water temperature model results were examined for the lower American River at Watt Avenue and near the mouth of the lower American River (i.e., RM 1) (Table 3.1-12).

Relative to E504, J602F3 ELD would be expected to provide:

- Similar adult immigration (September through June) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often over most of the evaluation period; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher or substantially higher frequency during January and February, and are higher by 10 percent or more with higher or substantially higher frequency during March through June, with minor net changes of 10 percent or more during the remainder of the evaluation period; (3) during low-flow conditions, flows are lower by 10 percent or more with higher or substantially higher frequency during February and April, and are higher by 10 percent or more with substantially higher frequency during March, with minor net changes of 10 percent or more during most months of the evaluation period; (4) over the monthly water temperature exceedance distributions, similar water temperatures over most the evaluation period; and (5) similar probabilities of water temperatures occurring within the specified range during all months evaluated at both locations, but with a slighter higher probability of occurring within the range during May.
- Similar spawning and embryo incubation (February through July) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows most of the time over the evaluation period; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency during February, and are higher by 10 percent or more with higher or substantially higher frequency during March through June, with minor net changes of 10 percent or more during July; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during February and April, and are higher by 10 percent or more with higher or substantially higher frequency during March, with minor net changes of 10 percent or more during May and June; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures during most months;

and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months evaluated, but with a slightly higher probability of occurring within the range during May.

- Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) over the monthly flow exceedance distributions, similar flows during most months of the evaluation period, but with higher flows more often during April and May, and lower flows more often during February; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher frequency during January and with substantially higher frequency during February, and are higher by 10 percent or more with higher frequency during May through July and with substantially higher frequency during March and April; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during February and April, and are higher by 10 percent or more with higher or substantially higher frequency during March and July; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures over most of the distributions during most months, but with higher water temperatures during August at the mouth; and (5) similar monthly probabilities of exceeding the WTI value during all months evaluated at both locations, but with slightly lower probabilities of exceedance during June and July.
- Overall, in consideration of all flow and water temperature–related impact indicators, as well as peak lifestage-specific temporal considerations, habitat conditions are expected to be similar for river lamprey under J602F3 ELD relative to E504.

Table 3.1-12. Net Difference in Water Temperature Index Value Exceedance Probabilities for River Lamprey

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under J602F3 ELD relative to E504 ELD											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	September through June	Mean Daily Water Temperature (°F)	American River at Watt Avenue	42-60[1]		All Years	1	0	0	0	0	0	0	2	1			0
			Mouth of the American River (RM 1)	42-60		All Years	0	0	0	0	0	1	0	2	1			0
Spawning and Embryo Incubation	February through July	Mean Daily Water Temperature (°F)	American River at Watt Avenue	50-64		All Years					1	-1	1	4	1	0		
Ammocoete Rearing and Downstream Movement	Year-round	Mean Daily Water Temperature (°F)	American River at Watt Avenue	72		All Years	0	0	0	0	0	0	0	0	-1	-2	0	0
			Mouth of the American River (RM 1)	72		All Years	0	0	0	0	0	0	0	-1	-2	0	-1	1

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

3.1.5 Pacific Lamprey

Flow and water temperature model results were examined for the lower American River at Watt Avenue and near the mouth of the lower American River (i.e., RM 1) (Table 3.1-13).

Relative to E504, J602F3 ELD would be expected to provide:

- Similar adult immigration (January through June) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during April and May, and lower flows more often during February, with similar flows most of the time during the remainder of the evaluation period; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher frequency during January and with substantially higher frequency during February, and are higher by 10 percent or more with higher frequency during May and June, and with substantially higher frequency during March and April; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during February and April, and are higher by 10 percent or more with higher or substantially higher frequency during March; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures over most of the distributions during most months, but with higher water temperatures during March below Nimbus Dam (when water temperatures are below 55°F); and (5) similar probabilities of water temperatures occurring within the specified range at both locations during all months evaluated, but with slight increases in the probability of occurring within the range during May.

- Similar spawning and embryo incubation (March through August) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows over the evaluation period; (2) over the entire flow exceedance distributions, flows are higher by 10 percent or more with higher frequency during May and June, and with substantially higher frequency during March and April, with minor net changes of 10 percent or more during July and August; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, and are higher by 10 percent or more with substantially higher frequency during March and July, with minor net changes of 10 percent or more during May, June, and August; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures over the evaluation period; (5) similar probabilities of water temperatures occurring within the specified range at both locations during all months evaluated, but with a slight increase in the probability of occurring within the range during May.
- Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) over the monthly flow exceedance distributions, similar flows during most months of the evaluation period, but with higher flows more often during April and May, and lower flows more often during February; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher frequency during January and with substantially higher frequency during February, and are higher by 10 percent or more with higher frequency during May through July and with substantially higher frequency during March and April; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during February and April, and are higher by 10 percent or more with higher or substantially higher frequency during March and July; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures over most of the distributions during most months, but with higher water temperatures during August at the mouth; and (5) similar monthly probabilities of exceeding the WTI value at both locations during all months, but with slight reductions in exceedance during June and July.
- Overall, in consideration of all flow and water temperature–related impact indicators, habitat conditions are expected to be similar for Pacific lamprey under J602F3 ELD relative to E504.

Table 3.1-13. Net Difference in Water Temperature Index Value Exceedance Probabilities for Pacific Lamprey

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under J602F3 ELD relative to E504 ELD											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	January through June	Mean Daily Water Temperature (°F)	American River at Watt Avenue	42-60[1]		All Years				0	0	0	0	2	1			
			Mouth of the American River (RM 1)	42-60		All Years				0	0	1	0	2	1			
Spawning and Embryo Incubation	January through August	Mean Daily Water Temperature (°F)	American River at Watt Avenue	50-64		All Years				0	1	-1	1	4	1	0	-1	
Ammocoete Rearing and Downstream Movement	Year-round	Mean Daily Water Temperature (°F)	American River at Watt Avenue	72		All Years	0	0	0	0	0	0	0	0	-1	-2	0	0
			Mouth of the American River (RM 1)	72		All Years	0	0	0	0	0	0	0	-1	-2	0	-1	1

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

3.1.6 Hardhead

Flow and water temperature model results were examined for the lower American River at Watt Avenue (Table 3.1-14).

Relative to E504, J602F3 ELD would be expected to provide:

- Similar adult and other lifestage (year-round) conditions due to: (1) over the monthly flow exceedance distributions, similar flows during most months of the evaluation period, but with higher flows more often during April and May, and lower flows more often during February; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with higher frequency during January and with substantially higher frequency during February, and are higher by 10 percent or more with higher frequency during May through July and with substantially higher frequency during March and April; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during February and April, and are higher by 10 percent or more with higher or substantially higher frequency during March and July; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures over most of the monthly distributions; and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months, but with a slight reduction in the probability of occurring within the range during May (due to a reduction in water temperatures under J602F3 ELD).
- Similar spawning (April through June) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often during April through June; (2) over the entire flow exceedance distributions, flows are higher by 10 percent or more with higher frequency during May and June, and with substantially higher frequency during April; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, with minor net changes in flow of 10 percent or more during May and June; (4) over the monthly water temperature exceedance distributions, similar or lower temperatures over the monthly distributions; and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months evaluated, but with a slight increase in the probability of occurring within the range during May.
- Overall, in consideration of all flow and water temperature–related impact indicators, habitat conditions are expected to be similar for hardhead under J602F3 ELD relative to E504.

Table 3.1-14. Net Difference in Water Temperature Index Value Exceedance Probabilities for Hardhead

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under J602F3 ELD relative to E504 ELD											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adults and Other Lifestages	Year-round	Mean Daily Water Temperature (°F)	American River at Watt Avenue	61-77[1]		All Years	0	0	0	0	0	0	0	-3	-1	0	1	0
Spawning	April through June	Mean Daily Water Temperature (°F)	American River at Watt Avenue	59-64		All Years							1	2	0			

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

3.1.7 American Shad

Flow and water temperature model results were examined for the lower American River at Watt Avenue (Table 3.1-15). In addition, flows near the mouth of the lower American River (i.e., RM 1) were evaluated for adult attraction into the lower American River.

Relative to E504, J602F3 ELD would be expected to provide:

- Similar adult attraction (May and June) conditions due to: (1) similar probability of flows at the mouth exceeding 2,000 cfs; (2) similar probability of flows at the mouth occurring between 3,000 and 4,000 cfs; and (3) similar probabilities that mean monthly flows at the mouth are equivalent to or greater than 10 percent of simulated mean monthly flow in the Sacramento River.
- Similar adult immigration and spawning (April through June) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during April and May, and lower flows more often during June; (2) over the entire flow exceedance distributions, flows are higher by 10 percent or more with substantially higher frequency during April, with minor net changes of 10 percent or more during May and June; (3) during low-flow conditions, minor net changes in flow of 10 percent or more occur during April through June; (4) over the monthly water temperature exceedance distributions, similar or lower temperatures over the monthly distributions; and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months evaluated.
- Similar juvenile rearing and downstream movement (April through December) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows over the monthly distributions; (2) over the entire flow exceedance distributions, flows are higher by 10 percent or more with higher or substantially higher frequency during April through June, with minor net changes of 10 percent or more during July through December; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, and are higher by 10 percent or more with substantially higher frequency during July, with minor net changes of 10 percent or more during May, June, and August through December; (4) over the monthly water temperature exceedance distributions, similar or lower temperatures most of the time; and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months evaluated, but with a slight increase in the probability of occurring within the range during August, and slight decreases in the probability of occurring within the range during October and May (due to reduced water temperatures under J602F3 ELD).
- Overall, in consideration of all flow and water temperature–related impact indicators, habitat conditions are expected to be similar for American shad under J602F3 ELD relative to E504.

Table 3.1-15. Net Difference in Flow and Water Temperature Index Value Exceedance Probabilities for American Shad

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under J602F3 ELD relative to E504 ELD											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Attraction	May and June	Mean Daily Flow (cfs)	Mouth of the American River (RM 1)	>2,000 cfs		All Years								2	2			
				3,000 - 4,000 cfs		All Years								0	0			
		Mean Monthly Flow (cfs)	Mouth of the American River (RM 1)	≥10% of Sac R. Flow		All Years								0	1			
Adult Immigration and Spawning	April through June	Mean Daily Water Temperature (°F)	American River at Watt Avenue	60-70[1]		All Years							0	-2	2			
Juvenile Rearing and Downstream Movement	April through December	Mean Daily Water Temperature (°F)	American River at Watt Avenue	63-77		All Years	-2	0	0				0	-4	-1	0	2	0

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

3.1.8 Striped Bass

Flow and water temperature model results were examined for the lower American River at Watt Avenue (Table 3.1-16). In addition, flows near the mouth of the lower American River (i.e., RM 1) were evaluated for adult attraction into the lower American River.

Relative to E504, J602F3 ELD would be expected to provide:

- Similar adult attraction (May and June) conditions due to similar probabilities of flows at the mouth exceeding 1,500 cfs.
- Similar adult immigration and spawning (April through June) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during April and May, and lower flows more often during June; (2) over the entire flow exceedance distributions, flows are higher by 10 percent or more with substantially higher frequency during April, with minor net changes of 10 percent or more during May and June; (3) during low-flow conditions, minor net changes in flow of 10 percent or more occur during April through June; (4) over the monthly water temperature exceedance distributions, similar or lower temperatures over the monthly distributions; and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months evaluated, but with a slight increase in the probability of occurring within the range during June.
- Similar juvenile rearing (May through October) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows over the monthly distributions; (2) over the entire flow exceedance distributions, flows are higher by 10 percent or more with higher frequency during May and June, with minor net changes of 10 percent or more during July through October; (3) during low-flow conditions, flows are higher by 10 percent or more with substantially higher frequency during July, with minor net changes of 10 percent or more during May, June, and August through October; (4) over the monthly water temperature exceedance distributions, similar or lower temperatures most of the time; and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months evaluated, but with a slight increase in the probability of occurring within the range during May (due to reduced water temperatures under J602F3 ELD).
- Overall, in consideration of all flow and water temperature–related impact indicators, habitat conditions are expected to be similar for striped bass under J602F3 ELD relative to E504.

Table 3.1-16. Net Difference in Flow and Water Temperature Index Value Exceedance Probabilities for Striped Bass

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under J602F3 ELD relative to E504 ELD											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Attraction	May and June	Mean Daily Flow (cfs)	Mouth of the American River (RM 1)	>1500 cfs		All Years								1	1			
Adult Immigration and Spawning	April through June	Mean Daily Water Temperature (°F)	American River at Watt Avenue	59-68[1]		All Years							0	-1	3			
Juvenile Rearing	May through October	Mean Daily Water Temperature (°F)	American River at Watt Avenue	61-71		All Years	0							-3	0	1	1	0

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Appendix D: Fisheries, Part 2

Model Appendices

Appendix 7A

1.1 Environmental Setting

This section describes the environmental setting related to fisheries and aquatic ecosystems in waterbodies that could be influenced by implementation of the proposed Folsom Dam Water Control Manual (WCM) Update that is being analyzed in this document by the U.S. Army Corps of Engineers (USACE). The following sections describe the aquatic habitats and fish populations in the Action Area, which includes the Primary Study Area of the lower American River as well as the "Far-Field" areas, including the Sacramento River, the Feather River, and the Sacramento–San Joaquin Delta (Delta) and the Yolo Bypass.

1.1.1 Fisheries Resources in the Action Area

This section describes specific conditions (e.g., species composition, spatial distribution, and temporal distribution) for each of the affected major waterbodies with special-status fish species in the Action Area. Life histories and lifestage-specific environmental considerations for several species can differ slightly among the waterbodies. Any differences are noted in the discussions of the individual waterbodies. If there are not any noted differences, USACE has assumed that the species' life history and environmental considerations are generally similar to the general discussions in the following Section 1.1.1.1, *Overview of Fish Species*.

1.1.1.1 Overview of Fish Species

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. USACE identified special-status fish species potentially occurring in the Action Area using U.S. Fish and Wildlife Service (USFWS) species lists for the Action Area and by reviewing environmental documents for other projects in the region. **Table 1** presents the special-status fish species that could occur within the Action Area and their Federal and state regulatory status, generally taken from the California Department of Fish and Wildlife (CDFW 2014). Table 1 also presents non-special-status fish species of recreational or commercial importance. **Table 2** indicates which species are evaluated in each waterbody in the Action Area.

Fish species of focused evaluation include those that are:

1. Federally and/or state-listed species and species proposed for Federal or state listing within the area; specifically:
    - Sacramento River winter-run Chinook salmon (Oncorhynchus tshawytscha) evolutionarily significant unit (ESU);
    - Central Valley spring-run Chinook salmon ESU;
    - Central Valley steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS);
    - Delta smelt (Hypomesus transpacificus);

  - Longfin smelt (Spirinchus thaleichthys); and
  - Southern DPS of North American green sturgeon (*Acipenser medirostris*);
2. Federal species of concern and state species of special concern, specifically:
  - Central Valley fall-/late fall-run Chinook salmon ESU;
  - Green sturgeon;
  - Hardhead (Mylopharodon conocephalus);
  - River lamprey (*Lamptera ayresi*);
  - Pacific lamprey (*Entosphenus tridentatus*); and
  - Sacramento splittail (Pogonichthys macrolepidotus);
3. Federal or state candidate species for listing (longfin smelt); and
4. Species that are recreationally or commercially important, specifically:
  - Fall-run Chinook salmon;
  - Steelhead;
  - White sturgeon (Acipenser transmontanus);
  - American shad (*Alosa sapidissima*); and
  - Striped bass (*Morone saxatilis*).

Table 1. Special-Status Fish Species and Species of Recreational or Commercial Importance in the Action Area.

Common Name	Status
• Sacramento River winter-run Chinook salmon ESU	Federally and state endangered
• Central Valley spring-run Chinook salmon ESU	Federally and state threatened
• Central Valley fall-/late fall-run Chinook salmon ESU	Federal species of concern State species of special concern
• Central Valley steelhead DPS	Federally threatened
• Southern DPS of North American green sturgeon	Federally threatened State species of special concern
• Delta smelt	Federally threatened State endangered
• Longfin smelt	Federal candidate[1] State threatened
• Hardhead	State species of special concern
• Pacific lamprey	Federal species of concern[2]
• River lamprey	State species of special concern
• Sacramento splittail	State species of special concern
• White sturgeon	Recreational and/or commercial importance
• American shad	Recreational and/or commercial importance
• Striped bass	Recreational and/or commercial importance

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[1] Federal candidate status is for the San Francisco Bay-Delta DPS of longfin smelt.

[2] Although not referenced as a federal species of concern in CDFW (2014), the Oregon USFWS office considers Pacific lamprey a species of concern. The Sacramento USFWS office does not maintain a species of concern list.

Table 2. Waterbodies and Fish Species of Focused Evaluation in the Lower American River and Far-Field Areas.

	Lower American River	Sacramento River	Feather River	Yolo Bypass	Delta
Sacramento River winter-run Chinook salmon ESU		✓		✓	✓
Central Valley spring-run Chinook salmon ESU	✓	✓	✓	✓	✓
Central Valley fall- and late fall-run Chinook salmon ESU	✓	✓	✓	✓	✓
Central Valley steelhead DPS	✓	✓	✓	✓	✓
North American green sturgeon (southern DPS)		✓	✓	✓	✓
Delta smelt*				✓	✓
Longfin smelt					✓
River lamprey	✓	✓	✓		✓
Pacific lamprey	✓	✓	✓		✓
Sacramento splittail				✓	
Hardhead	✓	✓	✓		
White sturgeon		✓	✓	✓	✓
American shad	✓	✓	✓		✓
Striped bass	✓	✓	✓		✓

USACE has placed special emphasis 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 National Marine Fisheries Service (NMFS) and USFWS Biological Opinions (BO). This focus is consistent with:

1. The NMFS (2009) *Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project*;
2. The NMFS (2014) Central Valley salmon and steelhead recovery plan;
3. CALFED’s (2000) Ecosystem Restoration Program Plan and Multi-Species Conservation Strategy;

4. The programmatic determinations for the CALFED Bay-Delta Program, which include the California Department of Fish and Game's (CDFG) Natural Community Conservation Planning Act (NCCPA) approval and the programmatic BOs issued by NMFS and USFWS;
5. USFWS's 1997 Draft Anadromous Fish Restoration Program (AFRP), which identifies specific actions to protect anadromous salmonids;
6. CDFG's 1996 Steelhead Restoration and Management Plan for California, which identifies specific actions to protect steelhead;
7. Sacramento County's American River Parkway Plan (Sacramento County 2008); and
8. CDFG's Restoring Central Valley Streams: A Plan for Action (CDFG 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.

Evaluating impacts on fishery resources requires understanding fish species' life histories, spatial and temporal distributions, and lifestage-specific environmental requirements. General information is provided below regarding legal status and life histories of fish species of focused evaluation in the Action Area.

1.1.1.1.1 Chinook Salmon

Chinook salmon is the most important commercial species of anadromous fish in California. Chinook salmon have evolved a broad array of life history patterns that allow them to take advantage of diverse riverine conditions throughout the year. Chinook salmon exhibit two generalized freshwater life history types (M.C. Healey 1991).

- Adult "stream-type" Chinook salmon enter freshwater months before spawning, while juveniles reside in freshwater for a year or more prior to emigrating.
- "Ocean-type" Chinook salmon spawn soon after entering freshwater and migrate to the ocean as fry or parr within their first year.

Both winter-run and spring-run Chinook salmon tend to enter freshwater in a sexually immature state and delay spawning for weeks or months while holding in freshwater. Fall-run Chinook salmon enter freshwater at an advanced stage of maturity, and generally spawn within a few days or weeks of freshwater entry (M.C. Healey 1991).

Four principal life history variants are recognized in the Central Valley and are named for the timing of their adult spawning runs: fall-run, late fall-run, winter-run, and spring-run. The Sacramento River supports all four runs of Chinook salmon. The larger tributaries to the Sacramento River (American, Feather, and Yuba Rivers) and rivers in the San Joaquin Basin also provide habitat for one or more of these runs. Discussions of each of these runs are provided below.

SACRAMENTO RIVER WINTER-RUN CHINOOK SALMON ESU

Winter-run Chinook salmon occur only in the Sacramento River; therefore, this species account is specific to the Sacramento River. The Sacramento River winter-run Chinook salmon ESU is listed as endangered under both the Federal and state ESAs. In 1993, critical habitat for winter-run Chinook salmon was designated to include:

1. The Sacramento River from Keswick Dam (river mile [RM] 302) to Chipps Island (RM 0) at the westward margin of the Sacramento–San Joaquin Delta;
2. All waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait;
3. All waters of San Pablo Bay westward of the Carquinez Bridge; and
4. All waters of San Francisco Bay north of the San Francisco–Oakland Bay Bridge (NMFS 2014).

On August 15, 2011, after a second 5-year status review (76 Federal Register [FR] 50447), NMFS determined that the ESU had continued to decline since 2005, with a negative point estimate for the 10-year trend. However, the current population size reportedly still falls within the low-risk criterion, and the 10-year average rate of hatchery fish spawning in the river (about 8 percent) remains below the low-risk threshold for hatchery influence (Williams et al. 2011).

Winter-run Chinook salmon are unique because they spawn during the summer when air temperatures usually approach their yearly maximum (NMFS 2014). Hence, primary spawning and rearing habitats for winter-run Chinook salmon are now confined to the coldwater areas between Keswick Dam (RM 302) and Red Bluff Diversion Dam (RBDD) (RM 243) (NMFS 2014). The lower reaches of the Sacramento River, Sacramento–San Joaquin River Delta (Delta), and San Francisco Bay serve as migration corridors for the upstream migration of adult and downstream migration of juvenile winter-run Chinook salmon.

According to NMFS (2009, 2014), adult winter-run Chinook salmon immigration (upstream spawning migration) in the Sacramento River occurs from November through July. The majority of the run passes RBDD from January through May, with the peak passage occurring in mid-March (Hallock and Fisher 1985 as cited in NMFS 2009), although the timing of migration can vary somewhat as a result of changes in river flows, dam operations, and water year type (Yoshiyama et al. 1998 and Moyle 2002, both as cited in NMFS 2009). Winter-run Chinook salmon spawn primarily between mid-April and mid-August, with the peak spawning generally occurring during June (Vogel and Marine 1991). Winter-run Chinook salmon embryo incubation in the Sacramento River can extend into September during wet water years (Vogel and Marine 1991).

During the Chinook salmon juvenile rearing and downstream movement lifestage, salmonids prefer stream margin habitats with sufficient depths and velocities to provide suitable cover and foraging opportunities. Juvenile Chinook salmon reportedly use river channel depths ranging from 0.9 foot to 2.0 feet, and most frequently use water velocities ranging from 0 feet per second (ft/s) to 1.3 ft/s (Raleigh et al. 1986). The water temperature reported for maximum growth of juvenile Central Valley Chinook salmon is 66.2 degrees Fahrenheit (°F) (Cech and Myrick 1999).

Winter-run Chinook salmon fry rearing in the upper Sacramento River exhibit peak abundance during September, with fry and juvenile emigration past RBDD occurring as early as mid-July and sometimes continuing through March in dry water years (NMFS 1997 and Vogel and Marine 1991, both as cited in NMFS 2014). From 1995 to 1999, all winter-run Chinook salmon outmigrating as fry passed RBDD by October, and all outmigrating pre-smolts and smolts passed RBDD by March (Martin et al. 2001 as cited in NMFS 2014). Juvenile emigration past Knights Landing occurs primarily between November and March, peaking in December, with some emigration continuing through May in some years (Snider and Titus 2000a). The numbers of juvenile winter-run Chinook salmon caught in rotary screw traps at the Knights Landing sampling location were reportedly dependent on the magnitude of flows during the emigration period (Snider and Titus 2000a). Additional information on the life history and habitat requirements of winter-run Chinook salmon is available in NMFS (2009, 2014).

According to NMFS (2014), juvenile winter-run Chinook salmon can occur in the Delta primarily from November through early May, based on size-at-date criteria from trawl data in the Sacramento River at West Sacramento (RM 57) (USFWS 2001). Juveniles reportedly remain in the Delta until they reach a fork length (FL) of about 118 millimeters (mm) and are from 5 to 10 months of age. Emigration to the ocean begins as early as November and continues through May (Fisher 1994 and Myers et al. 1998, both as cited in NMFS 2014).

CENTRAL VALLEY SPRING-RUN CHINOOK SALMON ESU

Because of the significantly reduced range and small size of remaining spring-run Chinook salmon populations, the Central Valley spring-run Chinook salmon ESU was listed as a threatened species under both the Federal and state ESAs (64 FR 50393, September 16, 1999). Critical habitat was designated on September 2, 2005 (70 FR 52488) and includes the mainstem Sacramento River from Chipps Island (RM 0) to downstream of Keswick Dam, and stream reaches such as those of the Feather and Yuba Rivers; Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear Creeks; and portions of the northern Delta.

Sacramento River spring-run Chinook salmon are known to use the Sacramento River as a migratory corridor to spawning areas in upstream tributaries. Historically, spring-run Chinook salmon did not use the mainstem Sacramento River downstream of the Shasta Dam site except as a migratory corridor to and from headwater streams (CDFG 1998).

As reported by NMFS (2014), adult spring-run Chinook salmon leave the ocean to begin their upstream migration in late January and early February (CDFG 1998) and enter the Sacramento River between March and September, primarily in May and June (Moyle 2002; Yoshiyama et al. 1998). Lindley et al. (2007) state that adult spring-run Chinook salmon migrate from the Sacramento River into spawning tributaries primarily between mid-April and mid-June (NMFS 2009). Butte Creek spring-run Chinook salmon adults migrate from February through June, with the peak occurring in mid-April (SJRRP 2010).

The primary characteristic distinguishing spring-run Chinook salmon from the other runs of Chinook salmon is that adult spring-run Chinook salmon hold in areas proximal to spawning grounds during the summer until their eggs fully develop and become ready for spawning. Adult spring-run Chinook salmon immigration and holding in the Central Valley occurs from mid-February through September (CDFG

1998; Lindley et al. 2004). The entire potential spring-run Chinook salmon holding and spawning habitat in the mainstem Sacramento River is located between Keswick Dam and RBDD (CDFG 1998).

Spring-run Chinook salmon spawning occurs during September and October depending on water temperatures (NMFS 2009). Spawning and embryo incubation has been reported to occur primarily during September through mid-February, with spawning peaking in mid-September (DWR 2004b; Moyle 2002; Vogel and Marine 1991). Survival of Chinook salmon eggs and alevins is believed to decrease rapidly when incubation temperatures exceed about 56°F for much or all of the incubation period (Reclamation 1991). The upper optimum water temperature for Chinook salmon egg development is reported to be 56°F (NMFS 1993). For maximum survival of Chinook salmon eggs and yolk-sac larvae in the Central Valley, USFWS (1995) suggested an upper water temperature value of 56.0°F. Water temperatures above 56°F reportedly result in significantly higher Chinook salmon alevin mortality in the Sacramento River (USFWS 1999). Consistently higher egg losses resulted at water temperatures above 60.0°F than at lower temperatures (Johnson and Brice 1953).

Boles et al. (1988) found that eggs incubated at constant water temperatures greater than 60°F or less than 38°F have suffered high mortalities. Survival increases, however, for eggs taken at high water temperatures but incubated at temperatures that gradually decline to the mid-40°F-to-mid-50°F range. Mortalities in fry were reduced to low levels when eggs were incubated at constant temperatures of from 50°F to 55°F, or under declining temperatures from initial incubation temperatures up to 60°F.

Spring-run Chinook salmon fry emerge from the gravel from November to March (Moyle 2002) and have highly variable emigration timing (NMFS 2009). Some juveniles begin emigrating soon after emergence from the gravel, whereas others over-summer and emigrate as yearlings with the onset of intense fall storms (CDFG 1998). The emigration period for spring-run Chinook salmon generally extends from November to early May, with up to 69 percent of the young-of-the-year (YOY) fish outmigrating through the lower Sacramento River and Delta during this period (CDFG 1998 as cited in NMFS 2009). As described in NMFS (2009), juvenile spring-run Chinook salmon emigration at RBDD occurs primarily from November through January and can extend into mid-May. Peak movement of yearling spring-run Chinook salmon in the Sacramento River at Knights Landing occurs in December, and again in March and April for YOY juveniles (NMFS 2009). However, juveniles also have been observed between November and the end of May (Snider and Titus 2000a).

Water temperature is generally considered to be the most limiting factor for the juvenile rearing lifestage, particularly during late spring. Water temperatures reported to be optimal for rearing Chinook salmon fry and juveniles are between 45°F and 65°F (NMFS 2002; Rich 1987; Seymour 1956). Raleigh et al. (1986) reviewed the available literature on Chinook salmon thermal requirements and suggested an upper limit of 75°F and a range of suitable water temperatures of about 53.6°F to 64.4°F. The smoltification process can become compromised at water temperatures above 62.6°F (Zedonis and Newcomb 1997).

Additional information on the life history and habitat requirements of spring-run Chinook salmon can be found in NMFS (2009, 2011, 2014).

CENTRAL VALLEY FALL-/LATE FALL-RUN CHINOOK SALMON ESU

Central Valley fall-run and late fall-run Chinook salmon are considered by NMFS to be the same ESU (64 FR 50394). NMFS determined that listing this ESU as threatened was not warranted (64 FR 50394) but subsequently classified it as a species of concern because of specific risk factors, including population size and hatchery influence (69 FR 19975). The Central Valley fall-run and late fall-run Chinook salmon ESU also is listed as a state species of special concern (CDFW 2014). The ESU includes all naturally spawned populations of fall-run Chinook salmon in the Sacramento and San Joaquin River basins and their tributaries east of Carquinez Strait, California. The Central Valley fall-run and late fall-run Chinook salmon ESU is not listed as threatened or endangered, so critical habitat has not been designated.

Annual run sizes of fall-run and late fall-run Chinook salmon are reported in GrandTab, a database administered by CDFW for the Central Valley that includes reported run size estimates from 1952 through 2013 for fall-run Chinook salmon and from 1970 through 2013 for late fall-run Chinook salmon (CDFW 2014). The Central Valley fall-/late fall-run Chinook salmon ESU has displayed broad fluctuations in adult abundance. Between 1959 and 1970, escapement of fall-run Chinook salmon in the mainstem Sacramento River exceeded 100,000 fish every year except for one year (1967). Since 1970, escapement in the mainstem Sacramento River generally has not exceeded 100,000 (Reclamation 2008a).

More recent estimates of fall-run Chinook salmon in the Sacramento River and its tributaries have ranged from 28,669 in 2009 to 738,652 in 2002. (This number does not include the lower Yuba and Feather Rivers because GrandTab does not distinguish between fall-run and spring-run Chinook salmon in-river spawners and does not include the Feather River Fish Hatchery [FRFH]). Since 2009, fall-run Chinook salmon escapement in the Sacramento River and its tributaries increased to over 100,000 spawners during 2010 through 2012, and over 300,000 spawners during 2013 (CDFW 2014). Hatchery escapement of fall-run Chinook salmon also has increased in recent years, from about 20,000 during 2007 through 2009 to over 100,000 during 2012 and 2013 (CDFW 2014).

As a result of very low returns of fall-run Chinook salmon to the Central Valley in 2007 and 2008, there was a complete closure of the commercial and recreational ocean Chinook salmon fishery in 2008 and 2009 (Lindley et al. 2009). In April 2009, the Pacific Fishery Management Council (PFMC) and NMFS adopted a closure of all commercial ocean salmon fishing through April 30, 2010, and placed restrictions on inland salmon fisheries (CDFG 2009). Fishing in 2010 was also constrained for the same reasons as in the previous two years. In 2011, both CDFW and PFMC approved reopening the commercial and recreational fishing season.

Although Central Valley fall-run and late fall-run Chinook salmon are considered to be the same ESU, because they differ in lifestage-specific timing, they are discussed and considered separately in this evaluation.

Fall-run Chinook Salmon

In the Central Valley, fall-run Chinook salmon are the most numerous of the four salmon runs and continue to support commercial and recreational fisheries of significant economic importance. Fall-run Chinook salmon is currently the largest run of Chinook salmon using the Sacramento River system.

Adult fall-run Chinook salmon enter the Sacramento and San Joaquin Rivers from July through December (Reclamation 2008a). Migration of adult fall-run Chinook salmon into the Sacramento River Basin reportedly begins in July, peaks in October, and ends in December (Vogel 2011). Unlike spring-run Chinook salmon, adult fall-run Chinook salmon do not exhibit an extended over-summer holding period, based on studies conducted in the lower Yuba River (RMT 2010, 2013). Rather, they stage for a relatively short period of time prior to spawning. Fall-run Chinook salmon generally spawn from October through December (Reclamation 2008a; Vogel 2011). Fall-run Chinook salmon spawning in the mainstem Sacramento River generally occurs between Keswick Dam and Princeton (CDFW 2013).

In general, the fall-run Chinook salmon spawning and embryo incubation period extends from October through March (NMFS 2004; Vogel and Marine 1991).

In the Sacramento River Basin, fall-run Chinook salmon juvenile emigration occurs from January through June (Moyle 2002; Vogel 2011; Vogel and Marine 1991). Juvenile fall-run Chinook salmon emigration at RBDD begins as early as December, peaks in January and February during winter flow events, decreases through the spring, and extends to as late as June or July (Gaines and Martin 2001 as cited in USFWS and CDFG 2012).

Late Fall-run Chinook Salmon

Central Valley late fall-run Chinook salmon escapement is dominated by spawners in the Sacramento River above RBDD and hatchery production at Coleman National Fish Hatchery on Battle Creek, with varying numbers of spawners in the Sacramento River downstream of RBDD and relatively few spawners in Battle Creek (CDFW 2014).

Adult immigration of late fall-run Chinook salmon in the Sacramento River generally begins in late October and extends through March (USFWS and CDFG 2012). Spawning has been suggested to occur in tributaries to the upper Sacramento River (e.g., Battle, Cottonwood, Clear, Big Chico, Butte and Mill Creeks) and the Feather and Yuba Rivers, although these fish do not make up a large proportion of the late fall-run Chinook population (USFWS 1995). Late fall-run Chinook salmon spawning generally occurs from January through April in the mainstem Sacramento River, primarily from Keswick Dam to RBDD (Moyle 2002; NMFS 2004; Vogel and Marine 1991).

Late fall-run Chinook salmon embryo incubation can extend from January through June (USFWS and CDFG 2012; Vogel and Marine 1991). Post-emergent fry and juveniles rear and disperse from their spawning and rearing grounds in the upper Sacramento River and its tributaries during the April through December period, with low rates of emigration occurring from July into the fall, although fall and winter freshets can increase emigration rates (Vogel 2011; Vogel and Marine 1991). According to USFWS and CDFG (2012), juvenile late-fall run Chinook salmon rear in the upper Sacramento River from late April through the following winter before emigrating to the estuary. Late fall-run Chinook salmon yearlings can use flow events as migration cues during the late-fall and winter, and some individuals could continue to emigrate for up to 5 months (Reclamation 2008a).

1.1.1.1.2 Central Valley Steelhead DPS

NMFS listed the Central Valley steelhead DPS as threatened under the Federal ESA on March 19, 1998, and reaffirmed its threatened status on January 5, 2006 (71 FR 834). On February 16, 2000, NMFS published a final rule designating critical habitat for Central Valley steelhead (65 FR 7764). Critical habitat was designated to include all river reaches accessible to listed steelhead in the Sacramento and San Joaquin Rivers and their tributaries in California. NMFS proposed new critical habitat for spring-run Chinook salmon and Central Valley steelhead on December 10, 2004 (69 FR 71880) and published a final rule designating critical habitat for these species on September 2, 2005. This critical habitat designation includes the Action Area.

Historical information on Central Valley steelhead populations is limited. Steelhead ranged throughout accessible tributaries and headwaters of the Sacramento and San Joaquin Rivers before major dam construction, water development, and other watershed disturbances. Many of the freshwater habitat factors cited for declines in spring-run Chinook salmon runs generally apply to steelhead as well, because of their need for tributaries and headwater streams where cool, well-oxygenated water is available year-round. Historical declines in steelhead abundance have been attributed largely to dams that eliminated access to most of their historic spawning and rearing habitat and restricted steelhead to unsuitable habitat below the dams. Other factors that have contributed to the decline of steelhead and other salmonids include habitat modification, over-fishing, disease and predation, inadequate regulatory mechanisms, climate variation, and artificial propagation (NMFS 1996).

Adult steelhead immigration into Central Valley streams typically begins in August, continues into March or April (McEwan 2001; NMFS 2014), and generally peaks during January and February (Moyle 2002). Adult steelhead immigration can occur during all months of the year at RBDD, with upstream migration occurring primarily during September and October (NMFS 2009). In Mill and Deer Creeks, adult steelhead immigration has been represented to not occur from July through September, with peak migration occurring from October through mid-March (NMFS 2009).

Water temperatures can affect the timing of adult spawning and migrations and can affect the egg viability of holding females. Few studies have been published that examine the effects of water temperature on either immigration or holding, and none have been recent (Bruin and Waldsdorf 1975; McCullough et al. 2001). The available studies suggest that adverse effects could occur to immigrating and holding steelhead at water temperatures that exceed the mid-50°F range and that immigration could be delayed if water temperatures approach about 70°F (Bruin and Waldsdorf 1975; McCullough et al. 2001).

Steelhead reportedly spawn from December through April, with peaks from January though March, in small streams and tributaries (NMFS 2009). Steelhead spawning in the mainstem Sacramento River is probably limited to the area upstream of RBDD, although specific information regarding steelhead spawning within the mainstem Sacramento River is limited because of lack of monitoring (NMFS 2004, 2009). Water depth range preference for spawning steelhead has been most frequently observed between 0.3 foot and 4.9 feet (Moyle 2002). The reported preferred water velocity for steelhead spawning is 1.5 ft/s to 2.0 ft/s (USFWS 1995).

Optimal steelhead spawning temperatures have been reported to range from 39°F to 52°F (CDFG 1991). The upper water temperature value for optimal egg incubation has been reported as 52°F (Humpesch 1985; NMFS 2001, 2002; Reclamation 1997; USFWS 1995). In the lower American River, fish surveys that identified newly emerged steelhead through May indicated that incubating steelhead embryos do survive at water temperatures above the reported preferred range (NMFS 2007). Most of the studies of *O. mykiss* embryo incubation conducted at or near 54.0°F report high survival and normal development (Kamler and Kato 1983; Redding and Schreck 1979; Rombough 1988), and some evidence suggests that symptoms of thermal stress arise at or near 54.0°F (Humpesch 1985; Timoshina 1972). Thus, water temperatures near 54°F could represent an inflection point between properly functioning water temperature conditions and the conditions that cause negative effects on steelhead spawning and embryo incubation.

Embryonic mortality increases sharply and development becomes retarded at incubation temperatures greater than or equal to 57.0°F (Rombough 1988; Velsen 1987). Thus, from the available literature, water temperatures in the low-50°F range appear to support high embryo survival, with substantial mortality to steelhead eggs reportedly occurring at water temperatures in the high-50°F range and above. McEwan (2001) reports that steelhead fry and fingerlings rear and move downstream in the Sacramento River year-round, although most steelhead smolts reportedly emigrate from January through June.

Based on CDFW sampling at Knights Landing, juvenile steelhead emigration occurs primarily from January through May with peaks during March and April (Snider and Titus 2000a). Juvenile steelhead emigration at Knights Landing has been variously reported as not occurring from mid-May through mid-December, or June through October (NMFS 2009). Although the reported preferred water temperatures for fry and juvenile steelhead rearing range from 45°F to 65°F, most of the literature on steelhead smolting suggests that water temperatures of 52°F (Adams et al. 1975; Myrick and Cech 2001; Rich 1987) or less than 55°F (EPA 2003; McCullough et al. 2001; Wedemeyer et al. 1980; Zaugg and Wagner 1973) are required for successful smoltification to occur.

1.1.1.1.3 Green Sturgeon

After completion of NMFS's North American green sturgeon status review (Adams et al. 2002), NMFS determined that green sturgeon consists of a northern DPS and southern DPS but that neither warranted listing under the ESA. However, because of uncertainties in the structure and status of both DPSs, NMFS added both the northern and southern DPSs to NMFS's species of concern list in 2004 (69 FR 19975). After a legal challenge to NMFS's determination that neither DPS warranted listing under the ESA, NMFS produced an updated status review in 2005, proposed the southern DPS to be listed as threatened under the ESA, and made a final rule to list the southern DPS as threatened in 2006 (71 FR 17757).

Within the Action Area, southern DPS green sturgeon occur only in the Sacramento and Feather Rivers and in the Delta region. On April 7, 2006, a final rule was issued and adopted to list the southern DPS as threatened under the ESA. The final rule became effective June 6, 2006 (71 FR 17757). NMFS (2005) states that the main factor for the decline of the southern DPS of green sturgeon is the reduction of spawning habitat in the Sacramento and Feather Rivers. On October 9, 2009, NMFS (74 FR 52300) designated critical habitat for the southern DPS of North American green sturgeon. In the Central Valley, critical habitat for green sturgeon includes the Sacramento River, lower Feather River, lower Yuba River, the Sacramento–San Joaquin Delta, and the San Francisco Estuary.

Green sturgeon adults in the Sacramento River are reported to begin their upstream spawning migrations into freshwater during late February, prior to spawning between March and July, with peak spawning believed to occur between April and June (Adams et al. 2002). NMFS (2009) reports that, based on recent data gathered from acoustically tagged adult green sturgeon, they migrate upstream during May as far as the mouth of Cow Creek near Bend Bridge on the Sacramento River. Heublein et al. (2009) observed that green sturgeon enter San Francisco Bay in March and April and migrate rapidly up the Sacramento River to the region between Glenn Colusa Irrigation District (GCID) and Cow Creek. The fish lingered at these regions at the apex of their migration for 14 to 51 days and presumably engaged in spawning behavior before moving back downriver (Heublein et al. 2009). Brown (2007) suggested that spawning in the Sacramento River can occur from April to June and that the potential spawning period can extend from late April through July, as indicated by the rotary screw trap data at RBDD from 1994 to 2000.

Since 2008 and including 2011 data, green sturgeon spawning habitat has been confirmed within a 58-mile reach of the Sacramento River extending from about RM 207 to RM 265 (Poytress et al. 2012). After spawning, the adults hold over in the upper Sacramento River between RBDD and GCID until November (Klimley et al. 2007). Some adult North American green sturgeon rapidly leave the system following their suspected spawning activity and re-enter the ocean in early summer (Heublein 2006).

Larvae and juvenile green sturgeon appear to be nocturnal (Cech et al. 2000), which could protect them from downstream displacement (LCFRB 2004). Green sturgeon larvae and juveniles (up to day 84) forage day and night, but activity is reported to peak at night. At days 110 to 118, juvenile green sturgeon are reported to move downstream at night, and habitat preference suggests that juveniles prefer deep pools with low light and some rock structure (Kynard et al. 2005). Wintering juveniles forage actively at night between dusk and dawn and are inactive during the day, seeking the darkest available habitat (Kynard et al. 2005).

Juvenile green sturgeon migrate downstream and feed mainly at night. Juvenile green sturgeon are taken in traps at RBDD and the GCID diversion in Hamilton City, primarily in May through August, with peak counts reported for June and July (68 FR 4433). Juvenile emigration can reportedly extend through September (Environmental Protection Information Center et al. 2001).

1.1.1.1.4 Delta Smelt

USFWS listed delta smelt as a threatened species under the ESA in March 1993 (58 Code of Federal Regulations [CFR] 12854), and critical habitat for delta smelt has been designated within the area. Critical habitat for delta smelt is defined as follows:

> *Areas and all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma Sloughs; and the existing contiguous waters contained within the Delta.* (USFWS 1994)

Delta smelt also is listed as threatened under the California Endangered Species Act (CESA).

Delta smelt is a euryhaline fish that is native to the Sacramento–San Joaquin Estuary. As a euryhaline species, delta smelt tolerate wide-ranging salinities but rarely occur in waters with salinities greater than 10 parts per thousand (ppt) to 14 ppt (Baxter et al. 1999). Similarly, delta smelt tolerate a wide range of water temperatures, as shown by their being found at water temperatures from 42.8°F to 82.4°F (Moyle 2002). Delta smelt are typically found within Suisun Bay and the lower reaches of the Sacramento and San Joaquin Rivers, although they are occasionally collected within the Carquinez Strait and San Pablo Bay.

The delta smelt is a small, slender-bodied fish with a typical adult size of 2 to 3 inches, although some individuals can reach lengths of 5 inches.

During the late winter and spring, delta smelt migrate upstream to spawn. Shortly before spawning, adults migrate upstream from the brackish-water estuarine areas into river channels and tidally influenced backwater sloughs.

In the Sacramento–San Joaquin River system, delta smelt spawning reportedly occurs from February through May, with embryo incubation extending through June (Wang 1986). Delta smelt are thought to spawn in shallow fresh or slightly brackish waters in tidally influenced backwater sloughs and channel edgewaters (Wang 1986). Although most delta smelt spawning seems to take place at 44.6°F to 59°F, gravid delta smelt and recently hatched larvae have been collected at 59°F to 71.6°F. Thus, it is likely that spawning can take place over the entire range of 44.6°F to 71.6°F (Moyle 2002).

Females generally produce between 1,000 and 2,600 eggs (Bennett 2005), which adhere to vegetation and other hard substrates. Larvae hatch in between 10 and 14 days (Wang 1986) and are planktonic (float with water currents) as they are transported and dispersed downstream into the low-salinity areas within the western Delta and Suisun Bay (Moyle 2002).

Delta smelt grow rapidly, with the majority of smelt living only 1 year. Most adult smelt die after spawning in the early spring, although they might be capable of spawning twice during a season (Bennett 2005; Brown and Kimmerer 2001; Moyle 2002). Delta smelt feed entirely on zooplankton. For the majority of their 1-year lifespan, delta smelt inhabit areas within the western Delta and Suisun Bay characterized by salinities of about 2 ppt. Historically, they have been abundant in low (around 2-ppt) salinity habitats. Delta smelt occur in open surface waters and shoal areas (USFWS 1994).

Because delta smelt typically have a 1-year lifespan, their abundance and distribution have been observed to fluctuate substantially within and among years. Delta smelt abundance appears to be reduced during years characterized by either unusually dry years with exceptionally low outflows (e.g., 1987 through 1991) or unusually wet years with exceptionally high outflows (e.g., 1982 and 1986). Other factors thought to affect the abundance and distribution of delta smelt within the Bay-Delta estuary include entrainment in water diversions, changes in the zooplankton community resulting from introductions of non-native species, and potential effects of toxins.

1.1.1.1.5 Longfin Smelt

Longfin smelt were listed as threatened under the CESA in 2009, and the San Francisco Bay-Delta DPS (Bay-Delta DPS) of longfin smelt was designated as a Federal candidate species by USFWS in 2012.

In response to a 2007 petition to list the Bay-Delta DPS of longfin smelt as endangered or threatened under the ESA, USFWS determined in 2009 that the Bay-Delta population of longfin smelt did not meet the discreteness element of USFWS's DPS policy and, therefore, was not a valid DPS and was not a listable entity under the ESA. In response to a legal complaint regarding USFWS's 2009 determination, USFWS conducted a more comprehensive rangewide status review of longfin smelt and further evaluated whether the Bay-Delta population of longfin smelt constitutes a DPS. In 2012, USFWS determined that listing the Bay-Delta DPS of longfin smelt was warranted, but the listing was precluded by higher-priority actions to amend the List of Endangered and Threatened Wildlife and Plants. Therefore, USFWS added the Bay-Delta DPS of longfin smelt to the USFWS candidate species list.

Longfin smelt is a euryhaline species. This is particularly evident in the Delta, where longfin smelt are found in areas ranging from almost pure seawater upstream to areas of pure freshwater. In this system, they are most abundant in San Pablo and Suisun Bays (Moyle 2002). They tend to inhabit the middle to lower portion of the water column. Longfin smelt spend the early summer in San Pablo and San Francisco Bays, generally moving into Suisun Bay in August. Most spawning is from February to April at water temperatures of 44.6°F to 58.1°F (Moyle 2002). The majority of adults perish following spawning.

Longfin smelt eggs have adhesive properties and are probably deposited on rocks or aquatic plants upon fertilization. Newly hatched longfin smelt are swept downstream into more brackish parts of the estuary. Strong Delta outflow is thought to correspond with longfin smelt survival, as higher flows transport longfin smelt young to more-suitable rearing habitat in Suisun and San Pablo Bays (Moyle 2002). Longfin smelt are rarely observed upstream of Rio Vista in the Delta (Moyle et al. 1995).

1.1.1.1.6 River Lamprey

River lamprey is not listed under the Federal ESA or the CESA, although it is identified as a California species of special concern.

River lampreys have generally not been studied in California (Moyle 2002). Most of the available information on their life history is based on studies in British Columbia (UC Davis 2012). Adult river lampreys are reportedly fish parasites in California rivers (Hart 1973, Kimsey and Fisk 1964, and Withler 1955, all as cited in Wang 1986). Their most common prey species are believed to be herring and salmon (UC Davis 2012).

Adult river lampreys migrate into freshwater in the fall and spawn during the winter or spring in small tributary streams, although the timing and extent of their migration in California is poorly known (UC Davis 2012). Wang (1986) reports that adult river lampreys spawn from April to June in small tributary streams, while Moyle (2002) reports that river lampreys spawn during February through May. Adults create saucer-shaped depressions in gravelly riffles for spawning by moving rocks with their mouths (UC Davis 2012).

Larval river lampreys (ammocoetes) burrow into sandy or muddy substrates near banks (Hart 1973 and Scott and Crossman 1973, both as cited in Wang 1986) and remain in silt-sand backwaters and eddies (UC Davis 2012). The ammocoete lifestage has been reported to last several years (Hart 1973 as cited in Wang 1986) and is believed be about 3 to 5 years (Moyle 2002). During the final stages of metamorphosis, ammocoetes congregate immediately upriver from saltwater and enter the ocean during late spring (Moyle et al. 1995), which indicates that downstream migration of juveniles in the Sacramento River can occur during the winter through spring.

River lampreys are reported to spawn at water temperatures ranging from 55.4°F to 56.3°F (Wang 1986), after which the adults die. Studies addressing the thermal requirements of early lifestages of Pacific and river lampreys have been conducted for the Columbia River Basin (Meeuwig et al. 2005). However, because of river lampreys' scarcity and the consequent inability to evaluate their early lifestage thermal requirements, river lampreys were not assessed. Laboratory studies and analyses did suggest, however, that consistently high survival and low occurrence of embryonic developmental abnormalities occur in Pacific lampreys at water temperatures ranging from 50°F to 64.4°F, with a significant decrease in survival and increase in developmental abnormalities at 71.6°F. Presumably, the adults need clean, gravelly riffles in permanent streams for spawning, while the ammocoetes (i.e., larvae) require sandy backwaters or stream edges in which to bury themselves, where water quality is continuously good and water temperatures do not exceed 77°F.

Ammocoetes begin their transformation into adults when they are about 12 centimeters (cm) (4.7 inches) total length (TL) during the summer. The process of metamorphosis can take 9 to 10 months, the longest known for any lamprey species. Lampreys in the final stages of metamorphosis congregate immediately upriver from saltwater and enter the ocean in late spring. Adults apparently spend only 3 to 4 months in saltwater, where they grow rapidly, reaching 25 to 31 cm (9.8 to 12.2 inches) TL (Moyle 2002).

1.1.1.1.7 Pacific Lamprey

Pacific lamprey is not listed under the Federal or California ESAs, although it is identified as a species of concern by the USFWS Portland office. Pacific lamprey was petitioned for protection under the ESA in 2003, but USFWS determined that insufficient population information existed to warrant its listing. Pacific lamprey is also considered a covered species in the Bay-Delta Conservation Plan (BDCP) (ICF 2013).

Adult Pacific lampreys typically migrate into freshwater streams between March and June (Moyle 2002), but upstream migrations have been observed during January and February (Entrix 1996 and Trihey and Associates 1996a, both as cited in Moyle 2002). Most upstream movement is reported to occur at night (Chase 2001 as cited in USFWS 2010; Moyle 2002).

Spawning reportedly generally occurs between March and July (USFWS 2010). The spawning habitat requirements of Pacific lampreys have not been well studied, but it is believed that adults need clean, gravelly riffles in permanent streams to spawn successfully and that these requirements are similar to those of salmonids (Moyle 2002; USFWS 2010). Moyle (2002) reported that, although historic spawning locations of Pacific lampreys are not known, they have been observed spawning in Deer Creek and likely could have migrated over 300 miles to spawn. Typically, spawning habitat is located near suitable ammocoete habitat, and low-to-moderate-gradient stream reaches with a mix of silt and cobble substrate are reported to potentially offer optimal spawning and rearing habitat (USFWS 2010).

Moyle (2002) reported that Pacific lamprey embryos hatch in about 19 days at 15 degrees Celsius (°C) (59°F). Eggs hatch into ammocoetes, spend a short time in the nest, and then drift downstream to suitable areas in sand, silt, or mud substrates (Moyle 2002; USFWS 2010).

Typical ammocoete habitat includes areas of low velocity with muddy or sandy substrate into which they burrow and remain in freshwater for about 3 to 7 years. Although mostly sedentary during their freshwater residence, ammocoetes are reported to have the ability to move downstream when disturbed or during high-flow events (USFWS 2010).

Ammocoetes begin metamorphosis into macropthalmia (juveniles) when they reach 14 to 16 cm TL. Juveniles reportedly drift and swim downstream between late fall and spring (USFWS 2010), but others report that downstream migration is associated with increased streamflows during the winter and spring (see USFWS 2010 and the references therein). Juvenile lifestages of lamprey (ammocoetes and macropthalmia), as well as adult lampreys, are reported to stay close to the stream bottom during their migration periods. Juveniles also are reported to prefer low light conditions and migrate mostly during the night (Moursund et al. 2003 as cited in Chelan County Public Utility District 2006).

1.1.1.1.8 Sacramento Splittail

USFWS removed Sacramento splittail from the list of threatened species on September 22, 2003, and did not identify it as a candidate for listing under the ESA. However, Sacramento splittail is identified as a California species of special concern (CDFW 2014). Splittail are believed to occur in the Sacramento River and its major tributaries, including the lower Feather and American Rivers.

Sacramento splittail spawning can occur anytime between late February and early July, but peak spawning occurs in March and April (Moyle 2002). DWR (2004a) reported that Sacramento splitttail spawning, egg incubation, and initial rearing in the Feather River occurs primarily during February through May. A gradual upstream migration begins in the winter to forage and spawn, although some spawning activity has been observed in Suisun Marsh (Moyle 2002). During wet years, upstream migration is much more directed, and fish tend to swim farther upstream (Moyle 2002). Attraction flows are necessary to initiate migration onto floodplains where spawning occurs (Moyle et al. 2004). Spawning generally occurs in water with depths of 3 to 6 feet over submerged vegetation where eggs adhere to vegetation or debris until hatching (Moyle 2002; Wang 1986). Caywood (1974) reports older fish are generally the first to spawn. Based on field observations and a review of splittail thermal tolerance literature, DWR (2004a) concluded that water temperatures from 45°F to 75°F are suitable for splittail spawning.

Eggs normally incubate for 3 to 7 days depending on water temperature (Moyle 2002). After hatching, splittail larvae remain in shallow weedy areas until water recedes, and then they migrate downstream (Meng and Moyle 1995). The largest catches of Sacramento splittail larvae occurred in 1995, a wet year when outflow from inundated areas peaked during March and April (Meng and Matern 2001).

Juvenile Sacramento splittail prefer shallow-water habitat with emergent vegetation during rearing (Meng and Moyle 1995). Sommer et al. (2002) report juvenile splittail are more abundant in the Yolo Bypass floodplain in the shallowest areas of the wetland with emergent vegetation. Juvenile splittail are classified as benthic foragers (USFWS 1995). Downstream movement of juvenile splittail appears to coincide with drainage from the floodplains between May and July (Caywood 1974; Meng and Moyle 1995; Sommer et al. 1997).

Sacramento splittail attain sexual maturity by the end of their second winter at a length of 180 to 200 mm (Daniels and Moyle 1983). The normal lifespan of Sacramento splittail ranges from 5 to 7 years (Caywood 1974; Meng and Moyle 1995). Adults can attain a length of over 300 mm (USFWS 1995). Adults are normally found in relatively shallow (<12 feet) water in brackish tidal sloughs, such as Suisun Marsh, but can also occur in freshwater areas with either tidal or riverine flows (Moyle et al. 2004). Splittail are also known to withstand very low dissolved oxygen (O_2) levels (<1 milligram O_2), a wide range of water temperatures (41.0°F to 75.2°F), and salinities of 6 to 10 ppt (Moyle et al. 2004).

Floodplain inundation during March and April appears to be the primary factor contributing to splittail abundance. Moyle et al. (2004) report that moderate-to-strong year classes of splittail develop when floodplains are inundated for 6 to 10 weeks between late February and late April. Reportedly, when floodplains are inundated for less than a month, strong year classes are not produced (Sommer et al. 1997).

Sommer et al. (1997) discuss the resiliency of splittail populations and suggest that, because of their relatively long lifespan, high reproductive capacity, and broad environmental tolerances, splittail populations can recover rapidly even after several years of drought conditions. This suggests that frequent floodplain inundations are not necessary to support a healthy population. Moyle et al. (2004) report that the ability of at least a few splittail to reproduce under even the worst flow conditions ensures that the population will persist indefinitely, despite downward trends in total population size during periods of drought.

Historically, Sacramento splittail were found as far up the Sacramento River as Redding, yet today are largely absent from the upper parts of their distribution range (Moyle 2002). It has been suggested that, during wet years, Sacramento splittail might migrate up the Sacramento River as far as RBDD (Moyle 2002). However, the extent of successful spawning in these upstream areas is unclear given that spawning reportedly occurs in inundated, vegetated floodplains.

1.1.1.1.9 Hardhead

Hardhead, a California species of special concern, is a large, native cyprinid (minnow) species that is widely distributed throughout the Sacramento–San Joaquin River system, although it is absent from the valley reaches of the San Joaquin River (Moyle 2002).

Hardheads generally occur in large, undisturbed low-to-mid-elevation rivers and streams of the region (Moyle 2002). Hardheads mature during their third year and often make spawning migrations, which occur in the spring, into smaller tributary streams (Moyle 2002). Most hardhead spawning is reportedly restricted to foothill streams (Wang and Reyes 2007). Hardheads reportedly spawn primarily during April and May (Grant and Maslin 1999; Reeves 1964) but might spawn into July in Sacramento River tributaries and into August in San Joaquin River tributaries (Wang and Reyes 2007). Estimates based on juvenile recruitment suggest that hardheads spawn by May and June in Central Valley streams (Wang 1986). Spawning behavior has not been documented, but hardheads are believed to elicit mass spawning in gravel riffles (Moyle 2002). Suitable temperatures for spawning hardhead can range from 59°F to 64.4°F (Wang 1986). Hardheads forage the bottoms of deep pools for aquatic insects, occasionally taking drifting insects on the surface (Moyle 2002).

Little is known about lifestage-specific temperature requirements of hardheads. However, temperatures ranging from about 65°F to 75°F are believed to be suitable (Cech et al. 1990), although most streams in which hardheads occur have summer water temperatures higher than 20°C (about 68°F). A recent laboratory study conducted on adult and juvenile hardheads indicated that they appear to be particularly well-suited to water temperatures below 25°C (77.0°F) and clearly avoid water temperatures above 26°C (78.8°F) (Thompson et al. 2012).

1.1.1.1.10 White Sturgeon

White sturgeon is not listed as threatened or endangered under the Federal or state ESAs, nor is it a Federal species of concern or a state species of special concern. However, white sturgeon is a recreationally important species in the Central Valley and is regulated by CDFW.

The number of adults fluctuates annually and appears to be the result of highly variable juvenile production; the population is dominated by a few strong year classes associated with high spring outflows (Moyle 2002).

Apparently triggered by photoperiod (Doroshov et al. 1997) and increases in river flow (Schaffter 1997), adult white sturgeons initiate their upstream migration into the lower Sacramento River from the Delta during late fall and winter (Kohlhorst and Cech 2001). Some mature adult white sturgeons move up the Sacramento River until they are concentrated near Colusa from March through May (Kohlhorst et al. 1991 as cited in Kohlhorst and Cech 2001).

White sturgeon spawning typically occurs between February and June when water temperatures are 46°F to 66°F (Moyle 2002). It is thought that adults broadcast spawn in the water column in areas with swift current. Fertilized eggs sink and attach to the gravel bottom, where they hatch. Eggs reportedly hatch after 4 days at 61°F (Beer 1981) but can take up to 2 weeks at lower water temperatures (PSMFC 1992). Although exact spawning locations are unknown, white sturgeons are reported to likely spawn between Knights Landing (RM 90) and Colusa (RM 143) (CDFG 2002 and Shafter 1997, both as cited in Beamesderfer et al. 2004; Kohlhorst 1976 as cited in Wang 1986; Moyle 2002), or several kilometers upstream of Colusa (Miller 1972, Kohlhorst 1976, and Schaffter 1997, all as cited in Israel et al. 2011). Vogel (2008) sampled adult sturgeons for a telemetry study near GCID between 2003 and 2006 and sampled white sturgeons as far upstream as RM 165. Juvenile rearing and downstream movement can occur year-round.

1.1.1.1.11 American Shad

American shad occur in the Sacramento River, its major tributaries, the San Joaquin River, and the Delta. Because of its importance as a sport fish, American shad has been the subject of investigations by CDFW. American shad are native to the Atlantic coast and were planted in the Sacramento River in 1871 and 1881 (Moyle 2002).

Adult American shad typically enter Central Valley rivers from April through early July (CDFG 1986), with the majority of immigration and spawning occurring from mid-May through June (Urquhart 1987). Spawning takes place mostly in the main channels of rivers, and generally about 70 percent of the spawning run is made up of first-time spawners (Moyle 2002).When suitable spawning conditions are found, American shad school and broadcast their eggs throughout the water column.

Water temperature is an important factor influencing the timing of spawning. American shad are reported to spawn at water temperatures ranging from about 46°F to 79°F (USFWS 1967), although optimal spawning temperatures are reported to range from about 60ºF to 70°F (Bell 1986; CDFG 1980; Leggett and Whitney 1972; Painter et al. 1979; Rich 1987). Eggs hatch in 6 to 8 days at 62°F; at temperatures near 75°F, eggs reportedly hatch in 3 days (MacKenzie et al. 1985). Egg development and hatching, therefore, are coincident with the spawning period.

Some young shad move downstream into brackish water soon after hatching, but large numbers reportedly remain in freshwater through November when they are 5 to 6 months old (CDFG 2010). Some juvenile American shad rear in estuaries for 1 to 2 years before migrating to the ocean, but the majority of American shad migrate directly to the ocean after transforming from larvae to juveniles, which occurs about 4 weeks after hatching (UC Davis 2015). Juvenile American shad can occur in the Sacramento River year-round (Moyle 2002).

1.1.1.1.12 Striped Bass

Striped bass occur in the Sacramento River, its major tributaries, and the Delta, spending most of their lives in the San Francisco Estuary. Because of its importance as a sport fish, striped bass has been the subject of investigations by CDFW. Substantial striped bass spawning and rearing occurs in the Sacramento River and Delta, although striped bass can typically be found upstream as far as barrier dams (Moyle 2002). Striped bass are native to the Atlantic coast and were first introduced to the Pacific coast in 1879, when they were planted in the San Francisco Estuary (Moyle 2002).

Adult striped bass are present in Central Valley rivers throughout the year, with peak abundance occurring during spring (CDFG 1971; DeHaven 1977, 1979). Adult striped bass are reported to prefer water temperatures from 68°F to 75.2°F (Emmett et al. 1991).

Striped bass spawn in water temperatures ranging from 59°F to 68°F (Moyle 2002). Therefore, spawning can begin in April but peaks in May and early June (Moyle 2002). In the Sacramento River, most striped bass spawning is believed to occur between Colusa and the mouth of the Feather River. In years of higher flow, spawning typically occurs farther upstream than usual because striped bass continue migrating upstream while waiting for temperatures to rise (Moyle 2002). No studies have definitively determined whether striped bass spawn in Sacramento River tributaries, including the lower American and Feather Rivers (CDFG 1971, 1986; DWR 2001).

Eggs are semibuoyant and are distributed throughout the water column by currents (Able and Fahay 1998). Egg survival requires a sufficiently strong current to keep the eggs suspended in the water column. If the current is not strong enough, eggs can settle on the bottom and become smothered (Collette and Klein-MacPhee 2002). After fertilization, eggs hatch within 2 to 3 days, followed by a net movement of the larval fish from upstream locations to downstream, tidal portions of the river (Moyle 2002). Striped bass larvae are generally distributed in the Delta or Suisun Bay, depending on flow through the estuary. In lower-flow years, striped eggs and larvae are generally found in the Delta, while during higher-flow years, eggs and larvae are transported downstream into Suisun Bay (Hassler 1988).

The number of striped bass entering Central Valley streams during the summer is believed to vary with flow levels and food production (CDFG 1986). Sacramento River tributaries can be nursery areas for young striped bass (CDFG 1971, 1986). Juvenile and sub-adult fish have historically been reported to be abundant in the lower American River and lower Yuba River during the fall (DeHaven 1977). Optimal water temperatures for juvenile striped bass rearing have been reported to range from about 61°F to 71°F (Fay et al. 1983).

1.1.2 Lower American River

The Primary Study 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.

As presented in NMFS (2009), historically over 125 miles of riverine habitat were available for anadromous salmonids in the American River watershed including the mainstem and the north, middle, and south forks (Yoshiyama et al. 1996).

In 1955, Folsom and Nimbus Dams were constructed on the mainstem American River about 28 miles and 23 miles, respectively, upstream from the confluence with the Sacramento River. Fish passage facilities were not built at Folsom or Nimbus Dams. Thus, with the closure of Nimbus Dam, upstream access to anadromous salmonids was blocked. Hydrological and ecological changes associated with the construction of Folsom and Nimbus Dams contributed to the extirpation of summer steelhead and spring-run Chinook salmon, which were already greatly diminished as a result of the effects of smaller dams (e.g., Old Folsom Dam and the North Fork Ditch Company Dam) and mining activities (Yoshiyama et al. 1996). All anadromous salmonids are now restricted to the lower 23 miles of the mainstem American River extending from Nimbus Dam downstream to the confluence with the Sacramento River (SWRI 2001). This 23-mile section of the mainstem river is now referred to as the lower American River.

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). 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).

Completion and operation of Folsom and Nimbus Dams resulted in higher flows during fall, lower flows during winter and spring, and higher flows during summer.

Seasonal water temperature regimes also have changed with development in the American River Basin, particularly with the construction and operation of Folsom and Nimbus Dams. Prior to the completion of Folsom and Nimbus Dams in 1955, maximum water temperatures during summer frequently reached temperatures as high as 75°F to 80°F in the lower American River (Gerstung 1971). Although summer water temperatures have been cooler in the lower river after Folsom Dam was constructed compared to the pre-dam conditions, prior to habitat elimination resulting from the dam, rearing fish had access to cooler habitats throughout the summer at higher elevations (NMFS 2009).

Historically, the riparian vegetation along the American River formed extensive, continuous forests in the floodplain, reaching widths of up to 4 miles (Water Forum 2005). Early settlers removed trees and converted riparian areas to agricultural fields. Hydraulic gold mining in the watershed caused deposits of 5 to 30 feet of sand, silt, and fine gravels on the riverbed of the lower American River, which resulted in an overall raising of the river channel and the surrounding floodplain (Water Forum 2005). This was later exacerbated by gravel extraction activities, and, 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 in the American River floodplain with urban land uses, causing a corresponding increase in urban runoff (SWRI 2001).

1.1.2.1.1 Historic Fisheries Resources Leading to Today's Species/Run Composition

The Chinook salmon that historically migrated into the upper reaches of the American River Basin were reportedly spring-run Chinook salmon (Gerstung 1971). Historically, fall-run Chinook salmon spawned in the lower reaches of the north, middle, and south forks of the American River and downstream in the mainstem American River (Gerstung 1971). In addition to spring- and fall-run Chinook salmon, historically summer-run, fall-run, and winter-run steelhead also annually returned to the American River Basin.

After 1950, when the fish ladder at Old Folsom Dam was destroyed by flood flows, summer-run steelhead perished in the warmwater in areas below Old Folsom Dam. By 1955, summer-run steelhead (and spring-run Chinook salmon) were completely extirpated from the American River Basin (Gerstung 1971).

Thus, the fish resources of the lower American River have experienced substantial changes over the years as a result of both natural and human-induced changes in population viability, habitat availability, and the hydrologic and thermal regimes of the river. The wide diversity of historic aquatic habitats and historic flow regimes (including thermal conditions) has been dramatically altered since the construction of Folsom Dam and Reservoir and the construction of Nimbus Dam and Lake Natoma. Presently, the runs of anadromous salmonids returning to the lower American River are restricted to fall- and winter-run steelhead and fall-run Chinook salmon.

1.1.2.1.2 Lower American River Physical Habitat Conditions

The lower American River provides a diversity of aquatic habitats including fast-water riffles, glides, runs, pools, and off-channel backwater habitats. The lower American River from Nimbus Dam (RM 23) to about Goethe Park (RM 14) is primarily unrestricted by levees but is bordered by some developed areas. Natural bluffs contain this reach of the river, and terraces cut into the side of the channel. The river reach downstream of Goethe Park, and extending to its confluence with the Sacramento River (RM 0), is bordered by levees. The construction of levees changed the channel geomorphology and has reduced river meanders and increased depth.

Dams upstream in the watershed have reduced gravel inputs to the system, but the lower American River contains large gravel bars and braiding in many locations, leaving gravel/cobble islands within the channel. The majority of the lower American River is bordered by the American River Parkway, which has preserved the surrounding riparian zone. The river channel does not migrate to a large degree because of the geologic composition that has allowed the river to incise deep into sediments, leaving tall cliffs and bluffs adjacent to the river.

Snider et al. (1992) divided the lower American River into three reaches. Reach 1, the 4.9 miles from the Sacramento River confluence to Paradise Beach, has a very low gradient and sand bed. Depth is normally controlled by the stage in the Sacramento River, rather than discharge, and varies with the tide (Williams 2001). Reach 2 includes the 6.7 miles of channel from Paradise Beach to Gristmill, with some slope (average gradient about 0.0005). The bed is mainly sand but includes some gravel riffles. Reach 3 covers 11.1 miles from Gristmill to the weir at Nimbus Hatchery with more slope (average gradient about 0.001) (Williams 2001). The bed is mainly gravel, but the river is still characterized by long pools separated by riffles. The average width of the river at a flow of 1,000 cfs is 350, 375, and 275 feet for reaches 1, 2, and 3, respectively (Williams 2001).

HABITAT RESTORATION ACTIONS

Since 2008, the U.S. Bureau of Reclamation (Reclamation), USFWS, the Water Forum, CDFW, and Sacramento County Regional Parks have collaborated to implement the Lower American River Gravel Augmentation and Side-Channel Habitat Enhancement project in an effort to improve salmonid habitat on the lower American River. This project is ongoing and has been developed in part to restore adult spawning and juvenile rearing habitat that was adversely affected by the construction of Folsom and Nimbus Dams on the American River.

The habitat-restoration activities have occurred at seven sites from the base of Nimbus Dam downstream 2.9 river kilometers (rkm) to the Upper Sunrise Recreational Area (USDOI 2008 as cited in PSMFC 2014b). Within that area, about 57,342 cubic meters of gravel were added to the river between 2008 and 2012 (PSMFC 2014b). During 2013, about 5,500 yards of improved spawning gravel and 400 yards of improved side channel juvenile rearing habitat were created (Reclamation 2013). Habitat-restoration actions in the lower American River continued in 2014, including placing an estimated 12,000 tons of gravel and creating a side channel about 350 yards long on the south side of the Nimbus Basin (Reclamation 2014).

During 2008–2010, the Water Forum, Sacramento County Regional Parks, the Sacramento Area Flood Control Agency, and the California Natural Resources Agency collaborated to deepen the existing Sunrise Side Channel to allow water to move through the side channel at lower flows, as well as construct more steep slopes to deter spawning on the margins of the side channel (Sacramento River Watershed Program

2014). Historically, the Sunrise Side Channel has supported up to about 10 percent of the total steelhead spawning in the lower American River. At flows greater than 4,000 cfs, the channel reportedly attracted spawning steelhead, which has resulted in redd dewatering once flows are reduced to below 3,500 cfs, as observed in 2002, 2003, and 2004. It is expected that this project will improve spawning habitat availability in the Sunrise Side Channel as well as reduce the potential for steelhead redd dewatering (Sacramento River Watershed Program 2014).

Zeug et al. (2013) analyzed changes in spawning utilization in the lower American River associated with gravel augmentation projects conducted during 2008, 2009, and 2010. The following discussion of the gravel augmentation actions evaluated is generally taken directly from Zeug et al. (2013).

The study area contained three gravel augmentation sites constructed during 2008, 2009, and 2010. The 2008 augmentation (hereafter referred to as Sailor Bar East) consisted of 6,350 metric tons of cleaned gravel between 6 and 102 mm with a D_{50} of about 24 mm. The 2009 augmentation (hereafter referred to as Sailor Bar West) extended Sailor Bar East downstream with 9,525 metric tons of gravel between 7 and 112 mm with a median grain size (D_{50}) of about 34 mm.

In 2010, 9,707 metric tons of gravel (hereafter referred to as Sunrise) was placed about 2 kilometers (km) downstream of Sailor Bar West. This augmentation contained gravel from 8 to 178 mm with a D_{50} of about 30 mm. A cobble island was included at Sunrise, which contained larger particles (D_{50} of 73 mm) than those in the surrounding augmentation.

An additional 4,989 metric tons of gravel were placed in the channel downstream of Sunrise. This gravel was not necessarily placed to provide spawning habitat but to (1) transport during high flows to replenish downstream spawning areas and (2) raise water levels in the main channel sufficiently to force flow down a side channel that was known to support salmonid spawning in the past but had been frequently dewatered during the spawning and incubation periods in recent years. Zeug et al. (2013) considered this newly rewatered side channel as an augmentation site and extended sampling to include this area (hereafter referred to as the Sunrise Side Channel).

The gravel in the Sunrise Side Channel has a D_{50} of 53.5 mm. In 2011, the Sunrise site was enhanced with an additional 8,135 metric tons of spawning gravel with a D_{50} of 64 mm. Also in 2011, 10,605 metric tons of large gravel and cobble were placed at the head of the Sunrise Side Channel to further enhance flooding of the side channel. Each year, gravel was placed in September prior to the Chinook and steelhead spawning period. Thus, the year of placement was also the first year of post-restoration evaluation.

Zeug et al. (2013) concluded that gravel augmentation increased utilization by steelhead and Chinook salmon for spawning. Differences in utilization among sites reportedly indicated that site design and selection of substrate size had a significant effect on the effectiveness of the augmentation for each species. Additionally, there were strong relationships between substrate size and redd dimensions within and among sites. Although all sites contained substrate sizes considered suitable for salmonids, spawning fish of both species responded most strongly at the site with the smallest D_{50} (Sailor Bar East). Thus, the value of substrate used for augmentation changes throughout the range considered as acceptable. Zeug et al. (2013) state that their results suggest that smaller substrates are favorable for augmentation actions because they provide spawning habitat to the widest size range of potential spawners.

1.1.2.1.3 Fish Species in the Lower American River

At least 44 species of fish have been reported to occur in the lower American River system historically or currently, including numerous resident native and introduced species as well as several anadromous species (**Table 3**). There are currently seven special-status fish species in the lower American River (**Table 4**).

Table 3. Fish Species Historically or Currently Reported to Occur in the Lower American River.

Common Name	Scientific Name	Occurrence
Anadromous Game Fish		
Chinook salmon	*Oncorhynchus tshawytscha*	Numerous in fall
Steelhead	*Oncorhynchus mykiss*	Numerous
Coho salmon	*Oncorhynchus kisutch*	Occasional
Pink salmon	*Oncorhynchus gorbuscha*	Rare
Chum salmon	*Oncorhynchus keta*	Rare
White sturgeon	*Acipenser transmontanus*	Uncommon
Striped bass [b]	*Morone saxatilis*	Numerous in summer
American shad [b]	*Alosa sapidissima*	Numerous in spring
Coldwater Game Fish		
Kokanee [b]	*Oncorhynchus nerka*	Numerous above Nimbus
Rainbow trout	*Oncorhynchus mykiss*	Numerous
Brown trout [b]	*Salmo trutta*	Rare
Warmwater Game Fish		
Largemouth bass [b]	*Micropterus salmonids*	Common in backwaters
Smallmouth bass [b]	*Micropterus dolomieui*	Common in backwaters
Green sunfish [b]	*Lepomis cyanellus*	Common in backwaters
Bluegill [b]	*Lepomis macrochirus*	Common in backwaters
Redear sunfish [b]	*Lepomis microlophus*	Few in backwaters
White crappie [b]	*Pomaxis annularis*	Few in backwaters
Sacramento perch	*Archoplites interruptus*	Rare
Channel catfish [b]	*Ictahurus punctatus*	Uncommon
White catfish [b]	*Ictahuruscatus*	Common in backwaters
Brown bullhead [b]	*Ictahurus nebulosus*	Few in backwaters
Black bullhead [b]	*Ictahurus melas*	Few in backwaters
Nongame Fish		
Sacramento sucker	*Catostomus occidentalis*	Numerous
Carp [b]	*Cyprinus carpio*	Numerous
Goldfish [b]	*Carassius auratus*	Numerous
Sacramento blackfish	*Orthodon microlepidotus*	Uncommon
Hardhead	*Mylopharodon conocephalus*	Occasional
Sacramento hitch	*Lavinia exilicauda*	Occasional
Sacramento pikeminnow	*Prychocheilus grandis*	Numerous
Splittail	*Pogonichthys macrolepidotus*	Occasional
Mosquitofish [b]	*Gambusia affinis*	Numerous in backwaters
Tule perch	*Hysterocarpus traski*	Numerous
Riffle sculpin	*Cottus gulosus*	Numerous
Pacific lamprey	*Lampetra tridentata*	Common and anadromous
River lamprey	*Lampetra ayresii*	Occasional and anadromous
Threadfin shad [b]	*Dorosoma petenense*	Occasional
Golden shiner [b]	*Notemigonus crysoleucas*	Present above Nimbus Dam
Fathead minnow [b]	*Pimephales promelas*	Present above Nimbus Dam
Thicktail chub	*Gila crassicauda*	Extinct
Sacramento-San Joaquin roach	*Lavinius symmetricus*	Uncommon
Sacramento tui chub	*Gila bicolor*	Uncommon
Speckled dace	*Rhinichthys osculus* sp.	Uncommon
Mississippi silverside	*Menidia beryllina*	Occasional
Smelt	*Hypomesus* sp.	Occasional

[a] Modified from Gerstung (1971)

[b] Introduced species

Table 4. Special-Status Fish Species in the Lower American River.

Common Name	**Status**
- Central Valley steelhead	Federal threatened
- Central Valley fall-/late fall-run Chinook salmon [a]	Federal species of concern State species of special concern
- Central Valley spring-run Chinook salmon (non-natal rearing only)	Federal and state threatened
- River lamprey	State species of special concern
- Pacific lamprey	Federal species of 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

[a] 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.

Some fish species, including Sacramento perch and coho salmon, were identified as potentially occurring in the lower American River but were not carried forward for impact assessment in this evaluation. Historically, Sacramento perch (designated by CDFW as a species of special concern) were found throughout the Central Valley, the Pajaro and Salinas Rivers, and Clear Lake (Moyle 2002). The only populations that represent continuous habitation within their native range are those in Clear Lake and Alameda Creek (Moyle 2002). Most populations today are established in warm, turbid, moderately alkaline reservoirs or farm ponds. Therefore, Sacramento perch are not further discussed or evaluated. In the Sacramento River drainage, coho salmon (Federally endangered[3]) were never common, but a small population probably once spawned in the McCloud and Upper Sacramento Rivers (Moyle 2002). Coho salmon rarely, if at all, use the Sacramento River or its tributaries and, therefore, are not further evaluated in this document.

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 warmwater 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 CDFG (Sacramento County 2008).

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[3] There is not a coho salmon ESU within the Central Valley.

Provided below is species and lifestage-specific life history information specific to the lower American River. General life history information pertaining to the Central Valley and Sacramento River previously discussed under *Overview of Fish Species*, above, is not repeated in this section.

STEELHEAD

Critical habitat for the Central Valley steelhead DPS was designated on January 2, 2006, and includes the lower American River up to Nimbus Dam (70 FR 52488, September 2, 2005). Central Valley steelhead is not listed under the California ESA.

Between 1944 and 1947, annual counts of summer-run steelhead passing through the Old Folsom Dam fish ladder during May, June, and July at Old Folsom Dam (RM 27) ranged from 400 to 1,246 fish (Gerstung 1971). After 1950, when the fish ladder at Old Folsom Dam was destroyed by flood flows, summer-run steelhead perished in the warmwater in areas below Old Folsom Dam. By 1955, summer-run steelhead (and spring-run Chinook salmon) were completely extirpated, and only remnant runs of fall- and winter-run steelhead and fall-run Chinook salmon persisted in the American River (Gerstung 1971).

Estimates of historic run sizes for fall- and winter-run steelhead in the American River were not identified in the available literature. However, both of these runs of steelhead were likely historically relatively abundant in the American River considering (1) the over 125 miles of available habitat, (2) the historic run size estimates of Chinook salmon before massive habitat degradation associated with hydraulic mining occurred, and (3) the reported historic run size estimates for summer-run steelhead in the 1940s which occurred even after extensive habitat degradation and elimination (NMFS 2009).

The Central Valley steelhead DPS includes naturally spawning steelhead in the American River but excludes steelhead spawned and reared at the Nimbus Fish Hatchery. The Nimbus Fish Hatchery, located below Nimbus Dam, is operated by CDFW to meet an annual production goal of 430,000 steelhead yearlings (NMFS 2009).

Run size estimates of 305, 1,462, and 255 naturally spawning steelhead for the 1990/1991, 1991/1992, and 1992/1993 spawning seasons, respectively, were reported in Water Forum (2005), although the methodology for how these estimates were obtained was not stated. From 2002 through 2007, annual population abundance estimates for American River steelhead spawning in the river have ranged from about 160 to about 240 adults (Hannon and Deason 2008). Currently, the naturally spawning population of steelhead is believed to be composed mostly of fish originating from Nimbus Hatchery (Water Forum 2005).

General information pertaining to the various lifestages of steelhead in the lower American River is presented below, and lifestage-specific periodicities are represented in **Table 5**.

Table 5. Lifestage-Specific Generalized Periodicities for Steelhead in the Lower American River.

Lifestage	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult immigration and holding	■	■	■	■	■	■															■	■	■	■
Spawning	■	■	■	■	■	■	■																	
Embryo incubation	■	■	■	■	■	■	■	■	■	■														
Juvenile rearing and downstream movement	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Smolt (yearling+) emigration	■	■	■	■	■	■	■	■																

Adult steelhead immigration and holding in the lower American River can begin as early as late spring or early summer but commonly begins in November and continues into April (SWRI 2001). Steelhead immigration generally peaks during January (CDFG, unpublished data; CDFG 1986; SWRI 2001). The adult immigration and adult holding lifestages are presented together because the timing of these two lifestages overlaps and the lifestages are inclusive. For this evaluation, the adult steelhead immigration and holding period is considered to extend from November through March.

Water temperatures can influence the timing of adult spawning migrations and can affect the viability of eggs in holding females. Few studies have been published that examine the effects of water temperature on either steelhead immigration or holding. The available studies suggest that adverse effects occur to immigrating and holding steelhead at water temperatures exceeding the mid-50°F range and that immigration will be delayed if water temperatures approach about 70°F (SWRI 2001). Optimal immigration and holding temperatures have been reported to range from 46°F to 52°F (CDFG 1991). Increasing levels of thermal stress to this lifestage can reportedly occur above 52°F. Water depth in the lower American River does not appear to be a factor impeding the upstream migration of steelhead. The lower American River is a large, perennial river with water depths generally well above those minimally necessary (1 to 2 feet) for successful migration, even during very low-flow (e.g., 250-cfs) conditions.

Steelhead spawning includes the period from redd construction until spawning is completed with the deposition and fertilization of eggs. Spawning typically begins during late December and can extend through March but reportedly also can range from November through April (CDFG 1986). Steelhead redd surveys conducted during most survey years from 2002/2003–2012/2013 indicate that spawning in the lower American River can begin as early as late December but generally extends from January through mid-April, with the vast majority of spawning (nearly 80 percent) occurring from mid-January through February. Hannon and Deason (2008) reported that peak spawning varies annually but most frequently occurs during mid-February.

The lowermost 5 miles of the lower American River from Discovery Park to just below Paradise Beach is deficient of steelhead spawning habitat because tides and Sacramento River flows back the water up to this point (Hannon 2013; Hannon and Deason 2008). Steelhead spawning is concentrated in the upper section of the river. Slightly more than about 50 percent of all steelhead redds occurred in the upper 3 miles (RM 20–RM 23) of the lower American River on average during recent survey periods (2002/2003, 2003/2004, 2004/2005, 2006/2007, 2010/2011, 2011/2012, and 2012/2013), and on average more than 95 percent occurred upstream of Watt Avenue (Hannon 2013). Out of the approximately 1,200 steelhead redds reported during all 7 of these survey years, about 357 (30 percent) of the redds were reported to be found in side channels (**Table 6**).

Table 6. Number of Steelhead Redds by Side Channel for the 2003–2005, 2007, and 2011–2013 Steelhead Redd Surveys in the Lower American River.

RM	Location	2003	2004	2005	2007	2011	2012	2013	*Totals*
21	Sailor Bar side channel	11	13	10	4	1	0	0	*39*
21	Upper Sunrise side channel	28	24	12	1	16	14	37	*132*
19	Lower Sunrise side channel	16	13	7	0	2	8	14	*60*
15	Sacramento Municipal Utility District cable crossing side channel	22	20	11	7	10	0	2	*72*
14	Upper River Bend side channel	4	9	5	3	0	0	0	*21*
14	River Bend side channel	11	4	0	0	4	0	2	*21*
9	Watt side channel	1	3	0	1	0	0	7	*12*
	TOTAL	93	86	45	16	33	22	62	*357*

NMFS (2007) reported that the steelhead population in the lower American River does not appear to be ultimately limited by spawning habitat availability but rather appears to be limited by factors such as summer water temperatures and predation following fry emergence.

The embryo incubation period extends from egg deposition until emergence from the substrate as a free-swimming fry. The egg and alevin incubation lifestage for steelhead in the lower American River has been reported to generally extend from late December into May (SWRI 2001). Based on the timing of observations of newly constructed steelhead redds and the amount of time required for incubation, the embryo incubation period has been estimated to generally extend from late December through late May in the lower American River (Hannon and Deason 2004, 2005, 2008; Hannon et al. 2003). For this evaluation, the steelhead embryo incubation period in the lower American River is generally characterized as extending from January through May.

Optimal steelhead spawning temperatures have been reported to range from 39°F to 52°F (CDFG 1991). The upper water temperature value for optimal egg incubation has been reported as 52°F (Humpesch 1985; NMFS 2001, 2002; Reclamation 1997; USFWS 1995). In the lower American River, fish surveys that identified newly emerged steelhead through May indicated that incubating steelhead embryos do survive at water temperatures above the reported preferred range (NMFS 2007). Most of the studies of *O. mykiss* embryo incubation conducted at or near 54.0°F report high survival and normal development (Kamler and Kato 1983; Redding and Schreck 1979; Rombough 1988), and some evidence suggests that symptoms of thermal stress arise at or near 54.0°F (Humpesch 1985; Timoshina 1972). Thus, water temperatures near 54°F could represent an inflection point between properly functioning water temperature conditions and the conditions that cause negative effects on steelhead spawning and embryo incubation.

Embryonic mortality increases sharply and development becomes retarded at incubation temperatures greater than or equal to 57.0°F (Rombough 1988; Velsen 1987). Thus, from the available literature, water temperatures in the low-50°F range appear to support high embryo survival, with substantial mortality to steelhead eggs reportedly occurring at water temperatures in the high-50°F range and above.

CDFG (2001) conducted a 4-year flow fluctuation study during 1997 to 2000. The results of the study indicate that:

1. Flow fluctuations are regular occurrences in the lower American River;
2. Flow fluctuations are more common during the October-to-June period; and
3. Flow fluctuations could dewater steelhead redds (CDFG 2001).

The minimum flow requirements established by NMFS (2009) include limits on the percentage reduction in flow during January and February from those flows that occurred during December. These limits would minimize the potential for dewatering steelhead redds during these months under controlled flow conditions. However, flow reductions continue to represent a stressor to steelhead associated with redd dewatering, particularly from March through May.

From 1992 through 2008, CDFW conducted seining surveys and rotary screw trapping (RST) surveys to define the temporal and spatial distribution of steelhead and other fish in the lower American River. Steelhead captured by seining are reported in Snider and McEwan (1993), Snider and Keenan (1994), Snider and Titus (1996, 2000b), and CDFG (unpublished data). In general, juvenile steelhead usually appeared in the seine samples during April, increased in abundance through April and/or May, and decreased thereafter. Juvenile steelhead continued to be present in relatively low numbers in the summer, primarily at upstream locations.

YOY steelhead historically began appearing in RSTs at the earliest in mid-January, but typically in mid-March. Most YOY steelhead were captured in RSTs from mid-April through June (Snider and Titus 2000b). Steelhead YOY, however, began appearing in seine surveys as early as early February but typically before mid-March, which suggests that emergence and emigration are not coincident (CDFG 2000; Snider and McEwan 1993; Snider and Keenan 1994; Snider and Titus 1995, 1996, 2000b; Snider et al. 1997, 1998). During RST surveys conducted during 2013, 98 percent (1,019) of the steelhead fry were caught between March 19 and April 22 (PSMFC 2014b). Seventy percent (540) of the steelhead with a parr lifestage were caught between April 30 and May 20 during the 2013 survey (PSMFC 2014b).

Yearling-sized individuals that were captured early in the season (i.e., winter to early spring) in previous RST surveys strongly suggest some over-summer survival, but evidence is inconclusive as to the origin of these fish. Yearling steelhead first appeared in the RSTs in the lower American River during late December and continued to be collected until early May, with most captured during January (Snider and Titus 2000b). The presence of apparent YOY steelhead in October samples indicates some capability to survive summer conditions, and this presence increases the likelihood of survival to smolt. It has been speculated that steelhead might spend summers outside the lower American River and return during the fall (Snider and McEwan 1993).

Snorkel surveys were conducted by the Fishery Foundation of California in the lower American River from the late winters to the early summers of 2003, 2004, and 2005 (Cannon and Kennedy 2006). Fall-run Chinook salmon and steelhead fry were the dominant fish observed from February through April. Steelhead YOY were observed from April through September, although densities observed declined sharply during the spring.

These studies indicate that juvenile steelhead can rear in the lower American River for relatively short periods after emergence, or for several months, or even up to a year before moving downstream out of the lower American River. In summary, although it has been reported that steelhead that rear over summer in the lower American River generally emigrate as smolts from January through June (McEwan 2001; Newcomb and Coon 2001; Snider and Titus 2000b), most emigrate from January through April (R. Titus, CDFW, pers. comm., 2013, as cited in Reclamation and NMFS 2014). Steelhead juveniles that emigrate from the lower American River as YOY generally do so from March through September (McEwan 2001).

Steelhead YOY that can volitionally or nonvolitionally move downstream to enter the Sacramento River probably continue to rear until reaching a size at which smoltification is initiated. The small sizes of juvenile steelhead captured at the RSTs support the presumption that these juvenile fish have not yet undergone smoltification but instead are moving out of the river into downstream rearing habitat.

Most juvenile steelhead rearing occurs in the upper reaches of the lower American River from Watt Avenue upstream (CDFG, unpublished data; Snider and Keenan 1994; Snider and Titus 1996). The majority of post-emergent fry are collected in glides (Snider and Keenan 1994; Snider and Titus 1996). By late summer, YOY steelhead are distributed throughout the lower American River and exhibit strong site fidelity (R. Titus, CDFG, pers. comm., 2001, as cited in SWRI 2001). Limited mark and recapture evaluations of juvenile steelhead collected by seining in the lower American River since 1996 indicate that juveniles tend to occupy specific habitats throughout the summer. Larger juvenile steelhead typically inhabit fast-water areas such as riffles. Yearling steelhead are found in bar complex and side channel areas characterized by habitat complexity in the form of velocity shelters, hydraulic roughness elements, and other forms of cover (R. Titus, CDFG, pers. comm., 2001, as cited in SWRI 2001).

Cannon and Kennedy (2006) reported that juvenile steelhead were most abundant near spawning areas in riffle and run margins with abundant cover of the upper portion of the lower American River, especially in small stream-type habitats of side channels. During the summer, juvenile steelhead concentrated in riffle habitats of the main river and side channels.

Low flows can negatively affect steelhead rearing in the lower American River (NMFS 2009). Yearling steelhead are found in bar complex and side channel areas characterized by habitat complexity in the form of velocity shelters, hydraulic roughness elements, and other forms of cover (SWRI 2001). At low flow levels, the availability of these habitat types becomes limited, forcing juvenile steelhead densities to increase in areas that provide less cover from predation. With high densities in areas of relatively reduced habitat quality, juvenile steelhead become more susceptible to predation as well as disease (NMFS 2009).

Rearing steelhead fry and juveniles can be exposed to stranding and isolation from main channel flows when high flows are required for flood control or Delta outflow requirements and then subsequently reduced after the requirement subsides (NMFS 2007). The U.S. Bureau of Reclamation attempts to avoid flow fluctuations during non-flood-control events that raise flows above 4,000 cfs and then drop them back below 4,000 cfs, as recommended by Snider et al. (2001) and NMFS (2009).

During 2014, an investigation was conducted to assess the response of juvenile *O. mykiss* and fall-run Chinook salmon to three pulse flows in the lower American River (PSMFC 2014a). Two of those pulse flows were intended to benefit salmonid outmigration in consideration of the low-flow conditions, and the third pulse flow coincided with a notable rainfall event. The analysis presented in PSMFC (2014a) relied on RST data collected immediately downstream of the Watt Avenue bridge.

Figure 1 displays the relationship between the maximum daily discharge at Watt Avenue and the number of natural-origin juvenile *O. mykiss* emigrating past the Watt Avenue RST site on the lower American River during 2014.

- Blue bars in Figure 1 indicate days when both American River RSTs operated without problems during a 24-hour day and actual catch data were used to calculate *O. mykiss* production estimates.
- Red bars indicate days when one or both RSTs were not fished on weekends or experienced operational problems within a 24-hour period, and it was necessary to impute *O. mykiss* catch as *O. mykiss* production (PSMFC 2014a).

Although PSMFC (2014a) suggested that the pulse flows appeared to facilitate the emigration of modest numbers of juvenile *O. mykiss* from the American River and that the rainfall event had little or no effect on the number of *O. mykiss* caught in the RSTs, no clear relationship between pulse flow events and RST captures are readily apparent (Figure 1).

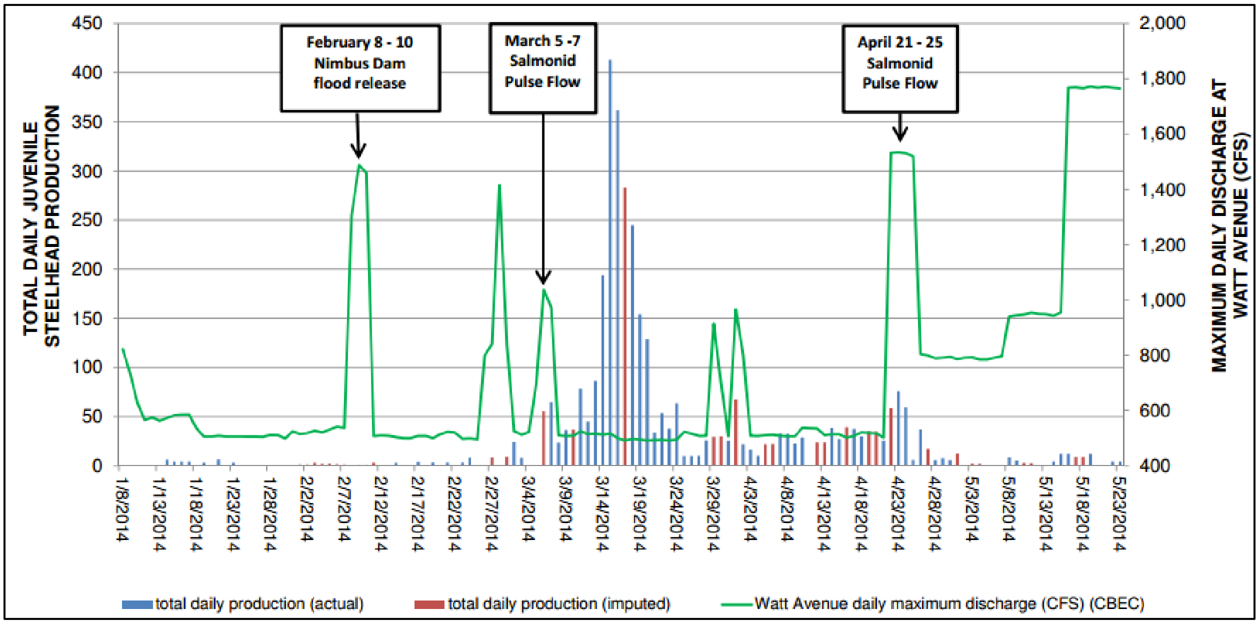


Figure 1. Maximum Daily Flow at Watt Avenue and the Number of Natural-Origin Juvenile *O. mykiss* Emigrating past the Watt Avenue RST Site on the Lower American River during 2014 (PSMFC 2014a).

Water temperature is the physical factor with perhaps the greatest influence on American River steelhead (NMFS 2009). Water temperature directly and indirectly affects growth rates, disease incidence, predation, and long-term survival (Myrick and Cech 2001). High water temperatures are a stressor to juvenile rearing steelhead in the lower American River, particularly during the summer and early fall (NMFS 2009).

Preferred water temperatures for fry and juvenile steelhead rearing are reported to range from 45°F to 65°F (NMFS 2002). The juvenile steelhead immune system properly functions up to about 60°F and then is dramatically compromised as water temperatures increase into the upper 60s (°F) (Water Forum 2005). With each 1-degree increase between 65°F and the upper lethal limit of 75°F, water temperature reportedly becomes increasingly less suitable and thermally more stressful for the fish (Bovee 1978).

The available information suggests that lower American River steelhead might be more tolerant to high temperatures than steelhead from regions farther north (Myrick and Cech 2004). Titus and Brown (2006) found that steelhead rearing in the lower American River occurs when temperatures exceed 65°F and that growth and condition appear good under the warmer summer and fall conditions, although these fish become very susceptible to bacterial infection and predation. They conclude that temperatures in excess of 65°F should be avoided and that improved habitat, including increased complex cover, could mitigate some of the effects of typically warm summer and fall water temperatures.

Elevated water temperatures in the lower American River likely result in increased predation rates on juvenile rearing steelhead (NMFS 2009). Juvenile rearing steelhead can be exposed to increased predation as a result of both increased predator abundance and increased digestion and consumption rates of these predators associated with higher water temperature (Vigg and Burley 1991 and Vigg et al. 1991, both as cited in NMFS 2009).

Specific flows have not been identified for juvenile steelhead emigration in the lower American River, although NMFS (2007) suggests that juvenile steelhead presumably do not need large pulses to emigrate effectively from the lower American River as long as water temperatures are suitable through the lower river.

FALL/LATE-FALL RUN CHINOOK SALMON

Fall-run Chinook salmon is currently the largest run of Chinook salmon to use the Sacramento River system and is the run of Chinook salmon using the lower American River (SWRI 2001).

Because fall-run Chinook salmon are not listed as threatened or endangered under the Federal or state ESAs, critical habitat has not been designated for fall-run Chinook salmon in the Central Valley. However, under the Magnuson-Stevens Fishery Conservation and Management Act, NMFS has identified essential fish habitat (EFH) for fall-run Chinook salmon in the lower American River from its mouth upstream to Nimbus Dam. EFH applies only to commercial fisheries, and EFH includes specifically identified waters and substrate necessary for fish spawning, breeding, feeding, or growing to maturity.

Historically, fall-run Chinook salmon spawned in the lower reaches of the north, middle, and south forks of the American River and downstream in the mainstem American River (Gerstung 1971). Annual salmon carcass surveys were conducted on the American River each fall beginning in 1944. Between 1944 and the construction of Folsom and Nimbus Dams in 1955, an estimated average of about 26,500 Chinook salmon (presumably fall-run) spawned in the mainstem of the American River below the city of Folsom. During this 11-year period, estimated annual Chinook salmon runs ranged from 12,000 to 38,652 (Gerstung 1971).

Since the early 1970s, tag-and-recapture data have been collected to estimate adult spawning escapement to several Central Valley tributary streams, including the American River. However, a review of spawning escapement surveys (Rich 1985) identified the need to standardize methodologies in surveying and estimating escapement populations in the lower American River. The inconsistencies between various survey methods identified in Rich (1985) included (1) differences in the timing of Nimbus Hatchery weir installation and removal, (2) survey problems, (3) differences in spawning survey (mark and recapture) methodologies, and (4) inaccurate and inconsistent spawning escapement estimation methodologies.

Using different methodologies of field survey and escapement estimation can cause problems when attempting to compare annual estimates. Since 1989, CDFW (and previously CDFG) has consistently used the Schaefer estimation procedure for annual fall-run Chinook salmon escapement in the lower American River.

In addition to spawning in the lower American River, returning fall-run Chinook salmon adults also ascend the Nimbus Hatchery fish ladder and enter the hatchery. Early adult spawners also can travel past the Nimbus Hatchery training weir, and adult spawners arriving throughout the spawning season have been able to pass through gaps in the foundation of Nimbus Hatchery training weir. These fish can either be caught by anglers or die. Some of the expired fish end up impinged on the weir. The hatchery operators routinely record “weir fish.”

The Anadromous Fish Restoration Program (AFRP) of the Central Valley Project Improvement Act has a goal of at least doubling the natural production of anadromous salmonids, including fall-run Chinook salmon, over the 1967–1991 baseline period. The AFRP defines natural production as the number of fish not produced in hatcheries that reach adulthood, including adults that are harvested prior to spawning (USFWS 1995). Although the main components included in the estimates of the total production and natural production vary on an annual basis and therefore add uncertainty into annual production estimates, total spawning escapement (in-river and hatchery returns, combined) serves as one index for comparative purposes. For the AFRP baseline period (1967–1991), in-river spawning escapement of fall-run Chinook salmon averaged 32,307 fish and hatchery returns averaged 8,733 fish, for a combined average of 41,040 spawning escapement (USFWS 1995). For the period from 1992 to 2008, in-river escapement averaged 64,507 fish and hatchery returns averaged 10,582 fish, for a combined average of 75,089 spawning escapement.

However, throughout the Central Valley including the lower American River, the number of Chinook salmon returning in the fall to spawn has declined in recent years. In the lower American River, CDFG estimated that fall-run Chinook salmon escapement (obtained from GrandTab) has declined each year since 2003, when the highest escapement in the entire period of record (1952–2013) occurred (163,742 in-river spawners and 14,887 hatchery returns, for a total of 178,629). The lowest estimated escapement in the entire period of record occurred during 2008 (2,514 in-river spawners and 3,232 hatchery returns, for a total of 5,746). Since 2008, total escapement has increased each subsequent year, particularly in-river escapement, with total escapement reaching 73,226 (64,150 in-river spawners and 9,076 hatchery returns) in 2013 (CDFW 2014).

General information pertaining to the various lifestages of fall-run Chinook salmon in the lower American River is presented below, and lifestage-specific periodicities are represented in
Table 7.

Table 7. Lifestage-specific Generalized Periodicities for Fall-run Chinook Salmon in the Lower American River.

Lifestage	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult immigration and staging [a]											▨	▨	▨	▨	▨	▨	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
Spawning																				🟦	🟦	🟦	🟦	🟦
Embryo incubation	🟦	🟦	🟦	🟦	🟦	🟦														🟦	🟦	🟦	🟦	🟦
Juvenile rearing and downstream movement	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦														

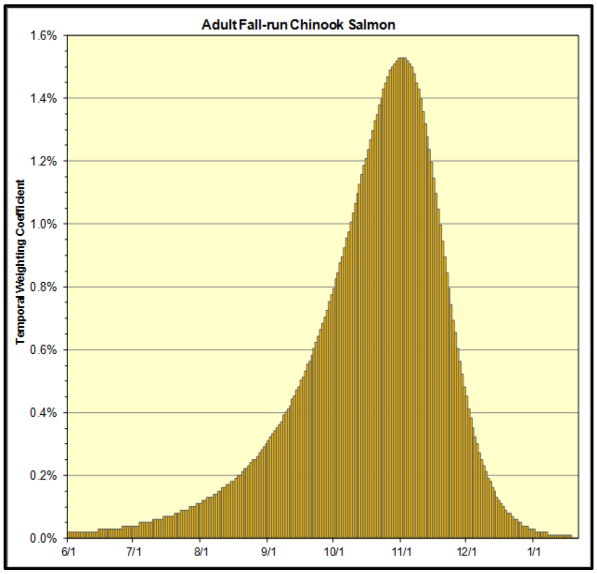
[a] Less than 10 percent of the adult fall-run Chinook salmon immigrate into the lower American River prior to September.

In the Central Valley, adult fall-run Chinook salmon are reported to generally begin migrating upstream annually in July, with immigration continuing through December in most years (NMFS 2004; Vogel and Marine 1991). The majority of the fall-run Chinook salmon adult immigration into the lower American River has previously been reported to occur from September through November and peak in November (SWRI 2001). As part of a study to evaluate angler effort and harvest of anadromous fishes in the Central Valley recreational river fishery, CDFW has performed periodic creel censuses in the lower American River that provide estimates of the fall-run Chinook salmon monthly catch that were used to assess the temporal distribution of pre-spawning adult fall-run Chinook salmon in the lower American River.

The length of time that fall-run Chinook salmon spend in the lower American River prior to spawning is not specifically known. The results of biotelemetry studies conducted on the upper Sacramento River at RBDD indicate that fall-run Chinook salmon can stay in the river from several days to over 1.5 months between their arrival in the upper river at RBDD and their observed movement onto the spawning grounds both upstream and downstream of the dam. These results suggest that fall-run Chinook salmon can spend a considerable amount of time in a river near their spawning grounds prior to spawning.

Estimated monthly catches of fall-run Chinook salmon in the lower American River were obtained by USACE for this Draft Technical Report from available CDFW angler survey reports (e.g., Massa and Schroyer 2003; Murphy et al. 2000; Murphy et al. 2001; Schroyer et al. 2002; Titus et al. 2008; Titus et al. 2009; Titus et al. 2010; and Wixom et al. 1995) and were used by USACE for this Draft Technical Report to obtain the temporal distribution of in-river adult fall-run Chinook salmon prior to spawning. The results of these analyses demonstrate that some adult fall-run Chinook salmon begin entering the lower American River as early as June and continuing through the summer prior to spawning from mid-October through December. Most immigrating fall-run Chinook salmon in the lower American River do not exhibit an extended staging period; rather, they spawn shortly after arriving in the spawning areas.

The process of developing information for the Water Forum and USACE (2015) updated Lower American River Mortality Model (see below) included fitting an asymmetric logistic function to 10 years of available creel survey data (over the period from 1991 to 2010) to represent the temporal distribution of adult fall-run Chinook salmon arriving in the lower American River prior to and during the spawning season (**Figure 2**). Thus, although the majority of fall-run Chinook salmon adults immigrate into the lower American River from September through November, the information recently developed by the Water Forum and USACE (2015) indicates that, in general, up to nearly 10 percent might immigrate into the river prior to September.



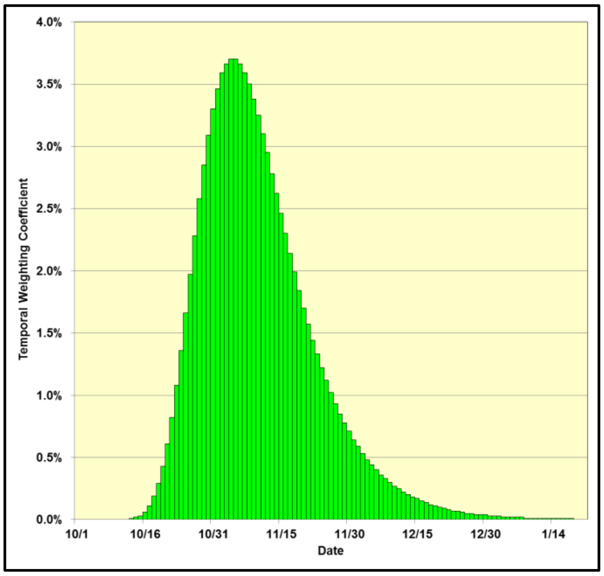


Figure 2. Daily Temporal Distribution of Adult Fall-run Chinook Salmon Immigration in the Lower American River.

Figure 3. Daily Temporal Distribution of Fall-run Chinook Salmon Spawning in the Lower American River.

Water depth in the lower American River does not appear to impede the upstream migration of adult fall-run Chinook salmon (SWRI 2001). The lower American River is a large, perennial river with water depths generally well above those minimally necessary (about 1 foot) for successful migration, even during very low-flow (e.g., 250-cfs) conditions. Regarding operational considerations in the Central Valley, NMFS (2000) reported that 59°F to 60°F is "[t]he upper limit of the optimal temperature range for adults holding while eggs are maturing." Also, NMFS (1997) states that "[g]enerally, the maximum temperature of adults holding, while eggs are maturing, is about 59°F to 60°F" and that the "[a]cceptable range for adults migrating upstream range[s] from 57°F to 67°F." ODEQ (1995) further reports that "many of the diseases that commonly affect Chinook [salmon] become highly infectious and virulent above 60°F."

Water temperatures in the lower American River often exceed the reported upper optimal water temperature index value of 64°F (Bratovich et al. 2012) during much of the adult immigration and staging lifestage at Watt Avenue and particularly at the mouth of the lower American River.

The process of developing information by the Water Forum and USACE (2015) for the updated Lower American River Mortality Model included calculating lag times between fitted Chinook salmon redd and carcass distributions and developing an adjusted asymmetric logistic function to describe fall-run Chinook salmon spawning timing in the lower American River based on 21 years of carcass surveys (from 1992/1993 through the 2012/2013 seasons) (**Figure 3** above). Based on the appearance of fresh, non-adipose fin-clipped fall-run Chinook salmon in the carcass surveys (1992/1993–2012/2013) and estimation of the lag period between spawning and appearance in the carcass surveys in the lower American River, fall-run Chinook salmon spawning (based on the cumulative distribution representing 21 years of estimated spawning time) characteristically begins on October 15 and ends on December 31.

Over the range of conditions that have occurred from 1992 through 2012, typically, fall-run Chinook salmon spawning in the lower American River:

- Begins during mid- to late October,
- Ends during late December into early January, and
- Peaks during November (nearly 70 percent of the annual spawning run).

The majority of fall-run Chinook salmon redds are constructed from Ancil Hoffman Park at RM 16 upstream to the Nimbus Hatchery weir (about RM 23), assuming that spawning occurs nearby or upstream of the location of observed carcasses (Vincik and Kirsch 2009). Aerial redd surveys conducted on about a weekly basis over the course of the spawning season have been conducted on the lower American River from only 1991 to 1995, and these surveys have shown that most (92 percent of) redds are formed upstream of RM 16 (Snider and Vyverberg 1996).

During 2009, Vincik and Kirsch (2009) suggested that there had not been any notable change in the overall spatial distribution of fall-run Chinook salmon spawning in the lower American River since 1995. However, a recent program has established additional habitat. The Lower American River Salmonid Spawning Gravel Augmentation and Side Channel Habitat Establishment Program (Reclamation 2008b, 2011) was implemented over a 6-year period from 2008 to 2013. The purpose of the program was to increase and improve Chinook salmon and steelhead spawning and rearing habitat by replenishing spawning gravel and establishing additional side-channel habitat in the lower American River between Nimbus Dam and Upper Sunrise Recreation Area (Reclamation 2008b). The results from recent spawning surveys suggest that fish are using the newly enhanced areas of the lower American River for spawning (Hannon 2013).

Eggs deposited in redds incubate until hatching, at which time they are referred to as alevins. Alevins remain in the gravel until most of the egg yolk is absorbed, then begin to emerge from the gravel. The intragravel residence period of incubating eggs and alevins is highly dependent on water temperature. The estimated general intragravel lifestage period of fall-run Chinook salmon in the lower American River extends from about mid-October through March. After alevins emerge from the gravel, they begin the rearing and emigration stages of their life histories (SWRI 2001).

The temporal distributions presented above might be slightly influenced by late fall-run Chinook salmon having strayed into the lower American River, particularly during the 2008/2009 spawning season. Chinook salmon have been encountered in the CDFG carcass surveys (M. Healey 2005, 2004; Healey and Fresz 2007; Healey and Redding 2008; Vincik and Kirsch 2009) through January in recent years, although a low percentage of fresh carcasses has been encountered after the first week of January (generally 0.2 percent to 3 percent). The highest number of fresh Chinook salmon carcasses encountered after the first week of January was observed during the 2008/2009 survey season, when 12 percent of all fresh carcasses were observed after the first week of January 2009 (Vincik and Kirsch 2009).

Spawning during January, particularly during the latter part, is somewhat atypical of fall-run Chinook salmon but is phenotypically consistent with late fall-run Chinook salmon. During the 2008/2009 surveys, recovery and analysis of 53 coded-wire tagged carcasses obtained throughout January 2009 found that all of them were late fall-run Chinook salmon strays originating from the Coleman National Fish Hatchery on Battle Creek. In addition to adipose fin-clipped (i.e., hatchery) carcasses, non-adipose fin-clipped carcasses also were encountered during January. Thus, Vincik and Kirsch (2009) speculated that the late-spawning (i.e., January-spawning) Chinook salmon in the lower American River were either Chinook salmon that had strayed from a hatchery or were wild Chinook salmon from other systems and are not likely a self-sustaining run within the lower American River. However, they recognize the need to further explore this issue in future monitoring.

More recently, Kormos et al. (2012) found that, relative to the total of 23,945 Chinook salmon carcasses sampled during 2010/2011, 162 (less than 1 percent of all Chinook salmon) were classified as late fall-run Chinook salmon, of which about 23 percent (37 fish) were from a hatchery.

The timing of adult Chinook salmon spawning is influenced by both behavioral characteristics and appropriate spawning temperatures. It has been previously reported that fall-run Chinook salmon begin to spawn in the lower American River when water temperatures decline to about 60°F (SWRI 2001). Water temperature monitoring data are available for the U.S. Geological Survey’s (USGS) Fair Oaks gage from 1998 to 2015. Based on carcass survey data (and estimating the lag period between the spawning and appearance of fresh carcasses in the carcass surveys) in the lower American River from 1998 through 2012, the initiation of fall-run Chinook salmon spawning (defined as 10 percent of the annual cumulative distribution) occurs when daily average water temperatures decreased to values generally ranging from 59.7°F to 64.0°F and to 67.4°F during one year (2001), with an average of 62.3°F.

Relatively high water temperatures at the beginning of the fall-run Chinook salmon spawning season can be detrimental to spawning success. Nimbus Hatchery data suggest that the percentage of egg fertilization rapidly increases when daily median temperatures decline below 60°F, and water temperatures of about 62°F or higher are reported to be lethal to incubating embryos (Hinze 1959; Reclamation 1991; Seymour 1956; USFWS 1992, 1999). In recent years, mean daily water temperatures at or below 60°F in the upper reaches of the lower American River have not occurred until dates ranging from October 27 to November 15. From 1998 through 2012, the average date on which mean daily water temperatures declined to 60°F in the upper reaches of the lower American River was November 6. For these same years, an average of 43 percent of the annual runs of fall-run Chinook salmon were estimated to have spawned by November 6.

Survival of Chinook salmon eggs and alevins is believed to decrease rapidly when incubation temperatures exceed about 56°F for much or all of the incubation period (Reclamation 1991). This temperature is the reported upper optimum water temperature for Chinook salmon egg development (NMFS 1993). For maximum survival of Chinook salmon eggs and yolk-sac larvae in the Central Valley, USFWS (1995) suggested an upper water temperature value of 56.0°F, and NMFS (1997) reported 56.0°F as the upper limit of suitable water temperatures for Chinook salmon egg incubation in the Sacramento River. Water temperatures above 56°F reportedly result in significantly higher Chinook salmon alevin mortality in the Sacramento River (USFWS 1999). Consistently higher egg losses resulted at water temperatures above 60.0°F than at lower temperatures (Johnson and Brice 1953).

T.P. Healey (1979) found, in an experiment that exposed Sacramento-strain fall-run Chinook salmon to a constant temperature, that mortalities to the fingerling stage were 80 percent or more when temperatures during incubation of eggs and fry development were 61°F to 61.9°F. These types of experiments using constant temperatures are common but generally do not provide information about the differences between constant and variable thermal conditions, the latter of which occur in the lower American River (SWRI 2001).

Eggs incubated at constant water temperatures greater than 60°F or less than 38°F have been reported to result in high mortalities (Boles et al. 1988). Survival increases, however, for eggs taken at high water temperatures but incubated at temperatures that gradually decline to the mid-40s to mid-50s (°F) range. Mortalities in fry were reduced to low levels when eggs were incubated at constant temperatures from 50°F to 55°F, or under declining temperatures from initial incubation temperatures ranging up to 60°F.

Variable water temperatures (those temperatures that emulate natural variation) have been shown to have reduced negative impacts at higher temperatures compared to constant-temperature incubation. The U.S. Environmental Protection Agency (EPA 1971 as cited in SWRI 2001) found that there was significantly greater survival in eggs incubated at fluctuating temperatures with peaks above 63°F (17.2°C) and significantly better survival for fry at all temperatures (with one exception) in the fluctuated-temperature group compared with constant-temperature groups.

Water temperatures in the lower American River nearly always exceed the reported upper optimal value of 56°F during October, and oftentimes exceed this value during the November portion of the fall-run Chinook salmon spawning and embryo incubation periods.

The juvenile fall-run Chinook salmon rearing period in the Central Valley reportedly extends from late December through June (Moyle 2002; Vogel and Marine 1991). According to Moyle (1976), juvenile Chinook salmon in California seldom spend more than 30 days in freshwater. This trend has been observed in the lower American River. In general, juvenile Chinook salmon spend little time in the lower American River for rearing, as demonstrated by RST surveys. Most fall-run Chinook salmon emigrate during the fry stage and, at the latest, the early juvenile stage in May and possibly into June. The vast majority of juvenile Chinook salmon caught during lower American River RST surveys conducted during 1994, 1995, 1996, 1997, 1998, and 1999 were fry (including yolk-sac fry) and parr, with very few emigrating as silvery parr or smolts (Snider and Titus 2002). The peak Chinook salmon catch occurred during February in most years but occurred in late January in 1996 and in early March in 1998 (Snider and Titus 2002).

Generally consistent with previous RST surveys, juvenile Chinook salmon catches during the most recent 2013 RST survey peaked between mid-February and early March, with fry passing Watt Avenue generally during January through March, parr passing generally during late March through April, and silvery parr passing generally during mid-April through May (PSFMC 2014). Emigration surveys conducted by CDFW have not demonstrated that peak juvenile emigration of Chinook salmon is related to the onset of peak spring flows in the lower American River (Snider et al. 1997).

Overall, the juvenile fall-run Chinook salmon rearing lifestage in the lower American River extends from January through May. The juvenile downstream movement period in the lower American River is coincident with the rearing period.

Water temperature is generally considered to be the most limiting factor for the juvenile rearing lifestage, particularly during late spring. Water temperatures reported to be optimal for rearing of Chinook salmon fry and juveniles are between 45°F and 65°F (NMFS 2002; Rich 1987; Seymour 1956). Raleigh et al. (1986) reviewed the available literature on Chinook salmon thermal requirements and suggested an upper limit of 75°F and a range of suitable water temperatures of about 53.6°F to 64.4°F. Water temperatures required during emigration are believed to be about the same as those required for successful rearing, although Zedonis and Newcomb (1997) report that the smoltification process can become compromised at water temperatures above 62.6°F.

Water temperatures in the lower American River can sometimes exceed the reported upper optimal value of 65°F during the warmest portion of the juvenile rearing and downstream movement lifestage (i.e., May) at Watt Avenue and particularly at the mouth of the lower American River.

Kormos et al. (2012) examined the percentage of hatchery-origin and natural-origin fall-run Chinook salmon spawners in the lower American River and the Nimbus Hatchery during 2010. They found that fall-run Chinook salmon adults spawning in the lower American River were predominantly of natural origin (68 percent), while returns to the Nimbus Fish Hatchery were predominantly of hatchery origin (79 percent).

SPRING-RUN CHINOOK SALMON

The lower American River from the outfall of the Natomas East Main Drainage Canal, also known as Steelhead Creek, downstream to the confluence with the Sacramento River was designated as critical habitat for spring-run Chinook salmon because it is believed to support non-natal rearing (70 FR 52488, September 2, 2005). NMFS further states that the lower American River can be used during high winter flows for rearing and refugia by multiple populations of spring-run Chinook salmon emanating from other rivers in the Central Valley. The downstream movement period for juvenile spring-run Chinook salmon in the lower Sacramento River reportedly occurs primarily from December through May (Snider and Titus 2000 as cited in NMFS 2014), which corresponds to the period when high winter flows typically occur.

Historically, spring-run Chinook salmon occurred in the headwaters of all major river systems in the Central Valley where natural barriers to migration were absent. Beginning in the 1880s, harvest, water development, construction of dams that prevented access to headwater areas, and habitat degradation significantly reduced the number and range of spring-run Chinook salmon in the Central Valley.

The Chinook salmon that historically migrated into the upper reaches of the American River watershed were reportedly spring-run Chinook salmon (Gerstung 1971). It has been estimated that the American River historically might have supported runs exceeding 100,000 Chinook salmon annually (spring-run and fall-run Chinook salmon combined) before mining and migration barriers from dam construction degraded the habitat (Sumner and Smith 1940).

The composition of the anadromous salmonid runs in the American River has changed over time because habitat has been degraded and eliminated. By 1955, spring-run Chinook salmon were extirpated from the American River (Gerstung 1971).

Currently, the lower American River does not support a spawning population of spring-run Chinook salmon. Habitat requirements for juvenile Chinook salmon were discussed above in the section on fall-run Chinook salmon.

RIVER AND PACIFIC LAMPREY

Both river and Pacific lampreys exhibit an anadromous, predatory life history pattern. Lamprey life history information specific to the lower American River is lacking. Generalized life histories for river lampreys and Pacific lampreys in the Central Valley are discussed above in *Overview of Fish Species*.

Most lampreys observed spawning in the lower American River have been reported as Pacific lampreys (Hannon and Deason 2008). However, both river lampreys and Pacific lampreys have been reported to be caught during RST surveys in the lower American River. During the 2013 RST survey, out of the 3,979 non-salmonids caught, 1,917 (48 percent of all non-salmonids) were identified as lampreys (PSFMC 2014). Most of the lampreys were identified as Pacific lampreys (83 percent), with 9 percent identified as river lampreys. The remaining 8 percent were lamprey ammocoetes that were not identified with regard to their species (PSFMC 2014). During the January through May 2013 RST survey, lampreys were caught throughout the season, but the majority of both species of lamprey were caught during May. In fact, 27 percent of the season’s lamprey catch was captured during one week in May (May 14–20) (PSFMC 2014).

Based on the identification of Pacific lamprey redds during steelhead spawning surveys in the lower American River (2002, 2003, 2004, 2005, 2007, and 2013), Pacific lamprey spawning is spatially concentrated downstream of Watt Avenue (particularly near Paradise Beach) and is temporally concentrated when Sacramento River flows are low and are not backing water up into the riffles in the lower reaches of the lower American River (Hannon 2013; Hannon and Deason 2005). The first observed fresh lamprey redd occurred during January in 2003, during March in 2004 and 2005, and during April in 2002 and 2013. An unconfirmed lamprey redd also was observed during February in 2007. The last fresh lamprey redd observed during the survey years when lamprey redds were identified generally occurred during April or May; however, redd surveys generally did not continue beyond April or May (Hannon 2013). The peak lamprey redd count date ranged from late March to early April (Hannon 2013).

Lamprey redds were not positively identified during steelhead spawning surveys during 2009, 2010, 2011, or 2013; however, redd surveys in the lower reaches of the lower American River have reportedly been less thorough since 2007 (Hannon 2013).

SACRAMENTO SPLITTAIL

Splittail might spawn in the lower American River in low numbers, with the majority of this spawning occurring in the lower sections of the river (i.e., downstream of RM 12) between February and May (SWRI 2001).

Fish community surveys have been conducted in the lower American River, encompassing the period from January through June annually from 1991 through 1997 (Brown et al. 1992; Snider and McEwan 1993; Snider and Keenan 1994; Snider and Titus 1996, 2000b; Snider et al. 1998); the results have been very low numbers of captured splittail (SWRI 2001).

At typical water temperatures in the lower American River in February through May (46°F–66°F), vegetation in the lower American River would need to be inundated for an estimated 2 to 4 weeks in order for spawning to occur, with the shorter end of this range applicable during April and May when water temperatures are higher. If an area is inundated for a substantially shorter period (e.g., a few days to a week) adults might spawn in the area, only to have the eggs or early larval stages stranded and dewatered when flows are reduced. When this occurs, strong year-classes are not produced (Sommer et al. 1997). Thus, inundation of riparian vegetation for such short periods is not expected to provide splittail with an opportunity to successfully produce swim-up fry capable of reaching the river's mainstem (SWRI 2001).

HARDHEAD

Little is known regarding use of the lower American River by hardheads. However, in Brown et al. (1992), larval hardheads were reportedly found in late May in the lower American River. In addition, hardheads were captured as early as November in CDFG emigration surveys using rotary screw traps (Snider and Titus 2000b; Snider et al. 1997). Generalized life history information for hardheads in the Central Valley is provided above in *Overview of Fish Species*.

AMERICAN SHAD

Adult American shad enter the lower American River beginning in April and can continue to be present in the river through the first week of July (CDFG 1986), with the majority of immigration and spawning occurring from mid-May through June (Urquhart 1987). Cannon and Kennedy (2003) observed adult American shad in the lower American River beginning in late May and continuing through August. American shad continue to provide a popular sport fishery during spring on the lower American River (Cannon and Kennedy 2006).

Since 1994, American shad have been captured in the lower American River during CDFW's emigration surveys using rotary screw traps (CDFG 2000; PSFMC 2014; Snider and Titus 1995, 2000b; Snider et al. 1997, 1998).

No specific estimates are available regarding the annual run size of American shad in the lower American River.

Generally about 70 percent of the annual spawning run consists of first-time spawners (Moyle 2002). Virgin fish have been reported to distribute themselves relative to the proportions of flow in the tributaries and the mainstem of the Sacramento River (Painter et al. 1978). Given that virgin fish often make up a majority of the spawners, the number of American shad spawning in the lower American River is expected to vary as flows in the lower American River change relative to flows in the Sacramento River.

Kelley et al. (1985b as cited in SWRI 2001) compared estimated lower American River shad catches in 1969 (Hooper 1970) and in 1976, 1977, and 1978 (Meinz 1981) with the relationship between American and Sacramento River flows during May and June of those years. In 1969 and 1978, when American River flows were 18 percent and 19 percent, respectively, of the Sacramento flows, catches were much higher than in 1976 and 1977, when American River flows were 10.5 percent and 5.4 percent, respectively, of the Sacramento River flows. No total catch estimates have been made since 1978, so further evaluations of these potential relationships have not been made (Kelley et al. 1985b as cited in SWRI 2001).

Previous reports have suggested that juvenile American shad do not use the lower American River as rearing habitat for extended periods and that the lower American River did not serve as a season-long nursery area for juvenile shad (Kelley et al. 1985b as cited in SWRI 2001; Meinz 1979; Painter et al. 1978). This suggestion apparently was based on CDFG seine surveys conducted for juvenile shad in the lower American River weekly from July through November 1977 and from mid-July through mid-September 1978. Only 98 juvenile American shad were collected, all from the mouth of the river, which suggests that juvenile American shad do not rear in the lower American River (Kelley et al. 1985b as cited in SWRI 2001).

By contrast, more-recent collections of juvenile American shad by CDFW suggest that juvenile American shad can rear in the lower American River for relatively extended periods. Emigration surveys conducted by CDFG from 1994 to 1999 (CDFG 2000; Snider and Titus 1995, 2000b; Snider et al. 1997, 1998) using a rotary screw trap indicate that juvenile American shad rearing occurs at least as far upstream as Watt Avenue well into November and even into December subsequent to spawning the previous spring.

Kelley et al. (1985b as cited in SWRI 2001) recommended flows of 2,000 cfs or greater from mid-May through June for attracting American shad. Snider and Gerstung (1986) recommended flow levels of 3,000 to 4,000 cfs in the lower American River during May and June as sufficient attraction flows to sustain the American shad fishery in the lower American River. Painter et al. (1978) recommended that to "[m]aintain a normal distribution of adult shad to tributaries in the watershed, the May/June flow of the American River should be not less than 10% of the Sacramento River at Sacramento."

STRIPED BASS

Limited information is available on striped bass in the lower American River. Few individuals have been captured by electrofishing, gill netting, seining, or rotary screw trapping. USFWS conducted Standard Fishing Method surveys throughout the year on a significant stretch of the lower American River from December 1976 through 1980 (DeHaven 1977, 1978, 1979, 1980). Those surveys provide information about the presence and distribution of striped bass both temporally and spatially.

No studies have definitively determined whether striped bass spawn in the lower American River (CDFG 1971; CDFG 1986 as cited in SWRI 2001). However, the scarcity of sexually ripe adults among sport-caught fish indicates that minimal, if any, spawning occurs in the lower American River and that adult fish that enter the river probably spawned elsewhere (DeHaven 1977, 1978).

Striped bass populations extend throughout Central Valley rivers, and juveniles and adults opportunistically use the lower American River as predators. Adult striped bass are present in the lower

American River throughout the year (DeHaven 1977), with peak abundance occurring during the summer (DeHaven 1977, 1978, 1979, 1980; Snider and McEwan 1993).

A spring “run” into the river might occur from the lower Sacramento River and Delta (Cannon and Kennedy 2006). Cannon and Kennedy (2003) fist observed adult striped bass in the lower American River during April and observed them in the largest numbers during June. Sacramento River tributaries, including the lower American River, can serve as opportunistic nursery areas for young striped bass (CDFG 1971, 1986). Numerous schools of 5-to-8-inch-long fish have been reported in the lower American River during the summer (CDFG 1971) and during fall (DeHaven 1977). Snider et al. (1998) collected some striped bass in their rotary screw traps in the summer period (May through August), which suggests an increase in abundance during that period. The majority of these fish caught were yearlings, and the remainder was divided between YOY and sub-adults. Catch rates of predominantly juvenile and subadult striped bass in the tidal reach of the lower American River reported in DeHaven (1977, 1978, 1979, 1980) seem to indicate an upstream movement of striped bass from winter and spring, to summer and fall, possibly peaking in late summer.

Optimal water temperatures for juvenile striped bass rearing have been reported to range from about 61°F to 71°F (Fay et al. 1983). The number of striped bass entering Central Valley streams during the summer is believed to vary with flow levels and food production (CDFG 1986). Snider and Gerstung (1986) suggested that flows of 1,500 cfs at the mouth during May and June would be sufficient to maintain the striped bass fishery in the lower American River. However, these investigators reported that, in any given year, the population level of striped bass in the Delta was probably the greatest factor determining the relative number of striped bass occurring in the lower American River.

1.1.3 Far-Field

The following watershed-specific sections provide descriptions of the waterbodies and associated fish species of focused evaluation. General life history information pertaining to the Central Valley, the Sacramento River, and the Delta previously discussed in *Overview of Fish Species* is not repeated in the following sections.

1.1.3.1 Sacramento River Basin

1.1.3.1.1 Sacramento River

Flows in the upper Sacramento River are regulated primarily by Shasta Dam and are reregulated 15 miles downstream at Keswick Dam. The watershed above Shasta Dam drains about 6,650 square miles with an average annual runoff of 5.7 million acre-feet (MAF). Shasta Dam has the largest capacity of any reservoir in California. Annual releases range from 9 MAF in wet years to 3 MAF in dry years. From 1964 to 1996, Keswick Dam releases averaged 7.3 MAF annually. More recently (1986 to 1996), Keswick Dam annual releases averaged 5.9 MAF (USFWS et al. 1999).

Shasta Reservoir releases, and therefore Sacramento River flow, are often governed by water temperature requirements below Keswick Dam for April through October and an end-of-September carryover storage target for Shasta Reservoir of 1.9 MAF to protect Sacramento River winter-run Chinook salmon (NMFS 2004, 2009, 2014). To meet the temperature objectives, Reclamation dynamically evaluates ambient air temperature, weather forecasts, water temperature at the release point, and release rate. Reclamation often determines the appropriate release rate based on the temperature of the water released rather than the rate needed to support Central Valley Project (CVP) operations. Generally, it takes higher releases to meet water temperature targets with warmer water and lower releases with colder water. The coldwater pool in the reservoir is essentially a function of the volume of water in the reservoir. During years when CVP facilities cannot be operated to meet required temperature and storage objectives, Reclamation reinitiates consultation with NMFS.

The upper Sacramento River is often defined as the portion of the river from Princeton (RM 163) (the downstream extent of salmonid spawning in the Sacramento River [Water Forum 1999]) to Keswick Dam (the upstream extent of anadromous fish migration and spawning). The upper Sacramento River provides a diversity of aquatic habitats including fast-water riffles and shallow glides, slow-water deep glides and pools, and off-channel backwater habitats. Consequently, this section of the river is of primary importance to native anadromous species and is presently used for spawning and early-life-stage rearing, to some degree, by all four runs of Chinook salmon (fall, late-fall, winter, and spring) and steelhead.

The lower Sacramento River is generally defined as the portion of the river from Princeton to the Delta at about Chipps Island (near Pittsburg), which includes the study area for this Project. The lower Sacramento River is predominantly channelized, leveed, and bordered by agricultural land. Aquatic habitat in the lower Sacramento River is characterized primarily by slow-water glides and pools, is depositional in nature, and has lower water clarity and habitat diversity relative to the upper portion of the river.

Many of the fish species using the upper Sacramento River also use the lower river to some degree, even if only as a migratory pathway to and from upstream spawning and rearing grounds. For example, adult Chinook salmon and steelhead primarily use the lower Sacramento River as an immigration route to upstream spawning habitats and an emigration route to the Delta. The lower river also is used by other fish species (e.g., Sacramento splittail and striped bass) that make little to no use of the upper river (upstream of RM 163).

Overall, fish species composition in the lower portion of the Sacramento River is similar to that of the upper Sacramento River and includes resident and anadromous cold- and warmwater species. Many fish species that spawn in the Sacramento River and its tributaries depend on river flows to carry their larval and juvenile lifestages to downstream nursery habitats. Native and introduced warmwater fish species use the lower river primarily for spawning and rearing, with juvenile anadromous fish species also using the lower river and non-natal tributaries, to some degree, for rearing.

Over 30 species of fish are known to use the Sacramento River. Of these, a number of both native and introduced species are anadromous. Anadromous species include Chinook salmon (winter-run, spring-run, fall-run, and late fall-run), steelhead, green and white sturgeon, Pacific lamprey, river lamprey, American shad, and striped bass.

Descriptions of life histories of fish species of focused evaluation in the Sacramento River are provided above in *Overview of Fish Species*.

1.1.3.1.2 Sutter and Yolo Bypasses

Flow from the Sacramento River spills into the Sutter and Yolo Bypasses during high-flow events. The bypasses form a floodplain corridor that is an important part of the flood-control system but also serves as important habitat for juvenile salmonids and other native fish. Fish can enter the bypasses through flood-relief structures and weirs. The Sacramento River enters the Sutter Bypass at Moulton, Colusa, and Tisdale Weirs and enters the Yolo Bypass at the Freemont Weir.

1.1.3.1.3 Sutter Bypass

Within the Sutter National Wildlife Refuge (NWR), native anadromous fish include steelhead and four distinct runs of Chinook salmon (USFWS 2009). Encompassing an area of about 2,600 acres, the Sutter NWR is located about 50 miles north of Sacramento, 10 miles southwest of Yuba City, and 5 miles south of Sutter, California. About 80 percent of the Sutter NWR is within the Sutter Bypass, which is west of Yuba City, California (USFWS 2009). The east and west Sutter Bypass canals are part of lower Butte Creek and are tributary to the larger Sacramento River system.

During periods of high flows in the Sutter Bypass, large numbers of Chinook salmon and steelhead can use the Sutter NWR (USFWS 2009). When the Sutter Bypass is inundated, the relatively warmer waters of the floodplain become very productive and produce an abundance of prey, resulting in rapid growth rates and relatively large sizes of juvenile anadromous salmonids outmigrating to the Delta and the Pacific Ocean.

During periods of flooding, the Sutter NWR provides high-value rearing habitat for migrating juvenile Chinook salmon. Water enters the Sutter Bypass in several ways. First, Butte Creek, a non–State Water Project (SWP)/CVP tributary of the Sacramento River, spills into Sutter Bypass via Butte Slough (Feyer et al. 2006). Second, when Sacramento River flows exceed between 90,000 and 100,000 cfs at Ord Ferry, water flows naturally over the banks into the Butte Basin. In addition to the Sacramento River overbank flows at Ord Ferry, the Sutter Bypass receives inflow at weirs along the Sacramento River during high-flow events. Water enters Sutter Bypass at Tisdale Weir when Sacramento River flow exceeds 21,012 cfs, at Moulton Weir when flow exceeds 44,990 cfs, and at Colusa Weir when flow exceeds 65,014 cfs (Feyer et al. 2006).

1.1.3.1.4 Yolo Bypass

The Yolo Bypass is a leveed, 59,000-acre floodplain on the west side of the lower Sacramento River. The bypass carries floodwaters from several northern California waterways to the Delta (Yolo Basin Foundation 2001). Yolo Bypass (and its upstream counterpart, the Sutter Bypass) conveys flood flows of the Sacramento River and smaller tributaries around and away from cities such as Sacramento (Sommer et al. 2008). The Yolo Bypass is inundated from flows from the Sacramento River during parts of winter and spring, in about 70 percent of years, when total flow in the Sacramento River exceeds 2,000 cubic meters per second at the northern boundary of the Yolo Bypass (Sommer et al. 2008).

The primary input to the Yolo Bypass is through Fremont Weir in the north, which conveys floodwaters from the Sacramento and Feather Rivers (Sommer et al. 2003). During major storm events (i.e., >5,000 cubic meters per second), additional water enters from the east via Sacramento Weir, adding flow from the American and Sacramento Rivers (Sommer et al. 2003). Flow also enters the Yolo Bypass from several small west-side streams, including Knight's Landing Ridge Cut, Cache Creek, the Willow Slough Bypass, and Putah Creek (Sommer et al. 2003).

At peak flows, up to 24,000 hectares of the Yolo Bypass are inundated (Sommer et al. 2008). Typical dimensions are 2 to 10 km (about 1.2 miles to about 6 miles) wide with a mean depth of 2 meters (about 6.5 feet) or less (Sommer et al. 2008). The floodwaters flowing through the Yolo Bypass re-enter the Sacramento River via Cache Slough (Moyle 2008). The principal permanent water channel in the Yolo Bypass is the Toe Drain, which runs along the levee on the eastern side (Moyle 2008).

The southern outlet of the Yolo Bypass is Liberty Island, which is an inundated island encompassing 5,209 acres (CALFED 2005). Liberty Island has been flooded since 1998 when its levees were breached during high flows through the Yolo Bypass (CALFED 2005). Between 1998 and 2005, Liberty Island has transformed from a large organic tomato farm to over 800 acres of freshwater tidal marsh and emerging marsh, 55 acres of herbaceous wetlands, and almost 20 acres of riparian habitat (CALFED 2005). While non-native fish have dominated sampling efforts at Liberty Island, native fish species observed include Chinook salmon, Sacramento splittail, longfin smelt, delta smelt, Sacramento tule perch, Sacramento pikeminnow, and starry flounder (CALFED 2005).

Important ecological processes within the overall Yolo Basin include streamflow and inundation, stream erosion, and natural sediment supply. Important aquatic habitats within the Yolo Basin include stream and slough channels for fish migration and holding, spawning, and nursery habitats (CALFED 2000). The Yolo Bypass provides diverse habitats for a wide variety of fish, wildlife, and plant communities, primarily native resident (nonmigratory) fish (see **Table 7**), riparian communities, seasonally and permanently flooded wetlands, wildlife, and waterfowl (CALFED 2000).

Sommer et al. (1997) demonstrated that the Yolo Bypass is one of the single most important habitats for Sacramento splittail. Introduced fish species frequently dominate the fauna in the Delta on a year-round basis (Bennett and Moyle 1996). However, unlike the other Delta habitats, the floodplain in the Yolo Bypass is seasonally dewatered during late spring through autumn, which prevents exotic species from establishing year-round dominance except in perennial water sources (Sommer et al. 2003).

Table 8. Native and Introduced Fish Species Observed in the Yolo Bypass.

Native Fish Species	Introduced Fish Species	
Chinook salmon	American shad	Redear sunfish
Steelhead	Threadfin shad	Green sunfish
Pacific lamprey	Common carp	Warmouth
River lamprey	Goldfish	Black crappie
Hitch	Fathead minnow	White crappie
Sacramento blackfish	Golden shiner	Bigscale logperch
Sacramento pikeminnow	Red shiner	Largemouth bass
Sacramento sucker	Channel catfish	Smallmouth bass
Sacramento splittail	White catfish	Spotted bass

Native Fish Species	Introduced Fish Species	
Prickly sculpin	Black bullhead	Striped bass
Pacific staghorn sculpin	Brown bullhead	Shimofuri goby
Threespine stickleback	Wakasagi	Yellowfin goby
Sacramento tule perch	Inland silverside	
Delta smelt	Western mosquitofish	
White sturgeon	Bluegill	
Source: Modified from Sommer et al. 2003		

The portion of the Yolo Bypass north of the Yolo Causeway on Interstate 80 is an important migratory route during wet years for downstream migrant Chinook salmon, steelhead, and other native and anadromous fish originating from upstream areas. When flooded, the Yolo Bypass provides valuable spawning habitat for native resident fish (CALFED 2000). For example, during flood pulses, the Yolo Bypass floodplain provides juvenile anadromous salmonids an alternative migration corridor to the lower Sacramento River (Sommer et al. 2003). The results of Sommer et al. (2001) indicated that this seasonal floodplain habitat provides better rearing conditions than the adjacent Sacramento River channel because of two major advantages: (1) increased area of suitable habitat (e.g., extensive shoals and increased habitat complexity); and (2) increased food resources. Sommer et al. (2001) found that improved rearing conditions allowed juvenile salmon to grow substantially faster in the Yolo Bypass floodplain than in the adjacent Sacramento River, primarily because of a higher abundance of invertebrate prey in the floodplain.

In addition to providing key habitat for native and non-native fish, seasonal inundation of the Yolo Bypass might also benefit organisms downstream in the brackish portion of the San Francisco Estuary through transfer of phytoplankton and detritus (Sommer et al. 2003). Modeling studies by Jassby and Cloern (2000) suggest that phytoplankton produced in the Yolo Bypass can be an important source of organic carbon to the San Francisco Estuary, at least during flood events. The Yolo Bypass also is probably a major pathway for detrital material to the phytoplankton-deficient San Francisco Estuary (Sommer et al. 2003). Schemel et al. (1996 as cited in Sommer et al. 2003) found that the Yolo Bypass is the major pathway for organic matter to the San Francisco Estuary during wet years.

The Cache Slough Complex, which includes Liberty Island, the Little Holland Tract, the Hastings Tract, and Prospect Island, has become an important focus for restoration activities in the North Delta to increase and improve the overall habitat for delta smelt (CDFG 2008). This region has high restoration potential as tidal freshwater marsh and slough habitat because:

1. Island subsidence is low compared to other parts of the Delta;
2. It maintains much of its original drainage pattern;
3. It is a major spawning and rearing region for delta smelt;
4. It has strong tidal currents that move water from the Sacramento River in and out of its channels;
5. It drains the lower end of the Yolo Bypass; and

6. It contains Liberty Island (which has already been flooded and provides high-quality habitat and ecological functions) (Moyle 2008).

The region can be converted relatively easily into favorable tidal habitat for native fish (Moyle 2008). This region could provide spawning beaches and productive rearing areas for larvae that are unsuitable to potential egg and larval predators, particularly inland silverside (Moyle 2008).

1.1.3.2 Feather River

The lower Feather River commences at the Low Flow Channel, which extends 8 miles from the Fish Barrier Dam (RM 67) to the Thermalito Afterbay Outlet (RM 59). Under an agreement with CDFG, flows in this reach of the river are regulated at 600 cfs, except during flood events when flows have been as high as 150,000 cfs (DWR 1983). Average monthly water temperatures typically range from about 47°F in winter to about 65°F in summer.

The majority of the Low Flow Channel flows through a single channel contained by stabilized levees. Side-channel or secondary channel habitat is extremely limited, occurring primarily in the Steep Riffle and Eye Riffle areas between RM 60 and RM 61. The channel banks and streambed consist of armored cobble as a result of periodic flood flows and the absence of gravel recruitment. However, there are nine major riffles with suitable spawning-size gravel, and about 75 percent of the Chinook salmon spawning takes place in this upper reach (Sommer et al. 2001). Releases are made from the coldwater pool in Oroville Reservoir, and this cold water generally provides suitable water temperatures for spawning in the Low Flow Channel (DWR 2001).

The lower reach extends 15 miles from the Thermalito Afterbay Outlet (RM 59) to Honcut Creek (RM 44). Releases from the outlet vary according to operational requirements. In a normal year, total flow in the lower reach ranges from 1,750 cfs in fall to 5,000 cfs to 8,000 cfs in spring. Water temperature in winter is similar to the Low Flow Channel but increases to 74°F in summer. Higher flows dramatically increase the channel width in this reach. Numerous mid-channel bars and islands braid the river channel, creating side-channel and backwater habitat. The channel is not as heavily armored, and long sections of riverbanks are actively eroding. In comparison to the Low Flow Channel, there is a greater amount of available spawning areas, which are isolated by longer and deeper pools (DWR 2001).

1.1.3.2.1 Spring-run Chinook Salmon

Adult spring-run Chinook salmon enter the Sacramento River Basin between March and September, primarily in May and June (Moyle 2002; Yoshiyama et al. 1998 as cited in NMFS 2014). Spring-run Chinook salmon adult immigration and holding in the lower Yuba River reportedly occurs from April through September (RMT 2013). Thus, spring-run Chinook salmon in the lower Feather River also might be holding into September. Adult Chinook salmon in the lower Feather River exhibiting the typical life history of the spring-run have been found holding at the Thermalito Afterbay Outlet and the Fish Barrier Dam as early as April (DWR 2007 as cited in NMFS 2014).

Spring-run Chinook salmon spawning and embryo incubation in the lower Feather River can occur from September through February (NMFS 2014). Spring-run Chinook salmon fry generally emerge from the gravel from November to March (Moyle 2002). Most juvenile Chinook salmon emigrate from the lower

Feather River within a few months of emergence (NMFS 2014). However, some spring-run Chinook salmon juveniles reportedly rear for up to 15 months prior to emigrating (NMFS 2014).

1.1.3.2.2 Fall-run Chinook Salmon

In the Central Valley, adult fall-run Chinook salmon are reported to generally begin migrating upstream annually in July, with immigration continuing through December in most years (NMFS 2004; Vogel and Marine 1991). Fall-run Chinook salmon spawning and embryo incubation generally extend from October through February or March (Moyle 2002; SWRI 2001; Vogel and Marine 1991). The juvenile fall-run Chinook salmon rearing period in the Central Valley reportedly extends from late December through June (Moyle 2002; Vogel and Marine 1991). In the Feather River, fall-run Chinook salmon fry emergence has been reported to occur as early as November (Seesholtz et al. 2003). Therefore, for this evaluation, USACE evaluated fall-run Chinook salmon juvenile rearing and downstream movement during November through June.

1.1.3.2.3 Steelhead

The majority of natural steelhead spawning in the Feather River is reported to occur in the Low Flow Channel, particularly in the upper reaches near Hatchery Ditch, although limited steelhead spawning also occurs below the Thermalito Afterbay Outlet (DWR 2007). The residence time of adult steelhead in the Feather River after spawning and the extent of adult steelhead post-spawning mortality are currently unknown (NMFS 2014). Recently, RMT (2013) identified steelhead lifestage periodicities in the lower Yuba River (a tributary of the Feather River), which are used in evaluating steelhead in the lower Feather River.

RMT (2010, 2013) identified the period extending from August through March as encompassing the majority of the upstream migration and holding of adult steelhead in the lower Yuba River. Steelhead adults typically spawn from December through April with peaks from January through March in small streams and tributaries where cool, well-oxygenated water is available year-round (McEwan 2001; Hallock et al. 1961). Based on all available information collected to date, RMT (2013) recently identified the steelhead spawning period in the lower Yuba River as extending from January through April, with embryo incubation extending into May.

Juvenile steelhead rearing in the lower Yuba River exhibits a variety of temporal periods. Some juvenile steelhead might rear in the lower Yuba River for a short duration (up to a few months) whereas others might spend from 1 to 3 years rearing in the river. A review of available data indicates that emigration of steelhead smolts 1 year old and older (yearling+) can extend from October through mid-April (RMT 2010, 2013).

1.1.3.2.4 Green Sturgeon

Limited information regarding green sturgeon distribution, movement and behavioral patterns, and lifestage-specific habitat utilization preferences is available for the Feather River. Although adult green sturgeon occurrence in the Feather River has been previously documented, larval and juvenile green sturgeons have not been collected despite attempts to collect them during the early spring through summer using rotary screw traps, artificial substrates, and larval nets deployed at multiple locations

(Seesholtz et al. 2003). Moreover, unspecific past reports of green sturgeon spawning (CDFG 2002; Wang 1986) have not been corroborated by observations of young fish or significant numbers of adults in focused sampling efforts (Beamesderfer et al. 2004; Niggemeyer and Duster 2003; Seesholz et al. 2003).

Based on these results, in 2006, NMFS concluded that an effective population of spawning green sturgeon did not exist in the lower Feather River (71 FR 17757). However, four fertilized green sturgeon eggs were collected near the Thermalito Afterbay Outlet on June 14, 2011, thus providing the first documentation of at least some successful spawning in the Feather River (A. Seesholtz, DWR, pers. comm., June 16, 2011, as cited in USACE 2013).

Green sturgeon in the Sacramento River have been documented and studied more widely than they have in the Feather River. For this evaluation, USACE assumes that green sturgeon in the Feather River would share the same life history traits as green sturgeon in the Sacramento River as described previously in *Overview of Fish Species*.

1.1.3.2.5 White Sturgeon

Although both green and white sturgeon are native to California, white sturgeon are more commonly observed in the Feather River (DWR 2003 as cited in DWR 2005) and are known to spawn in the Feather River (Moyle 2002). For this evaluation, USACE assumes that white sturgeon life history periodicities in the Feather River are the same as those previously discussed for the Sacramento River in *Overview of Fish Species*.

1.1.3.2.6 River Lamprey

River lamprey life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed for the Sacramento River in *Overview of Fish Species*.

1.1.3.2.7 Pacific Lamprey

Pacific lamprey life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed for the Sacramento River in *Overview of Fish Species*.

1.1.3.2.8 Sacramento Splittail

Sacramento splittail life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed for the Sacramento River in *Overview of Fish Species*. Sacramento splittail spawning, embryo incubation, and initial rearing lifestages in the lower Feather River occur from February through May. Sacramento splittail spawning in the lower Feather River has been reported to occur predominantly on flooded vegetated benches (DWR 2004a).

1.1.3.2.9 Hardhead

Hardhead life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed for the Sacramento River in *Overview of Fish Species*.

AMERICAN SHAD

American shad life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed for the Sacramento River in *Overview of Fish Species*. American shad adult spawning in the lower Feather River occurs from April through June (DWR 2007). American shad juvenile rearing reportedly occurs in the Feather River below Yuba City (USFWS 1995).

STRIPED BASS

Striped bass life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed for the Sacramento River in *Overview of Fish Species*. Striped bass spawning in the lower Feather River extends from April through June (DWR 2007).

1.1.3.3 Delta

The San Francisco Bay/Sacramento–San Joaquin Delta makes up the largest estuary on the west coast of the United States (EPA 1992). The Sacramento–San Joaquin Delta, the most upstream portion of the Bay-Delta estuary, is a triangle-shaped area composed of islands, river channels, and sloughs at the confluence of the Sacramento and San Joaquin Rivers. The northern Delta is dominated by the waters of the Sacramento River, which are of relatively low salinity, whereas the relatively higher-salinity waters of the San Joaquin River dominate the southern Delta. The central Delta includes many channels where waters from the Sacramento and San Joaquin Rivers and their tributaries converge. The Delta includes the river channels and sloughs at the confluence of the Sacramento and San Joaquin Rivers.

The Delta's tidally influenced channels and sloughs cover a surface area of about 75 square miles. Data suggest that these intertidal waters favor a number of resident freshwater fish and invertebrate species at the deepest, most subsided sites. Marsh plains and tidal channels formed within these intertidal regions continuously drain and fill with the ocean tide, allowing movement of fish, in addition to primary and secondary production, inshore and offshore. Tidal action can therefore be important for pelagic organisms as inundation allows increased foraging success and opportunity resulting from the larger abundance of phytoplankton and zooplankton inshore.

Intertidal habitats can also provide reduced predation for young fishes (Brown 2003). These waters can also be used as migration corridors and rearing areas for anadromous fish species and as spawning and rearing grounds for many estuarine species. Similarly to intertidal regions, shallow-water habitats, defined as areas that are less than 3 meters in depth (mean low water), are considered particularly important forage, reproduction, rearing, and refuge areas for numerous fish and invertebrate species.

Historical modification of ecosystem processes and functions in the Delta and throughout the Sacramento and San Joaquin River watersheds have influenced the current aquatic habitat conditions, which directly affects special-status species and other species of focused evaluation (i.e., recreationally and commercially important species). Flow-related habitat conditions are the result of a combination of (1) unaltered discharges from surface water and groundwater flowing into the Delta and (2) managed releases from reservoirs. Flows in the Delta vary seasonally and annually with rainfall, runoff, and water supply management.

The majority of fish species in the Delta use the Tidal Perennial Aquatic community (see the *CALFED Ecosystem Restoration Program Plan* for detailed description of the aquatic communities in the Delta). Delta aquatic communities are used by fish for foraging, spawning, egg incubation and larval development, juvenile nursery areas, and migratory corridors. Most Delta resident fish species spend their entire lives in the Tidal Perennial Aquatic community, while other fishes in the Delta can spend certain seasons or part of their lives in different areas of the community, based on physical factors such as salinity, turbidity, dissolved oxygen, flow rates, and water temperature.

Use of the various aquatic habitats within the Delta by individual species is often determined by multiple physical factors (e.g., flow, salinity, wind, tide, and temperature), many of which vary at multiple temporal scales (Kimmerer 2004). Resident and migratory fish use Delta aquatic habitats for spawning, rearing, foraging, and escape cover. Striped bass, delta smelt, Sacramento splittail, and many resident Bay-Delta fish use this habitat for rearing and as adults (CALFED 2000). Young steelhead and Chinook salmon forage in these productive waters as fry and juveniles to gain weight and improve their condition before entering the ocean.

In the Delta, saline coastal oceanic water is mixed and diluted by the flowing freshwater of rivers. This mix of fresh and oceanic water forms a salinity gradient that varies by area and location with seasonal variations in freshwater inflow and tidal action. This gradient drives the location of species that depend on salinity, such as delta smelt and longfin smelt. The location of this gradient reportedly varies on multiple time scales as a result of multiple processes: daily tides, the monthly lunar cycle, intra-annual (seasonal) flow patterns, and interannual flow variation from interannual rainfall variation, and long-term global climate change (Kimmerer 2004). During low-flow periods, the salinity gradient is maintained at locations that provide freshwater in the Delta at levels that maintain human uses. Historically, the salinity gradient was generally farther downstream than it now occurs under similar hydrologic conditions.

As reported in the *Pelagic Organism Decline Progress Report: 2007 Synthesis of Results* (Baxter et al. 2008; Feyrer et al. 2007), habitat for pelagic fish species consists of open water, largely away from shorelines and vegetated inshore areas. These areas are used for the majority of the lifecycle needs of the pelagic fish species except perhaps during spawning. Pelagic open-water habitat includes the deeper areas of many of the larger channels in the Delta, in addition to large embayments such as Suisun Bay. Pelagic fish habitat is characterized by physical and chemical properties, including salinity, turbidity, and water temperature, and biological properties such as prey production. Thus, pelagic fish habitat suitability in the estuary is influenced by variation in freshwater flow (e.g., Delta outflow) (Bennett and Moyle 1996; Jassby et al. 1995; Kimmerer 2004).

Several fish species use a variety of behaviors to maintain themselves within open-water areas where water quality and food resources are favorable (Bennett et al. 2002 as cited in Reclamation 2008). Delta smelt, longfin smelt, striped bass, and threadfin shad distribute themselves at different concentrations of salinity within the estuarine salinity gradient (Feyrer et al. 2007; Kimmerer 2002a), which indicates that, at any point in time, salinity is a major factor affecting their geographic distributions. Because of the importance that salinity has on fish distribution in the estuary, the term *Low-Salinity Zone* (LSZ) within the San Francisco Estuary was created. This term is defined as the area within the estuary where salinity is about 0.5 to 6 ppt. X2 (i.e., roughly the center of the LSZ), is defined as salinity of around 2 ppt

(Kimmerer 2002b). The term *X2* is used to define the distance from the Golden Gate Bridge upstream to the location where salinity near the bottom of the water column is about 2 ppt.

Salinity between 2 ppt and about 30 ppt is roughly linearly distributed between X2 and the mouth of the estuary (Monismith et al. 1996 as cited in Kimmerer 2002b). X2 reflects the physical response of the San Francisco Estuary to changes in flow and provides a geographic frame of reference for estuarine conditions (Kimmerer 2002b). The estuary responds to freshwater flow on a time scale of 2 weeks, as characterized by the statistical relationship between X2 and flow (Jassby et al. 1995 as cited in Kimmerer 2004). Because the position of X2 relies on a number of physical parameters including river flows, water diversions, and tides, its position shifts over many kilometers on a daily and seasonal cycle. Over the course of a year, the location of X2 can range from San Pablo Bay during high-river-flow periods up into the Delta during the summer.

According to CDFG (2010), the available data and information indicate:

1. The abundances of many fish and aquatic species are related to water flow timing and quantity (or the placement of X2);
2. For many fish and aquatic species, more water flow translates into greater species production or abundance;
3. Fish and aquatic species are adapted to use the water resources of the Delta during all seasons of the year, but, for many species, important life history stages or processes consistently coincide with increased winter-spring flows; and
4. The source, quality, and timing of water flows through the estuary influences the production of Chinook salmon in both the San Joaquin River and Sacramento River Basins (CDFG 2010).

However, Delta outflow is affected by multiple factors and conditions, many of which are involved in hypothesized mechanisms for X2 relationships (Kimmerer 2004). Therefore, the presence of an X2 relationship does not necessarily imply anything about the conditions at the location where the salinity is near 2 ppt (Kimmerer 2004).

Delta inflow and outflow are important for species residing primarily in the Delta (e.g., delta smelt and longfin smelt) (USFWS 1994) and for juveniles of anadromous species (e.g., Chinook salmon) that rear in the Delta prior to ocean entry. Seasonal Delta inflows and outflows affect several key ecological processes including:

1. The migration and transport of various lifestages of resident and anadromous fish using the Delta (EPA 1992);
2. Salinity levels at various locations within the Delta as measured by the location of X2; and
3. The Delta's primary (phytoplankton) and secondary (zooplankton) production.

Species and lifestage-specific discussions are provided below for fish species of focused evaluation and for species that depend on the Delta for one or more lifestages. General life history information provided in Section 1.1.2.1, *Overview of Fish Species* is not repeated in this section.

1.1.3.3.1 Delta Smelt

Delta smelt are endemic to the Bay-Delta estuary (Moyle 2002). Delta smelt are found primarily downstream of Isleton on the Sacramento River, downstream of Mossdale on the San Joaquin River, and in Suisun Bay and Suisun Marsh. Delta smelt adults occur primarily in the tidally influenced low salinity region of Suisun Bay and the freshwater regions of the Delta and the Sacramento and San Joaquin Rivers (Moyle 2002). The downstream location of the low-salinity habitat for delta smelt is typically located in Suisun Bay but extends farther to the west in response to high Delta outflows and farther to the east in response to low Delta outflows.

Delta smelt have been collected in Carquinez Strait, the Napa River, and even as far downstream as San Pablo Bay in wet years (Moyle 2002). During September or October, adults begin upstream movement toward freshwater sloughs and channels of the western Delta to spawn. Spawning takes place between February and July but appears to be greatest during mid-April and May (Bennett 2005). Spawning can occur in the Sacramento River as far upstream as Sacramento, the Mokelumne River system, and the Cache Slough region (Moyle 2002). Since 1982, the center of adult delta smelt abundance in the fall has been the northwestern Delta in the channel of the Sacramento River near Decker Island. In any month, two or more lifestages (adult, larvae, and juveniles) of delta smelt could be present in Suisun Bay (DWR and Reclamation 1994; Moyle 2002; Wang 1991). Delta smelt are also found seasonally in Suisun Marsh.

1.1.3.3.2 Longfin Smelt

Longfin smelt larvae have a widespread distribution in the San Francisco Estuary and are detected each year in the western Delta, Suisun Bay, Suisun Marsh, and the southern Delta (Baxter 1999). Larval longfin smelt are also frequently caught in San Pablo Bay, and they are sometimes caught in the Central and South Bays and the eastern and southern Delta (Baxter 1999). In many years, longfin smelt are caught in the Napa River Estuary as well. Larval sampling in the South Bay is not extensive enough to characterize the presence or abundance (if any) of larval longfin smelt.

Longfin smelt are widespread within the Delta and, historically, they were found seasonally in all of its major open-water habitats and Suisun Marsh. Longfin smelt are believed to spawn at the transition zone between freshwater and saltwater, but the exact spawning locations and conditions that support egg deposition and incubation are unknown. Spawning almost certainly occurs in the Sacramento River mainstem, probably near Rio Vista and downstream.

Spawning longfin smelt scatter adhesive eggs on sand substrates from December through May (CDFG 2010). Based on the identified presence of newly hatched larvae and an assumed 25-day incubation period, CDFG (2009) estimated that longfin smelt likely spawn during November through April, with a peak in January. Longfin smelt spawning is believed to occur in the Sacramento River mainstem near Rio Vista and downstream (Reclamation 2008a). As water temperatures drop below 18°C during the fall, maturing adult longfin smelt migrate from the lower estuary to the LSZ and congregate prior to spawning (CDFG 2009). Spawning reportedly starts when water temperatures drop below 16°C and becomes consistent when water temperatures drop below 13°C (CDFG, unpublished data, as cited in CDFG 2009). Moyle (2002) states that longfin smelt inhabiting the Bay-Delta estuary are thought to spawn in freshwater or slightly brackish water over sandy or gravel substrates at temperatures ranging from 7°C to 14.5°C (44.6°F to 58.1°F) (Moyle 2002).

Movement patterns based on catches in CDFG fishery sampling suggest that longfin smelt actively avoid water temperatures greater than 22°C (72°F). In addition, sampling data suggest that longfin smelt do not occupy areas with temperatures greater than 22°C (72°F) in combination with salinities greater than 26 ppt.

1.1.3.3.3 Chinook Salmon

As reported in NMFS (2014), as Chinook salmon begin the smoltification stage, they are found rearing in the estuary where ambient salinity reaches 1.5 to 2.5 ppt (T.P. Healey 1979). Within the Delta, juvenile Chinook salmon forage in shallow areas with protective cover, such as tidally influenced sandy beaches and vegetated zones (T.P. Healey 1979). Juvenile Chinook salmon movements within estuarine habitat are dictated by the interaction between tidally driven saltwater intrusions through the estuary and freshwater outflow from the Sacramento and San Joaquin Rivers. Juvenile Chinook salmon follow rising tides into shallow-water habitats from the deeper main channels and return to the main channels when the tides recede (M.C. Healey 1991). Kjelson et al. (1981) reported that juvenile Chinook salmon demonstrated a diel migration pattern, orienting themselves to nearshore cover and structure during the day but moving into more open, offshore waters at night.

Juvenile Chinook salmon were found to spend about 40 days migrating through the Delta to the mouth of San Francisco Bay and grew little in length or weight until they reached the Gulf of the Farallones (MacFarlane and Norton 2002). Based on the mainly ocean-type life history observed (i.e., fall-run), MacFarlane and Norton (2002) concluded that, unlike other salmonid populations in the Pacific Northwest, Central Valley Chinook salmon show little estuarine dependence and might benefit from expedited ocean entry (NMFS 2009).

1.1.3.3.3.1 Winter-run Chinook Salmon

Because spawning adult winter-run Chinook salmon use only the Sacramento River Basin, adults are likely to migrate upstream primarily along the western edge of the Delta through the Sacramento River corridor. Because juvenile winter-run Chinook salmon have been collected at various locations in the Delta (including the SWP and the CVP south Delta export facilities), juveniles likely use a wider range of the Delta for migration and rearing than adults (ICF 2013).

Winter-run Chinook salmon fry and smolts emigrate downstream from July through March through the Sacramento River, reaching the Delta from September through June. Winter-run Chinook salmon juvenile rearing in the Delta reportedly occurs primarily from November through early May (NMFS 2014). Juveniles reportedly remain in the Delta until they reach a fork length of about 118 mm and are from 5 to 10 months of age, and emigrate to the ocean as early as November (NMFS 2014). The importance of the Delta in the life history of Sacramento River winter-run Chinook salmon is reportedly not well understood (NMFS 2014).

1.1.3.3.3.2 Spring-run Chinook Salmon

Adult Central Valley spring-run Chinook salmon reportedly migrate primarily along the western edge of the Delta through the Sacramento River corridor, and juvenile spring-run Chinook salmon use the Delta, Suisun Marsh, and the Yolo Bypass for migration and rearing (ICF 2013). As reported by NMFS (2009), the emigration period for spring-run Chinook salmon extends from November to early May, with up to 69 percent of the YOY fish outmigrating through the lower Sacramento River and Delta during this period (CDFG 1998). NMFS (2014) stated that juvenile spring-run Chinook salmon have been found at Chipps Island in the Delta primarily during December through June. However, by the time that yearling spring-run Chinook salmon reach Chipps Island, they cannot be distinguished from fall-run Chinook salmon yearlings.

1.1.3.3.3.3 Fall and Late Fall-run Chinook Salmon

Adult fall-run and late fall-run Chinook salmon migrating into the Sacramento River and its tributaries primarily use the western and northern portions of the Delta, whereas adults entering the San Joaquin River system reportedly use the western, central, and southern Delta as a migration pathway (ICF 2013). Juvenile fall-run and late fall-run Chinook salmon use the Delta, Suisun Marsh, and the Yolo Bypass for rearing to varying degrees, depending on their lifestage (fry versus juvenile), size, river flows, and time of year (ICF 2013).

Adult fall-run Chinook salmon reportedly migrate through the Delta and into Central Valley rivers from June through December, while adult late fall-run Chinook salmon migrate through the Delta from October through April (ICF 2013). In general, fall-run Chinook salmon fry abundance in the Delta increases following high winter flows. Most fall-run Chinook salmon fry rear in freshwater from December through June, with emigration as smolts occurring primarily from January through June (ICF 2013). Late fall-run fry rear in freshwater from April through the following April and emigrate as smolts from October through February (Snider and Titus 2000 as cited in ICF 2013). In general, fall-run and late fall-run Chinook salmon juveniles primarily occur in the Delta during November through June (ICF 2013).

1.1.3.3.4 Central Valley Steelhead

Steelhead adults entering the Sacramento River system to spawn reportedly use the northern, western, and central Delta as a migration pathway (ICF 2013).

Some juvenile steelhead might use brackish tidal marsh areas, nontidal marshes, and other shallow water areas in the Delta as rearing areas for short periods of time prior to their emigration to the ocean (ICF 2013). Hallock et al. (1961) found that juvenile steelhead in the Sacramento River Basin migrate downstream during most months of the year, but the peak emigration period occurred during the spring, with a smaller peak during the fall. Nobriga and Cadrett 2003 as cited in NMFS 2009) reportedly verified these temporal findings based on analysis of captures in USFWS monitoring surveys conducted near Chipps Island. NMFS (2009) reported that steelhead rearing and outmigration in the Delta occurs during October through July.

1.1.3.3.5 Green Sturgeon

The Delta serves as a migratory corridor, feeding area, and juvenile rearing habitat for southern DPS green sturgeon (ICF 2013). Adults migrate upstream primarily through the western edge of the Delta into the lower Sacramento River between March and June (Adams et al. 2002; ICF 2013). Although little is known about the distribution of and movement of YOY and juvenile green sturgeon, observations suggest that they are distributed in the mainstem Sacramento River below Anderson and in fresh and brackish portions of the north and interior Delta (Israel and Klimley 2008). Larvae and post-larvae are reportedly present in the lower Sacramento River and northern Delta between May and October, primarily during June and July (CDFG 2002 as cited in ICF 2013). Juvenile green sturgeon have been captured in the Delta during all months of the year (Borthwick et al. 1999 and CDFG 2002, both as cited in ICF 2013). Juvenile green sturgeon have been reported to be caught by anglers in the Sacramento River between Rio Vista and Chipps Island, in the Sacramento Deep Water Ship Channel, in Montezuma Slough, in the Napa River, in the Carquinez Strait, and in Suisun Bay (Gleason et al. 2007 as cited in Israel and Klimley 2008).

Subadult green sturgeon inhabit the Delta and bays during summer, while adults reportedly are most often in the seawater and mixing zones of bays and estuaries and are occasionally found in the lower stretches of some rivers (Environmental Protection Information Center et al. 2001).

1.1.3.3.6 White Sturgeon

The Delta serves as a migratory corridor, feeding area, and juvenile rearing area for white sturgeon. White sturgeon spend most of their lives in the brackish portions of the upper estuary, although a small number of individuals move extensively in the ocean (Moyle 2002, Surface Water Resources, Inc. 2004, and Welch et al. 2006, all as cited in ICF 2013). Adult white sturgeon move from the waters of San Francisco Bay into the Delta and the lower Sacramento River during the late fall and winter to spawn (ICF 2013). Juvenile white sturgeon can be present in the Delta year-round.

1.1.3.3.7 Sacramento Splittail

Splittail spend most of their life in the San Francisco Estuary throughout the Delta, Suisun Bay, and Suisun Marsh (Moyle 2002). Spawning occurs in the tidal freshwater and euryhaline habitats of the Sacramento–San Joaquin Estuary on terrestrial vegetation and floodplain debris that is inundated by spring high flows, typically at depths between 1.6 and 6.6 feet (0.5 and 2 meters) (Moyle 2002).

Most juvenile splittail move downstream to the Sacramento–San Joaquin Estuary during late spring and early summer (ICF 2013). YOY splittail are salvaged at the SWP and CVP facilities primarily from late May through mid-July during their downstream migrations from upstream floodplains to tidal rearing habitat in Suisun Marsh and Suisun Bay. However, during wet water years, salvage can continue into July (Moyle et al. 2004).

1.1.3.3.8 River and Pacific Lamprey

Because lamprey macropthalmia are difficult to identify and are not reported by species in Delta surveys, river and Pacific lamprey macropthalmia are discussed together. Lamprey ammocoetes are reportedly found throughout all of the Delta, although there are no abundance estimates from Delta sampling programs (ICF 2013). The extent to which lampreys use the Delta for purposes other than a migration corridor is unknown. However, outmigrating lamprey macropthalmia (juveniles) in the final stages of metamorphosis to adults hold just upstream of saltwater until late spring (ICF 2013). River and Pacific lamprey juveniles might be present in the Delta year-round.

1.1.3.3.9 American Shad

Adult American shad enter the Delta from San Francisco Bay via Suisun and Honker Bays on spawning migrations and return to the ocean after spawning in freshwater. Juvenile American shad are reported to sometimes rear in the Delta (CDFG 2010), although little information exists regarding the distribution of juvenile American shad in the Delta. However, juvenile and adult American shad might be present in the Delta year-round.

1.1.3.3.10 Striped Bass

Most striped bass larvae and fry are transported from the spawning areas to the Delta or Suisun Bay within days of spawning. Therefore, striped bass egg and larval lifestages can occur in the Delta during April through June. Juvenile and adult striped bass can occur in the Delta year-round.

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Appendix 7B

1.1 Impact Assessment Methodology

This appendix describes the impact assessment methodology, impact indicators, and significance criteria used by the U.S. Army Corps of Engineers (USACE) to evaluate, for regulatory compliance purposes, the effects of the Folsom WCM alternatives on fisheries and aquatic habitat compared to the CEQA Existing Condition and NEPA No Action Alternative scenarios.

Several fish species are sensitive to changes in both river flows and water temperatures throughout the year. Because USACE anticipates that the Folsom WCM alternatives would change water temperatures and river flows, the fisheries impact assessment focuses on these and other habitat-based elements. Taking into account species and lifestage-specific habitat requirements, USACE assessed the operational components of the Folsom WCM alternatives in order to evaluate their effects on identified fish species and associated aquatic habitats.

The assessment of effects on identified fish species and associated aquatic habitat is organized and conducted by geographic regions within the Project Area based on the anticipated magnitude of changes in aquatic habitat conditions with the Folsom WCM alternatives and based on the types of modeling tools available for each geographic region, or study area, listed below.

- **Lower American River**
- **Far-Field**
  - Sacramento River downstream of Keswick Dam
  - Lower Feather River
  - Yolo Bypass
  - Sacramento–San Joaquin Delta

Because the Folsom WCM alternatives are most likely to affect fisheries habitat conditions in the lower American River, USACE conducted more-detailed water temperature modeling and fisheries analyses for the lower American River than for other potentially affected areas within the Far-Field. Specifically, fisheries evaluations in the Far-Field Study Area were conducted in order to determine whether more-detailed modeling or analyses were warranted in order to identify the effects of the Folsom WCM alternatives.

For each component of the Far-Field Study Area, the impact assessment identifies fish species of focused evaluation within potentially affected geographic regions within the study areas. Evaluation species consist of special-status fish species (Federal- and state- listed threatened and endangered species, 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).

Both quantitative and qualitative assessments were conducted by USACE to evaluate the effects on fisheries and aquatic habitat that would occur with the Folsom WCM alternatives. Mass balance hydrologic and water temperature modeling was performed to provide a quantitative basis from which to assess the operations-related effects of the Folsom WCM alternatives on fish species of focused evaluation and aquatic habitats within the lower American River and Far-Field Study Area, relative to the basis of comparison.

Specifically, USACE used the hydrological modeling analyses to simulate data representing State Water Project/Central Valley Project (SWP/CVP) operational conditions that would occur with the Folsom WCM alternatives, which were compared to modeled data representing operational conditions under the basis of comparison (i.e., the Existing Condition). Appendix 4A, Modeling Technical Memorandum, describes the methodologies that were used to simulate comparative operational scenarios with the Folsom WCM alternatives, relative to the basis of comparison.

The impact assessment of fisheries and aquatic habitat consists of hydrologic and water temperature–related changes associated with the Project operations. The general analytical framework used to assess the effects of each component of the Folsom WCM alternatives evaluated is described below.

1.1.1 Analytical Tools

The fisheries and aquatic habitat impact assessment relies on hydrologic modeling to provide a quantitative basis from which to assess the effects of the Folsom WCM alternatives on fish species of focused evaluation and aquatic habitats within the SWP/CVP system, relative to the basis of comparison. Specifically, USACE used the hydrological modeling and post-processing applications to simulate the operations that USACE expects to occur in SWP/CVP reservoirs and rivers and the Sacramento–San Joaquin Delta (Delta) with the Folsom WCM alternatives, relative to the basis of comparison.

Hydrologic simulation results from CalSim II hydrologic model (see Appendix 4A, Modeling Technical Memorandum) of mean monthly river flows and end-of-month reservoir storages provide a quantitative basis for assessing the effects of the Folsom WCM alternatives on fish species, relative to the basis of comparison, for the period of simulation from water year 1922 through 2003 (an 82-year simulation period) the Far-Field Study Area. These simulated results were used as inputs to the Bureau of Reclamation's (Reclamation) Water Temperature Models (Reclamation 1997) for the Sacramento and Feather Rivers; these models simulate mean monthly water temperature of the main river systems for the same simulation period. For the lower American River, CalSim II hydrologic output was used as input to daily flow and water temperature models to simulate daily flow and water temperature in the lower American River (see Appendix 4A, Modeling Technical Memorandum).

Simulated daily water temperatures for the lower American River (LAR) were used as inputs to Reclamation's Mortality Model, as modified and updated by the Water Forum and USACE (2015), referred to in this appendix as the LAR Mortality Model, to estimate annual mortality rates for the early lifestages (in-vivo eggs, incubating eggs, and pre-emergent fry) of fall-run Chinook salmon (*Oncorhynchus tshawytscha*) in the lower American River. Simulated flows were used as inputs to tools that model salmonid spawning habitat (weighted usable area, or WUA) and salmonid redd dewatering to quantify specific effects of the Folsom WCM alternatives on salmonid habitat in the lower American River. (A *redd* is a spawning nest built by salmon and steelhead.)

The following sections identify specific nodes from hydrologic and water temperature model output for the purpose of assessing effects on fisheries, as well as identify the types of model outputs for flow, water temperature, habitat and population analyses (e.g., cumulative probability exceedance distributions, long-term average monthly flows, and average monthly flows by water year type).

The following sections summarize the evaluation tools that USACE used to support the fisheries and aquatic habitat impact assessment. Appendix 4A, Modeling Technical Memorandum, presents detailed information about specific modeling tools and the modeling assumptions used to characterize Project operations. Detailed discussion regarding each species and waterbody evaluated in this Draft Technical Report is presented below in assessment approach sections that are specific to each waterbody.

1.1.1.1 Model Uncertainty

Although the physical habitat models used in the analyses are mathematically precise, they should be viewed as having inherent uncertainty because of limitations in the theoretical basis of the model and the scope of the formulation and function for which the model is designed. Although models can provide useful insight to complex systems, they are a simplification of the system and processes and provide results with limitations (Reclamation 2008). Nonetheless, physical habitat models developed for planning and impact assessment purposes represent the best available information with which to conduct evaluations of proposed changes in SWP and CVP operations. Therefore, USACE used physical habitat models as analytical tools to identify simulated changes in aquatic habitat variables (e.g., flows and water temperatures) as well as inputs to species-specific analytical tools. Appendix 4A, Modeling Technical Memorandum, presents a detailed discussion of the hydrologic and water temperature modeling tools, the modeling assumptions used, and the uncertainty associated with the models.

1.1.1.2 Application of Model Output

USACE used computer simulation models and post-processing tools to assess changes in river flows, water temperatures, and associated changes in species-specific habitat conditions that could occur with the Folsom WCM alternatives, relative to the basis of comparison.

Model assumptions and results were used for comparative purposes rather than for absolute predictions, and the focus of the analysis is on differences in the results among comparative scenarios. The simulation results were designed for a comparative evaluation because the physical models use generalized rules to operate the CVP and SWP systems, and the results are a gross estimate that might not reflect how actual operations would occur (Reclamation 2008). Further, generalizations also are made for programs based on adaptive management that are too dynamic to capture the range of factors used in actual operations decision-making (Reclamation 2008). All of the assumptions were the same for both the with-project and without-project model runs, with the exception of the assumptions associated with the Folsom WCM Project itself, and the focus of the analysis is the differences in the results.

1.1.2 General Analytical Approach for Evaluating Fisheries and Aquatic Habitat (Flow)

Streamflow quantity and timing are critical components of water supply, water quality, and the ecological integrity of river systems (Poff et al. 1997). Streamflow, which is strongly correlated with many critical physicochemical characteristics of rivers, can be considered a master variable that limits the distribution and abundance of riverine species (Power et al. 1995; Resh et al. 1988) and regulates the ecological integrity of flowing water systems.

Components of the flow regime can be used to characterize the entire range of flows and specific hydrologic phenomena (e.g., floods and low flows) that are vital to the integrity of river ecosystems. The five components of the flow regime are (1) magnitude, (2) frequency, (3) duration, (4) timing, and (5) rate of change of hydrologic conditions (Poff et al. 1997). Furthermore, Poff et al. (1997) report that, by defining flow regimes in these terms, the ecological consequences of particular human activities that modify one or more components of the flow regime can be considered explicitly. The following discussion regarding these components is taken directly or modified from Poff et al. (1997).

- **Magnitude**: The *magnitude* and frequency of high and low flows regulate numerous ecological processes. The composition and relative abundance of species that are present in a stream or river often reflect the frequency and intensity of high flows (Schlosser 1985; Meffe and Minckley 1987). Flows of low magnitude can also provide ecological benefits through recruitment opportunities for riparian plant species in regions where floodplains are frequently inundated (Wharton et al. 1981).
- **Frequency**: The *frequency* of occurrence refers to how often a flow above a given magnitude recurs over some specified time interval. Frequency of occurrence is inversely related to flow magnitude. For example, a 100-year flood is equaled or exceeded on average once every 100 years, and the median flow over a specified time period has a 50 percent probability of occurrence.
- **Duration**: *Duration* is the period of time associated with a specific flow condition. Duration can be defined relative to a particular flow event (e.g., a floodplain might be inundated for a specific number of days by a 10-year flood), or it can be defined as a composite expressed over a specified time period (e.g., the number of days in a year when flow exceeds some value).

  The duration of a specific flow condition often determines its ecological significance, and changes in the duration of flow conditions have significant biological consequences (Poff et al. 1997). For aquatic species, prolonged flows of particular levels can be damaging. For example, differences in tolerance to prolonged flooding in riparian plants (Chapman et al. 1982) and to prolonged low flow in aquatic invertebrates (Williams and Hynes 1977) and fishes (Closs and Lake 1996) allow these species to persist in locations from which they might otherwise be displaced by dominant, but less tolerant, species.
- **Timing:** The *timing*, or predictability, of flows of defined magnitude refers to the regularity with which they occur. For example, annual peak flows might occur with low seasonal predictability or with high seasonal predictability. The timing, or predictability, of flow events is critical ecologically because the lifecycles of many aquatic and riparian species are timed to either avoid or exploit flows of variable magnitudes.
- **Rate of Change**: The *rate of change* typically refers to how quickly flow changes from one magnitude to another. For this Draft Technical Report, rate of change specifically applies to the magnitude of hydrologic change over specified time periods for impact assessment.

For the Folsom WCM Project, the river-specific fisheries impact assessment includes quantitative evaluation of the types of flow-related changes described above, as further described in the following sections.

1.1.2.1 Long-Term Average Flow and Average Flow by Water Year Type

Post-processing tools use monthly hydrologic output (Far-Field) and daily hydrologic output (lower American River) to calculate the long-term average flows, by month, occurring over the respective simulation periods with the Folsom WCM alternatives and the basis of comparison. Monthly average simulated flows by water year type are used to compare differences between the basis of comparison and the Folsom WCM alternatives. 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 simulated changes with the Folsom WCM alternatives, relative to the basis of comparison.

1.1.2.2 Flow Exceedance Distributions

USACE developed monthly flow exceedance distributions (or curves) from monthly hydrologic output (Far-Field) and from daily hydrologic output (lower American River). These distributions illustrate the distribution of simulated flows with the Folsom WCM alternatives 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 (e.g., 1922–2003). 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 time 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.

1.1.2.3 Flow-Dependent Habitat Availability

1.1.2.3.1 Spawning WUA

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 WUA and 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).

USACE applied spawning WUA-discharge relationships to simulated mean daily flows for anadromous salmonids in the lower American River. Although USACE does not expect substantial flow changes in the Far-Field, because the relationship between flow and flow-dependent spawning habitat is not linear, simulated mean monthly flow output was applied to spawning WUA-discharge relationships for anadromous salmonids in the lower Feather River and the upper Sacramento River.

In the lower American River, available spawning habitat for fall-run Chinook salmon and steelhead is expressed by a scaled composite WUA that corresponds to the available spawning habitat associated with the monthly flows during the spawning season. The scaled composite WUA annual index (i.e., $CWUA_Y$) is calculated as the sum of the WUAs that correspond to the daily flows during the species' spawning season at five sampled reaches within the species' spawning area, multiplied by a temporal weighting coefficient that represents the average relative spawning intensity on the particular day of the spawning season, divided by the maximum WUA for the sum of the five spawning reaches, over the flow range for which the WUA-flow relationship was developed. Appendix 7E, Analysis of Spawning Weighted Usable Area for Lower American River Salmonids, provides a detailed discussion of the spawning WUA-discharge relationships used for fall-run Chinook salmon and steelhead in the lower American River.

After calculating the scaled composite WUAs for fall-run Chinook salmon and steelhead spawning in the lower American River over the entire simulation period of flows modeled for the Folsom WCM alternatives and basis of comparison, USACE used the resulting annual scaled composite WUAs to develop exceedance distributions and to calculate long-term average spawning WUA and average spawning WUA by water year type. Spawning WUA exceedance distributions and long-term average spawning WUA and average spawning WUA by water year type were used to evaluate changes in spawning habitat with the Folsom WCM alternatives, relative to the basis of comparison.

USACE evaluated spawning WUA for anadromous salmonids in the Sacramento and Feather Rivers using similar methodologies as described above for the lower American River, but with monthly flow output. USACE also developed species-specific spawning WUA exceedance distributions and long-term average and average by water year type spawning WUA to evaluate spawning WUA with the Folsom WCM alternatives, relative to the basis of comparison. Appendix 7D, Analysis of Spawning Weighted Usable Area for Upper Sacramento River and Feather River Salmonids, 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.

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 Draft Technical Report. Rather, the evaluation of juvenile fall-run Chinook salmon and steelhead habitat suitabilities in the lower American River in this Draft Technical Report focuses on differences in flow and differences in the primary stressor to these lifestages—water temperature.

1.1.2.3.2 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 this Draft Technical Report 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.

In this Draft Technical Report, the potential for fall-run Chinook salmon and steelhead redd dewatering due to daily flow fluctuations in the lower American River under the Folsom WCM alternatives 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 7F.

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.

Although Chinook salmon and steelhead redd dewatering has been estimated for the lower American River, those estimates cannot be directly integrated into a redd dewatering methodology for this Draft

Technical Report due to the estimates being developed under different annual flow conditions, at varying spatial and temporal scales, and often with different estimation and sampling techniques (see Appendix 7F).

1.1.2.4 Evaluation Criteria

1.1.2.4.1 Flow

The U.S. Geological Survey's *Handbook of Hydrology* (Maidment 1993) considers a flow estimate within 10 percent of the actual flow to be acceptable or good and within five percent to be excellent. Additionally, a decrease in monthly flow of 10 percent or greater has been previously identified by various environmental documents as an appropriate criterion to evaluate flow changes. For example, in the Trinity River Mainstem Fishery Restoration Draft Environmental Impact Statement (EIS)/Environmental Impact Review (EIR) (USFWS et al. 1999), the U.S. Fish and Wildlife Service (USFWS) identified reductions in flow of 10 percent or greater as changes that could be sufficient to reduce habitat quantity or quality to an extent that could significantly affect fish. The Trinity River EIS/EIR further states, "… [t]his assumption [is] very conservative … [i]t is likely that reductions in stream flows much greater than 10 percent would be necessary to significantly (and quantifiably) reduce habitat quality and quantity to an extent detrimental to fishery resources." Conversely, the Trinity River EIS/EIR considers increases in stream flow of 10 percent or greater, relative to the basis of comparison, to be "beneficial" to fish species.

In addition to the USFWS criteria, the San Joaquin River Agreement EIS/EIR (San Joaquin River Group Authority 1999) used criteria thresholds based on the ability to accurately measure stream flow discharges to ±10 percent. The criterion used to determine the level of riverine impacts associated with implementation of the San Joaquin Agreement was based on average percentage changes to stream flow, relative to the basis of comparison. The San Joaquin River Agreement EIS/EIR considered instream flow changes of less than ±10 percent to be insignificant (San Joaquin River Group Authority 1999).

The Freeport Regional Water Project Draft EIR/EIS (Jones & Stokes 2003) used a similar rationale for selecting criteria to evaluate changes in flow. The Freeport EIR/EIS states, "Relative to the base case, a meaningful change in habitat is assumed to occur when the change in flow equals or exceeds approximately 10 percent. The 10-percent criterion is based on the assumption that changes in flow less than 10 percent are generally not within the accuracy of flow measurements, and will not result in measurable changes to fish habitat area."

Although the environmental documents listed above have been legally certified (i.e., Trinity River Mainstem Fishery Restoration Record of Decision on December 19, 2000; San Joaquin River Agreement Record of Decision in March 1999; and Freeport Regional Water Project Record of Decision on January 4, 2005), biological justifications specific to using a 10 percent change as a criterion for a meaningful change in habitat affecting fisheries resources in a particular river have not been provided. Nevertheless, these documents apparently have resulted in consensus in the use of 10 percent when evaluating flow changes. Accordingly, the fisheries impact assessment relies on previously established information and, therefore, evaluates changes in flow of 10 percent or greater between compared scenarios as an index of potential impact.

Results from past instream flow studies indicate that Chinook salmon spawning and rearing habitat is most sensitive to changes during lower-flow conditions (CDFG 1994; USFWS 1985). Research quantifying the relationship between anadromous salmonid (e.g., Chinook salmon) spawning habitat (suitability and availability) and flow typically show a relatively rapid increase in habitat with an increase in flow at relatively low flow levels until reaching an apex and then declining thereafter. This generalized pattern has been demonstrated for the Sacramento (USFWS 2003a), Feather (DWR 2004), and American Rivers (USFWS 2003b).

Studies that have attempted to quantify habitat-flow relationships have often shown that rearing habitat area for juvenile salmonid tends to reach maximum abundance at low flows that inundate most of the channel area in a river (Reclamation and Freeport Regional Water Authority 2003). Rearing habitat area has been shown to decline as flows increase, primarily in response to increased average velocity. Because juvenile Chinook salmon and steelhead fry generally prefer relatively low-velocity areas, increasing flows often lead to reductions in habitat area. However, this flow-habitat relationship might be misleading because it might not adequately reflect local habitat conditions (i.e., availability of low velocity) or the importance of flow-related habitat attributes (e.g., water temperature conditions or cover and prey availability).

For example, yearling steelhead in the lower American River are reportedly found in bar complex and side channel areas characterized by habitat complexity in the form of velocity shelters, hydraulic roughness elements, and other forms of cover (SWRI 2001). During low-flow conditions in the lower American River, the availability of these habitat types becomes limited, resulting in increased juvenile steelhead densities in areas that provide less cover from predation (NMFS 2009). In addition, low-flow conditions in large riverine systems can crowd fish and increase the potential for disease, reduce macroinvertebrate food production, and reduce accessibility to (and the functionality of) shaded riverine aquatic (SRA) habitat and riparian vegetation. SRA habitat and riparian vegetation can provide cooler localized water temperatures, allochthonous food sources, and refuge from predators.

The impact assessment specifically evaluates changes during low-flow conditions (e.g., flows for critical and dry water year types). Recent and current hydrologic modeling of the SWP/CVP includes an 82-year period of record for evaluation (water years 1922–2003), of which 30 years (37 percent) are classified as dry or critical according to the Sacramento Valley (40-30-30) Index. Recent regulatory and environmental documents evaluating fisheries in the Central Valley, including the Reclamation (2008) Biological Assessment (BA) on the continued long-term operations of the SWP and CVP, the National Marine Fisheries Service (NMFS 2009) Biological Opinion on the long-term operations of the SWP and CVP, and the Public Review Draft of the Bay Delta Conservation Plan (ICF International 2013), evaluate flows and/or some fisheries indicators of potential impact by water year type. In accordance with the selected flow criteria described above, a change in flow generally encompassing dry and critical conditions (i.e., the lowest 40 percent of the monthly flow exceedance probability distributions) of 10 percent or greater under an alternative, relative to the basis of comparison, is used as an impact indicator.

This approach is generally consistent with the methodology in previous environmental documentation, including the Freeport Regional Water Project EIS/EIR (Reclamation and Freeport Regional Water Authority 2003) and the Yuba Accord EIR/EIS (YCWA et al. 2007). Specifically, net changes in flow of 10 percent or more are calculated 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 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.

1.1.2.4.2 Spawning Habitat

Another impact indicator is changes in spawning habitat availability (expressed as a percentage of maximum WUA), relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect anadromous salmonids over the entire simulation periods. There have been no definitive determinations regarding how much WUA represents a stressor to specific species/lifestages. The use of 80 percent of maximum spawning WUA as a benchmark is based on testimony presented as part of the State Water Resources Control Board (SWRCB) Mono Lake Decision 1631 process.

Dr. Tom Hardy (a fisheries biologist retained by the Los Angeles Department of Water and Power) testified that "… no objective criteria [have] been validated to guide investigators on what percentage reduction in optimal habitat represents a significant impact, or at what exceedance value associated with either optimal or median habitat represents adequate protection for the aquatic resources." However, Dr. Hardy testified that several instream flow studies in which he had participated targeted a range of 80 percent to 85 percent of the maximum WUA as optimal habitat conditions. Therefore, the impact assessment in this Draft Technical Report uses as an impact indicator the probability of achieving 80 percent of maximum spawning WUA over the probability of exceedance distribution with the Folsom WCM alternatives, relative to the basis of comparison.

In addition, differences in spawning WUA over the exceedance distributions when spawning WUA is below 80 percent of maximum with both scenarios are also used to evaluate changes in spawning habitat with the Folsom WCM alternatives, relative to the basis of comparison.

1.1.2.4.3 Redd Dewatering

Changes in potential redd dewatering (using an index of the annual percent of redds dewatered at least one time) under the alternatives, relative to the basis of comparison, of sufficient magnitude and frequency to substantially affect fall-run Chinook salmon and steelhead spawning in the lower American River over the entire simulation period also is used as an impact indicator. There have been no definitive determinations of how much redd dewatering represents a stressor to steelhead or fall-run Chinook salmon redds. The evaluation of changes in the redd dewatering index resulting from implementation of the Folsom WCM Project Alternatives, relative to the basis of comparison, involves the examination of the annual average relative difference in the species-specific redd dewatering index over the long-term and by water year type. Additionally, annual redd dewatering exceedance probabilities are evaluated to identify differences in the probability of occurrence of the redd dewatering index evaluated by the model. Examination of the relative difference is necessary to avoid the masking of more severe impacts on evaluated species, and to evaluate the biological significance of changes in the redd dewatering index. Relative difference comparisons appropriately assess the magnitude of change in conditions between the Folsom WCM Project Alternatives and the basis of comparison.

1.1.3 General Analytical Approach for Evaluating Fisheries and Aquatic Habitat (Water Temperature and Early Lifestage Mortality)

USACE recognizes that water temperature changes can exhibit an equal or greater influence on coldwater fish species, including anadromous salmonids, relative to flow, as described below.

- Among all environmental parameters, water temperature is suggested to have the greatest influence on the status of fish and aquatic life (McCullough et al. 2001; Myrick and Cech 2001).
- Coldwater species such as Chinook salmon and steelhead that are near the southernmost edge of their geographic distributional range (i.e., the California Central Valley) might be particularly constrained by elevated water temperatures, especially during the summer when instream conditions tend to exhibit increased warming due to ambient solar radiation.
- Water temperature is perhaps the physical factor with the greatest influence on steelhead in the lower American River (NMFS 2009).

Thus, the flow analyses are supplemented by separate species and lifestage-specific water temperature evaluations, as described in the following sections.

1.1.3.1 Water Temperature Exceedance Distributions

Monthly exceedance distributions (or curves) of simulated water temperature from monthly water temperature model output (Far-Field) and from daily water temperature model output (lower American River) were developed by USACE for the entire simulation period. These distributions illustrate the distribution of simulated water temperatures with the Folsom WCM alternatives 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 temperatures (Far-Field) and daily water temperatures (lower American River) were applied to species and lifestage-specific water temperature index values with the alternatives, relative to the basis of comparison, as further described below.

1.1.3.2 Water Temperature Guidelines

Impact indicators and evaluation guidelines have been developed as a means to assess the operational-related effects of the Folsom WCM alternatives on aquatic resources. For the fisheries and aquatic habitat impact assessment, water temperature impact indicator values are used to evaluate whether the project would affect a species' habitat. Changes in water temperatures during certain periods of the year could affect all lifestages of fish species. Therefore, changes in water temperatures during the adult upstream migration and holding, spawning and embryo incubation, juvenile rearing, and outmigration lifestages of anadromous species were used by USACE as impact indicators.

Water temperature evaluation guidelines have been developed more extensively for Chinook salmon and steelhead than for other species because Chinook salmon and steelhead are native to the Pacific Coast and historically have been socially, recreationally, commercially, and economically important to the region (Bratovich et al. 2012; YCWA et al. 2007).

As further described in Bratovich et al. (2012), water temperature impact indicators and evaluation guidelines for anadromous salmonids have been developed based on an extensive review of fisheries literature, with special emphasis on research conducted in the Central Valley. Although there could be small local variations in the periods associated with stream-specific habitat utilization by different species and lifestages, the temporal applications of timing periods used for analytical purposes in this Draft Technical Report are based on studies in the Central Valley and are applied uniformly throughout the document.

The water temperature index (WTI) values presented in this appendix represent a gradation of potential biological effects from optimal to lethal water temperatures for each lifestage. Literature on salmonid water temperature requirements generally reports water temperature thresholds using various descriptive terms including *optimal*, *preferred*, *suitable*, *suboptimal*, *tolerable*, *stressful – chronic and acute*, *sublethal*, *incipient lethal*, and *lethal*. Water temperature effects on salmonids are often discussed in terms of *lethal* and *sublethal* effects and depend on both the magnitude and the duration of exposure (Sullivan et al. 2000) as well as on acclimation water temperatures. Exposure to adverse water temperatures can result in adverse effects on salmonids' biological functions, feeding activity, lifestage timing, growth, reproduction, competitive interactions, susceptibility to disease, growth and development, and ultimately probability of survival (McCullough 1999).

Lifestage-specific WTI values were based on long-term (≥ 7 days) chronic temperature exposure rather than acute (< 7 days) temperature exposure. The boundary between the upper end of the chronic exposure range and the lower end of the acute exposure range is typically measured as the upper incipient lethal temperature (UILT) where 50-percent mortality occurs after 7 days (Elliott 1981).[1]

The UILT for both juvenile steelhead and Chinook salmon is similar and is between 75°F and 79°F (24°C and 26°C) depending on the study (McCullough 1999; McCullough et al. 2001; Sullivan et al. 2000). The UILT for adult steelhead and Chinook salmon is between 70°F and 72°F (21°C and 22°C) (Becker 1973; Coutant 1970; McCullough et al. 2001), which is much lower than that for juveniles and is approximately the same temperature that has been identified as an upstream migration barrier for Chinook salmon (McCullough 1999).

Acute (< 7 days) temperature response strongly depends on the duration of exposure. **Figure 1** shows some example acute exposure relationships for juvenile salmonids. The hourly (60-minute) acute temperature is 5.4–9.0°F (3–5°C) higher than the 7-day (10,000-minute) chronic temperature. Because the acute temperature for juvenile salmonids (approximately 82.4°F [28.4°C]) is relatively high, it rarely becomes a factor affecting survival in natural streams (Sullivan et al. 2000). However, the acute temperature for adult salmonids is lower—it could become a survival factor particularly for adult Chinook salmon holding through the summer.

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[1] Note that some authors have measured the UILT using shorter duration exposure than 7 days (e.g., 1,000 minutes or 24 hours). UILT values based on a shorter duration exposure than 7 days will be higher than the UILT values based on a 7-day exposure.

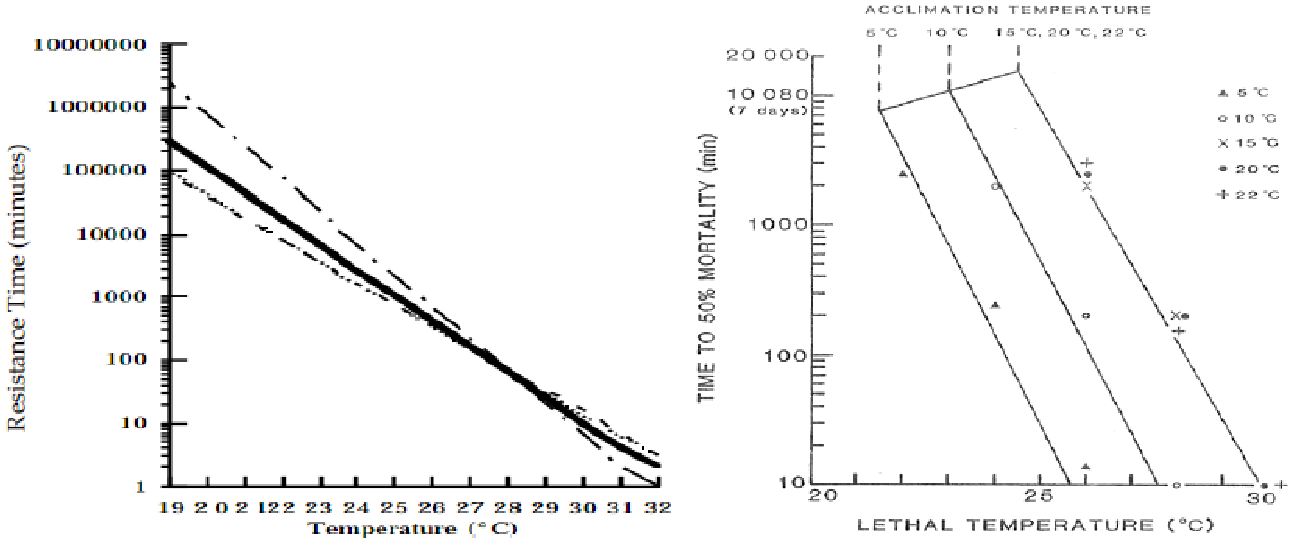

Figure 1. Relationship between the Time (Minutes) to Mortality and the Lethal Temperature for Rainbow Trout (Left) (Bidgood 1969) and Brown Trout (Right) (Elliott 1981). Note the effect of acclimation temperature in the figure on the right.

The temperature range between the UILT (7 days) and very-short-duration mortality (minutes) (e.g., critical thermal maximum) is called the *zone of resistance*. Below the UILT is a zone of tolerance where fish can tolerate the temperature for an extended period (> 7 days). At the higher temperatures in the tolerance zone, fish might not feed, grow, or reproduce, and they could have modified behavior (e.g., holding in temperature refugia locations). An important point to note is that the effects of water temperature are associated with duration of exposure and, depending on the actual water temperature value, short-duration exposure to relatively high temperatures might not cause sustained adverse effects if temperatures quickly decrease to non-impactive levels.

At lower temperatures in the tolerance zone, denoted as *tolerable*, growth and/or reproduction occur but are reduced from optimal levels due to temperature effects. The zone of temperature where fish processes (e.g., growth, reproduction, and behavior) are not affected appreciably by temperature is denoted as the *optimum* temperature range (**Figure 2**).

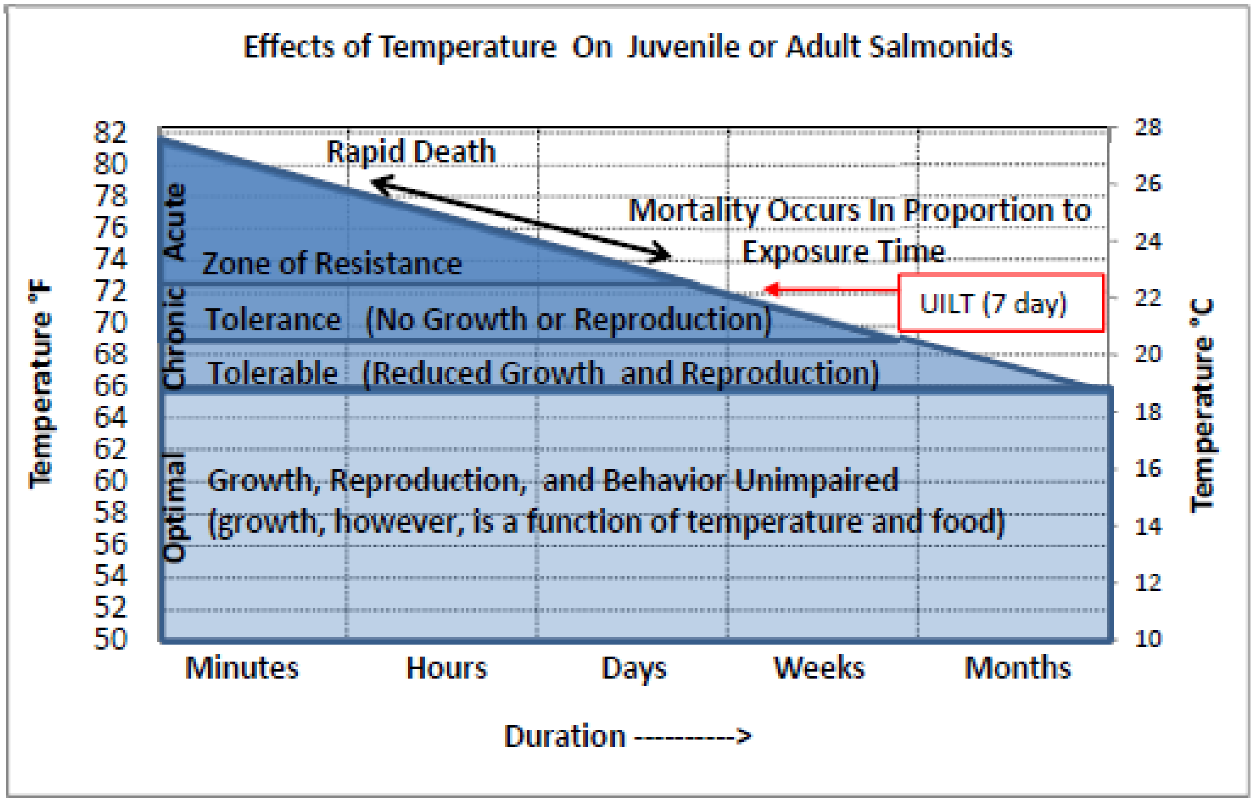

Figure 2. Acute, Chronic and Optimum Temperature Zones.

There are inherent limitations associated with developing and applying WTI values. Some of the limitations are summarized by McEwan (2001); namely, that WTI values serve only as general guidelines, because WTI values are often developed based on laboratory studies conducted under specific conditions and/or on studies conducted in specific streams that differ from the stream that the WTI values are being applied to. Research studies conducted under controlled laboratory conditions or in specific streams do not take into account ecological considerations associated with water temperature regimes or considerations such as predation risk, inter- and intra-specific competition, long-term survival, and local adaptation in the stream that the WTI values are being applied to.

Species- and lifestage-specific WTI values developed by Bratovich et al. (2012) were used by USACE as a means to assess the effects of the Folsom WCM alternatives, 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 reintroducing spring-run Chinook salmon and steelhead into the upper Yuba River Basin, and describe development of the upper optimum (UO) WTI values and upper tolerable (UT) WTI values used for this assessment.

- ☐ **Upper Optimum Temperature (UO).** 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.

- ☐ **Upper Tolerable Temperature (UT).** The upper tolerable temperature represents a water temperature at which fish can survive indefinitely without experiencing substantial detrimental effects to their physiological and biological functions such that survival occurs, but growth and reproduction success are less than at the optimum water temperature.

The UO and UT WTI values represent boundaries above which water temperatures could be considered to affect evaluated fish species. The WTI values are not meant to be significance thresholds but instead provide a mechanism by which to compare the resulting water temperatures associated with the Folsom WCM alternatives, relative to the basis of comparison.

Table 1 presents the UO and UT WTI values for Chinook salmon and steelhead. These two species of anadromous salmonids are presented here because of their ubiquitous distribution throughout the Project Area for this Draft Technical Report. Chinook salmon holding WTI values are 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 soon after reaching freshwater spawning grounds.

The Chinook salmon smolt emigration WTI values are 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).

Table 1. 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 & outmigration	61°F	65°F	Juv. rearing & outmigration	65°F	68°F
Smolt emigration	63°F	68°F	Smolt emigration	52°F	55°F

For other fish species of focused evaluation, WTI values evaluated in this Draft Technical Report are presented in **Table 2**. Appendix 7C provides background information on reported lifestage-specific water temperature tolerances and preferences for the other fish species of focused evaluation and the rationale for selecting the representative WTI values and ranges evaluated in this Draft Technical Report. WTI value ranges are typically used for a lifestage when insufficient information is available to identify specific WTI values (see Appendix 7C).

Table 2. Lifestage-specific WTI Values and Ranges for Other Fish Species of Focused Evaluation.

Species	Lifestage	Water Temperature Index Values and Ranges (°F)
Green sturgeon	Adult immigration and holding	61
	Spawning and embryo incubation	68
	Juvenile rearing and downstream movement	66
White sturgeon	Adult immigration and holding	77
	Spawning and embryo incubation	68
	Juvenile rearing and downstream movement	66
River lamprey	Adult immigration	42–60
	Spawning and embryo incubation	50–64
	Ammocoete rearing and downstream movement	72
Pacific lamprey	Adult immigration	42–60
	Spawning and embryo incubation	50–64
	Ammocoete rearing and downstream movement	72
Hardhead	Adults and other lifestages	65–82
	Spawning	59–64
American shad	Adult immigration and spawning	60–70
	Juvenile rearing and downstream movement	63–77
Striped bass	Adult immigration and spawning	59–68
	Juvenile rearing	61–71

1.1.3.3 Chinook Salmon Early Lifestage Mortality

The water temperature modeling results for the lower American River also were used by USACE as inputs to the updated LAR Early Lifestage Chinook Salmon 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. Since the LAR Mortality Model was originally developed, additional information has become available that could be incorporated into the model to improve its accuracy. For this reason, 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:

1) The temporal distribution for the arrival of spawning fall-run Chinook salmon adults in the lower American River.
2) The temporal distribution for fall-run Chinook salmon spawning in the lower American River
3) The spatial distribution of spawning fall-run Chinook salmon in the lower American River
4) The thermally induced Chinook salmon daily mortality rates for pre-spawn eggs, fertilized eggs, and pre-emergent fry

5) The Accumulated Thermal Unit (ATU) thresholds associated with the end of the fertilized-egg and pre-emergent-fry lifestages.

Appendix 7G, Lower American River Chinook Salmon Early Lifestage Mortality Model: Updates and Refinements, provides a detailed description of the updates and modifications that the Water Forum and USACE made to the original model, documents the coding modifications and programming language conversion that the Water Forum and USACE performed on the original model, and identifies the cumulative effects of each update and refinement made by the Water Forum and USACE to the model on its annual average mortality estimates for the lower American River.

Annual early lifestage mortality of fall-run Chinook salmon in the lower American River was generated with the updated LAR Mortality Model for the entire simulation period for the Folsom WCM alternatives and the basis of comparison. The resulting series of annual values for early lifestage mortality was compared over the corresponding exceedance distributions and long-term averages and averages by water year type for the Folsom WCM alternatives and basis of comparison.

1.1.3.3.1 Evaluation Criteria

WATER TEMPERATURE

Differences in the frequency of exceeding a particular WTI value between the Folsom WCM alternatives and the basis of comparison were used by USACE to evaluate thermal impacts to individual species and lifestages at a particular location. Differences in the frequency of exceeding WTI values are represented by the difference in the percentage of time that the WTI value would be exceeded with the alternatives, relative to the basis of comparison. However, a difference in the probability of exceeding a WTI value does not necessarily constitute an impact. Impact determinations are based on USACE's consideration of all evaluated impact indicators for all lifestages for a particular species. USACE considers an impact to be potentially significant if implementing a Folsom WCM alternative would adversely affect an individual species, in consideration of all evaluated impact indicators for all lifestages.

EARLY LIFESTAGE MORTALITY

USACE's assessment of the survival of early life-stages of fall-run Chinook salmon resulting from the Folsom WCM alternatives, relative to the basis of comparison, involves examining of the annual average relative difference in total early lifestage mortality over the long term and by water year type. Additionally, total annual mortality over the exceedance distribution is evaluated by USACE to identify differences in the probability of occurrence of mortality evaluated by the model. Examining the relative difference is necessary to avoid masking more-severe effects on evaluated species and to evaluate the biological significance of changes in water temperature conditions on early lifestage survival. Comparisons of relative difference appropriately assess the magnitude of change in conditions between the Folsom WCM alternatives and the basis of comparison.

1.1.4 Lower American River

This section describes applications of output resulting from computer simulation models and post-processing tools specific to the lower American River.

1.1.4.1 Tools and Application of Model Output

The mass-balance modeling tools have previously been used by agencies including Reclamation (2008) and NMFS (2009), among others, to characterize flows and water temperatures in the lower American River for various regulatory compliance applications. These previously applied modeling tools capture the general concepts of lower American River planning operations and incorporate coldwater pool availability in Folsom Reservoir (e.g., monthly isothermograph and seasonal operational planning) on an average monthly basis. Within the context of integrated SWP/CVP operations, monthly outputs have been used for general planning applications.

However, monthly mass balance models are restricted in their temporal timestep. More-focused, detailed technical evaluations of flow and water temperature–related effects (both adverse and beneficial) associated with different operational characterizations require model outputs on a finer temporal scale. By applying daily flow and water temperature modeling to the lower American River, USACE used daily hydrologic and water temperature model output to evaluate the effects of alternative operational characterizations. Detailed discussion of the hydrologic and water temperature modeling for the lower American River is provided in Appendix 4A, Water Temperature Modeling Technical Memorandum.

1.1.4.2 Lower American River

Flows and water temperatures in the lower American River are strongly influenced by the operations of Folsom Dam and Reservoir. For example, seasonal releases from Folsom Reservoir's coldwater pool provide thermal conditions in the lower American River that affect the water temperature suitability for the various lifestages of fall-run Chinook salmon and steelhead. Folsom Reservoir's coldwater pool is typically not large enough to allow coldwater releases during the warmest months (July through September), releases that would provide maximum thermal benefits to lower American River steelhead, and coldwater releases during October and November that would maximally benefit fall-run Chinook salmon immigration and staging, spawning, and embryo incubation. Consequently, managing the reservoir's coldwater pool on an annual basis is essential to providing thermal benefits to both fall-run Chinook salmon and steelhead, within the constraints of the coldwater pool.

1.1.4.2.1 Evaluation Species

For this Draft Technical Report, the fish species in the lower American River that are the focus of evaluation are presented below. These species are included in the impact assessment either because of the importance of their commercial and/or recreational fisheries (American shad [*Alosa sapidissima*] and striped bass [*Morone saxatilis*]) and/or because they are special-status species (i.e., currently listed under the Federal Endangered Species Act [ESA] and/or the California ESA, or are a Federal species of concern or a state species of special concern). Because the species selected by USACE for species-specific assessments include those sensitive to changes in both river flow and water temperature throughout the year, USACE believes that an evaluation of effects on these species will reasonably encompass the range of effects on fish resources in the lower American River that could occur with the Folsom WCM alternatives. Refer to Appendix 7A, Environmental Setting, for more-detailed descriptions of the habitat requirements and lifestage periodicities for fish species of focused evaluation in the lower American River.

Table 3. Fish Species of Focused Evaluation in the Lower American River.

Common Name	Status
• Central Valley steelhead distinct population segment (DPS)	Federal threatened Recreational and/or commercial importance
• Central Valley fall-/late fall-run Chinook salmon evolutionarily significant unit (ESU) [a]	Federal species of concern State species of special concern Recreational and/or commercial importance
• Central Valley spring-run Chinook salmon ESU (non-natal rearing only)	Federal and state threatened
• River lamprey	State species of special concern
• Pacific lamprey	Federal species of concern
• Hardhead	State species of special concern
• American shad	Recreational and/or commercial importance
• Striped bass	Recreational and/or commercial importance

[a] Although the official designation of the ESU 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.

1.1.4.2.2 Species-Specific Analytical Approach

Flow and water temperature–related evaluations (described above in Sections 1.1.2 and 1.1.3) were applied by USACE at a species- and lifestage-specific level. Species- and lifestage-specific specific flow and water temperature–related evaluations for the lower American River fisheries assessment generally included the following metrics:

- Long-term average flow and average flow by water year type
- Daily flow (as represented by probability of exceedance distributions)
- Daily water temperature (as represented by probability of exceedance distributions) applied to specific WTI values
- Long-term average and average by water year type annual spawning WUA (steelhead and fall-run Chinook salmon)
- Annual spawning WUA (as represented by probability of exceedance distributions) (steelhead and fall-run Chinook salmon)
- Long-term average and average by water year type annual redd dewatering index (steelhead and fall-run Chinook salmon)
- Annual redd dewatering index probability of exceedance distributions (steelhead and fall-run Chinook salmon)
- Long-term average and average by water year type annual early lifestage mortality (fall-run Chinook salmon)
- Annual early lifestage mortality (as represented by probability of exceedance distributions) (fall-run Chinook salmon)

The potential for changes in flows and water temperatures resulting from the Folsom WCM alternatives to affect fish resources in the lower American River depends on the species- and lifestage-specific spatial and temporal distributions, which are summarized in the following sections. In addition, the specific periods of evaluation and model nodes evaluated by USACE for each lifestage are also identified. For further details on the life history, spatial and temporal distributions, and habitat requirements of the species of focused evaluation, refer to Appendix 7A, Environmental Setting.

STEELHEAD

Adult steelhead immigration and holding in the lower American River can begin as early as late spring or summer but occur primarily beginning in November and continue into April (SWRI 2001). Steelhead immigration into the lower American River generally peaks during January (CDFG 1986; SWRI 2001). Spawning typically begins during late December and can extend through March, but also can range from November through April (CDFG 1986). Steelhead redd surveys conducted during most survey years from 2001/2002 through 2012/2013 indicate that spawning generally occurs in the lower American River from late December through mid-April, with nearly all spawning (about 98 percent) occurring from January through April, with the majority (nearly 80 percent) of spawning occurring from mid-January through February (Hannon 2013).

Hannon and Deason (2008) reported that the peak of steelhead spawning varies annually, but most frequently occurs during mid-February. Based on the timing of observations of newly constructed steelhead redds and the amount of time required for incubation, the embryo incubation period has been estimated to generally extend from late December through late May in the lower American River (Hannon et al. 2003; Hannon and Deason 2004, 2005, 2008). For this Draft Technical Report, the steelhead embryo incubation period in the lower American River is generally characterized as extending from January through May.

Previously conducted studies (e.g., PSFMC 2014; Snider and Titus 2000a) indicate that juvenile steelhead might rear in the lower American River for short periods after emergence, or for several months, or even up to a year before moving downstream out of the lower American River. In summary, steelhead that rear in the lower American River year-round reportedly emigrate as smolts generally from January through June (McEwan 2001; Newcomb and Coon 2001; Snider and Titus 2000a), although most emigrate from January through April (Reclamation and NMFS 2014), particularly during January (Snider and Titus 2000a).

Steelhead juveniles that emigrate from the lower American River as young-of-the-year (YOY) do so from March through September (McEwan 2001). YOY steelhead historically began appearing in rotary screw traps (RSTs) at the earliest in mid-January, but typically in mid-March, with most YOY steelhead captured in RSTs from mid-April through June (Snider and Titus 2000a). During RST surveys conducted during 2013, 98 percent (1,019) of the steelhead fry were caught between March 19 and April 22 (PSMFC 2014). Seventy percent (540) of the steelhead with a parr lifestage were caught between April 30 and May 20 during the 2013 survey (PSMFC 2014).

Steelhead might rear in freshwater for 1 to 2 years before undergoing smoltification. Some individuals might rear in their natal streams, while others might volitionally or non-volitionally move downstream to enter the mainstem rivers, where they continue to rear until reaching a size at which smoltification is initiated, as observed by many YOY steelhead captured in rotary screw traps in the Yuba, Feather, and lower American Rivers. The small sizes of juvenile steelhead captured at the rotary screw traps support the presumption that these juvenile fish have not yet undergone smoltification but instead are moving out of the river into downstream rearing habitat. Therefore, habitat conditions for YOY downstream-moving juveniles were assessed using the WTI values for juvenile rearing, whereas separate WTI values were used for the smolt emigration lifestage.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on steelhead in the lower American River for each of the following lifestages, life history periodicities, and modeled locations. Flow was evaluated for the spawning lifestage through evaluating spawning WUA, and is evaluated for the embryo incubation lifestage through evaluation of redd dewatering.

- ☐ Adult immigration (November through March)
  - Flows at Watt Avenue and at river mile (RM) 1
  - Water temperatures at Watt Avenue and RM 1
- ☐ Adult holding (November through March)
  - Flows below Nimbus Dam and at Watt Avenue
  - Water temperatures below Nimbus Dam and at Watt Avenue
- ☐ Spawning (January through mid-April)
  - Spawning WUA percentage of maximum)
  - Water temperatures below Nimbus Dam and at Watt Avenue
- ☐ Embryo incubation (January through May)
  - Redd dewatering index (%)
  - Water temperatures below Nimbus Dam and at Watt Avenue
- ☐ Juvenile rearing and downstream movement (year-round)
  - Flows below Nimbus Dam, at Watt Avenue, and at RM 1
  - Water temperatures below Nimbus Dam, at Watt Avenue, and at RM 1
- ☐ Smolt emigration (December through April)
  - Flows at Watt Avenue and RM 1
  - Water temperatures at Watt Avenue and RM 1

FALL-RUN CHINOOK SALMON

The majority of the fall-run Chinook salmon adult immigration into the lower American River has previously been reported to occur from September through November and to peak in November (SWRI 2001). However, as part of a study to evaluate angler effort and harvest of anadromous fishes in the Central Valley recreational river fishery, the California Department of Fish and Wildlife (CDFW) has performed periodic creel censuses in the lower American River that provide estimates of the fall-run

Chinook salmon monthly catch that were used by the Water Forum and USACE (2015) to assess the temporal distribution of pre-spawning adult fall-run Chinook salmon in the lower American River.

The Water Forum and USACE (2015) obtained the results of analyses of estimated monthly catches of fall-run Chinook salmon in the lower American river from available CDFW angler survey reports (see Water Forum and USACE [2015]; Appendix 7G). These results demonstrate that adult fall-run Chinook salmon begin entering the lower American River as early as June, continuing through the summer prior to spawning from mid-October through December. Information that the Water Forum and USACE (2015) developed for the updated LAR Mortality Model included fitting an asymmetric logistic function to 10 years of available creel survey data (over the period extending from 1991 to 2010) to represent the temporal distribution of adult fall-run Chinook salmon arriving in the lower American River prior to and during the spawning season.

Although some fall-run Chinook salmon adults immigrate into the lower American River as early as June, the recently developed information indicates that, in general, over 90 percent immigrate into the river from September through December. Because the vast majority of fall-run Chinook salmon in the lower American River do not exhibit an extended staging period prior to spawning, the adult immigration WTI values were used by USACE to evaluate this lifestage from September through December. Moreover, the effects of water temperature on the relatively low percentage of adults immigrating into the lower American River from June to September are addressed by USACE through applying the Water Forum and USACE (2015) updated LAR Mortality Model.

Fall-run Chinook salmon spawning in the lower American River generally begins on October 15 and ends on December 31, based on carcass survey data from 1992/1993 through 2012/2013 and the estimated lag period between spawning and carcass survey observations (Water Forum and USACE 2015). Over the range of conditions that have occurred from 1992 through 2012, fall-run Chinook salmon spawning in the lower American River generally peaks during November (when nearly 70 percent of the annual spawning occurs).

The majority of fall-run Chinook salmon redds are formed from Ancil Hoffman Park at RM 16 upstream to the Nimbus Hatchery weir (about RM 23), assuming that spawning occurs nearby or upstream of the location of observed carcasses (Vincik and Kirsch 2009). Aerial redd surveys were conducted on about a weekly basis over the course of the spawning season on the lower American River from only 1991to 1995. These surveys showed that most (92 percent of) redds were formed upstream of RM 16 (Snider and Vyverberg 1996). Vincik and Kirsch (2009) suggested that, as of 2009, there had not been any notable change in the overall spatial distribution of fall-run Chinook salmon spawning in the lower American River since 1995.

Most fall-run Chinook salmon emigrate during the fry stage and, at the latest, the early juvenile stage. The vast majority of juvenile Chinook salmon caught during lower American River RST surveys conducted during 1994, 1995, 1996, 1997, 1998, and 1999 were fry (including yolk-sac fry) and parr, with very few emigrating as silvery parr or smolts (Snider and Titus 2002). The peak Chinook salmon catch occurred during February of most years, while also occurring in late January of 1996 and in early March of 1998 (Snider and Titus 2002). Generally consistent with previous RST surveys, juvenile Chinook salmon catches during the most recent 2013 RST survey peaked between mid-February and early March, with fry passing Watt Avenue generally during January through March, parr passing generally during late March through April, and silvery parr passing generally during mid-April through May (PSMFC 2014).

Overall, the fall-run Chinook salmon juvenile rearing lifestage in the lower American River extends from January through May. The juvenile downstream movement period in the lower American River is coincident with the rearing period.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on fall-run Chinook salmon in the lower American River for each of the following lifestages, life history periodicities, and modeled locations. Flow was evaluated for the spawning lifestage through evaluation of spawning WUA, and is evaluated for the embryo incubation lifestage through evaluation of redd dewatering.

☐ Adult immigration and staging (August through December)

  - Flows below Nimbus Dam, at Watt Avenue, and at RM 1 of the lower American River
  - Water temperatures below Nimbus Dam, at Watt Avenue, and at RM 1

☐ Spawning (Mid-October through December)

  - Spawning WUA (percentage of maximum)
  - Water temperatures below Nimbus Dam and at Watt Avenue

☐ Embryo incubation (Mid-October through March)

  - Redd dewatering index (%)
  - Water temperatures below Nimbus Dam and at Watt Avenue

☐ Total early lifestage mortality (June through May)

☐ Juvenile rearing and outmigration (January through May)

  - Flows below Nimbus Dam, at Watt Avenue, and at RM 1
  - Water temperatures below Nimbus Dam, at Watt Avenue, and at RM 1

SPRING-RUN CHINOOK SALMON

Currently, the lower American River does not support a spawning population of spring-run Chinook salmon.

USACE's analysis of effects on spring-run Chinook salmon in the lower American River is based on the only individual lifestage (i.e., non-natal juvenile rearing) for which critical habitat has been designated by the National Marine Fisheries Service (NMFS). NMFS designated critical habitat for the Central Valley spring-run Chinook salmon evolutionarily significant unit (ESU) on September 2, 2005. The critical habitat designation includes the reach of the lower American River extending from the outfall of the Natomas East Main Drainage Canal downstream to the confluence with the Sacramento River (70 Federal Register [FR] 52488; September 2, 2005). This section of the lower American River was included in the critical habitat designation because it might be used during high winter flows for non-natal rearing and refugia by spring-run Chinook salmon originating from other rivers in the Sacramento River Basin.

The downstream movement period for spring-run Chinook salmon in the lower Sacramento River reportedly occurs from November through April (NMFS 1997), which corresponds to the period when high winter flows typically occur. Therefore, USACE’s impact assessment in this Draft Technical Report considers flow- and water temperature–related changes to affect non-natal spring-run Chinook salmon rearing in the lower American River during the November-through-April period.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on spring-run Chinook salmon in the lower American River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Non-natal juvenile rearing (November through April)
  - Flows at RM 1
  - Water temperatures at RM 1

RIVER LAMPREY

The life history periodicities for river lamprey that are evaluated in this report for the lower American River are based on reported river lamprey life history periodicities in the Sacramento River.

Adult river lampreys migrate into freshwater in the fall and spawn during the winter or spring months in small tributary streams, although the timing and extent of their migration in California is poorly known (UC Davis 2012). For this Draft Technical Report, USACE assumed that adult river lampreys could immigrate from September through June. River lampreys have been reported to spawn from February through May (Moyle 2002) and from April through June (Wang 1986). Moyle (2002) reported that Pacific lamprey embryos hatch in about 19 days at 15 degrees Celsius (°C) (59°F). USACE assumed that river lamprey embryos might incubate for a duration similar to that of Pacific lamprey embryos and therefore assumed that river lamprey embryos could incubate into July. Therefore, for this Draft Technical Report, USACE assumed that river lamprey spawning and embryo incubation could occur from February through July. Lamprey redds observed in the lower American River suggest that lamprey spawn primarily downstream of Watt Avenue (Hannon 2013; Hannon and Deason 2005).

Because river lamprey ammocoetes can remain buried for several years, USACE evaluated ammocoete rearing and downstream movement year-round.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on river lampreys in the lower American River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration (September through June)
  - Flows at Watt Avenue and RM 1
  - Water temperatures at Watt Avenue and RM 1
- ☐ Spawning and embryo incubation (February through July)
  - Flows at Watt Avenue

- Water temperatures at Watt Avenue

☐ Ammocoete rearing and downstream movement (year-round)

  - Flows at Watt Avenue and RM 1
  - Water temperatures at Watt Avenue and RM 1

PACIFIC LAMPREY

The life history periodicities for Pacific lampreys that are evaluated in this report for the lower American River are based on reported Pacific lamprey life history periodicities in the Sacramento River as well as on additional information based on Pacific lamprey redd observations in the lower American River. Specifically, Pacific lamprey redds were reportedly observed as early as January in the lower American River (Hannon 2013; Hannon and Deason 2005). Based on lamprey redd observations from 2002 through 2007, the peak lamprey redd count date ranged from late March to early April, and occurred during late April in 2013 (Hannon 2013). However, the reported peak dates of lamprey redd counts could be biased as a result of lack of sampling after the peak number of redds was observed. Therefore, USACE assumes that peak lamprey spawning could begin as early as late March or early April but could extend later.

Lamprey redds observed in the lower American River suggest that lamprey spawn primarily downstream of Watt Avenue (Hannon 2013; Hannon and Deason 2005).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on Pacific lampreys in the lower American River for each of the following lifestages, life history periodicities, and modeled locations:

☐ Adult immigration (January through June)

  - Flows at Watt Avenue and RM 1
  - Water temperatures at Watt Avenue and RM 1

☐ Spawning and embryo incubation (January through August)

  - Flows at Watt Avenue
  - Water temperatures at Watt Avenue

☐ Ammocoete rearing and downstream movement (year-round)

  - Flows at Watt Avenue and RM 1
  - Water temperatures at Watt Avenue and RM 1

HARDHEAD

Hardheads often make spawning migrations in the spring into smaller tributary streams (Moyle 2002). Hardheads spawn primarily during April through June (Grant and Maslin 1999; Reeves 1964; Wang 1986). In Brown et al. (1992), larval hardheads were reportedly found in late May in the lower American River. In addition, hardheads were captured as early as November in emigration surveys using rotary screw traps (Snider et al. 1997; Snider and Titus 2000a).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on hardheads in the lower American River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Spawning (April through June)
    - Flows at Watt Avenue
    - Water temperatures at Watt Avenue
- ☐ Adults and other lifestages (year-round)
    - Flows at Watt Avenue
    - Water temperatures at Watt Avenue

AMERICAN SHAD

The primary American shad spawning migration period in the lower American River is believed to occur during April through June (Urquhart 1987), and extended juvenile rearing could occur into December, based on CDFW surveys in the lower American River.

Several flow indicators have been identified in the literature to evaluate adult American shad attraction to the lower American River: (1) Kelley et al. (1985b as cited in SWRI 2001) recommended flows of 2,000 cubic feet per second (cfs) or greater from mid-May through June for American shad attraction, (2) Snider and Gerstung (1986) recommended flow levels of 3,000 to 4,000 cfs in the lower American River during May and June, and (3) Painter et al. (1978) recommended that lower American River outflow be at least 10 percent of the Sacramento River flow during May and June. Therefore, USACE assessed changes in American shad attraction flows by determining the number of years in which May and June flows at the mouth of the lower American River would be: (1) greater than 2,000 cfs, (2) within the range of 3,000 cfs to 4,000 cfs, and (3) at least 10 percent of the Sacramento River flow with the Folsom WCM alternatives, compared to the frequency of these flows with the basis of comparison.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on American shad in the lower American River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult attraction (May and June)
    - Attraction flows at RM 1
- ☐ Adult immigration and spawning (April through June)
    - Flows at Watt Avenue
    - Water temperatures at Watt Avenue
- ☐ Juvenile rearing and downstream movement (April through December)
    - Flows at Watt Avenue
    - Water temperatures at Watt Avenue

STRIPED BASS

There is little information regarding specific lifestage periodicities for striped bass in the lower American River. The striped bass spawning period in the Central Valley reportedly occurs from April through June. Although it is not known whether striped bass spawn in the lower American River, adult striped bass have been observed in the lower American River during the spawning season (Cannon and Kennedy 2003; DeHaven 1977). Therefore, striped bass spawning was evaluated by USACE in the lower American River during April through June. Primary rearing areas for juvenile striped bass are located in the Sacramento–San Joaquin Delta; however, the lower American River is used as an opportunistic nursery area during the summer and into the fall (CDFG 1971, 1986; DeHaven 1977). For this Draft Technical Report, striped bass juvenile rearing in the lower American River was evaluated by USACE from May through October.

The number of adult striped bass entering the lower American River is believed to vary with flow levels and food production. Snider and Gerstung (1986) suggested that flows of 1,500 cfs at the mouth of the lower American River during May and June would be sufficient to maintain the striped bass sport fishery. Hence, USACE assessed flow-related changes on the striped bass sport fishery by determining the percentage of time that flows at the mouth of the lower American River would be less than 1,500 cfs in May and June with the Folsom WCM alternatives (and the No Action Alternative), relative to the basis of comparison.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on striped bass in the lower American River for each of the following lifestages, life history periodicities, and modeled locations:

- ❑ Adult attraction (May and June)
    - Attraction flows at RM 1
- ❑ Adult immigration and spawning (April through June)
    - Flows at Watt Avenue
    - Water temperatures at Watt Avenue
- ❑ Juvenile rearing (May through October)
    - Flows at Watt Avenue
    - Water temperatures at Watt Avenue

1.1.5 Far-Field

The Far-Field Study Area consists of the SWP and CVP water operations within the Sacramento River watershed. Specifically, the Far-Field includes the Sacramento River downstream of Keswick Dam, the lower Feather River, Yolo Bypass, and the Sacramento–San Joaquin Delta (Delta).

Because the Folsom WCM Project could change hydrology and water temperature as well as Delta habitat parameters (e.g., X2 location) in the Secondary Study Area, the impact assessment focuses on these and other habitat-based elements. This “initial evaluation” focuses on an evaluation of mean monthly flows and water temperatures at representative nodes for species of focused evaluation in the Far-Field (i.e., net changes in mean monthly flow of 10 percent or more, and changes in the probability of exceeding lifestage-specific WTI values of 10 percent or more).

USACE's decision regarding whether or not to conduct more-detailed impact determinations was based on a consideration of all flow and water temperature indicators of potential impact for all lifestages for a particular species. Detailed evaluations were conducted by USACE if the initial evaluation indicated that the Folsom WCM alternatives could adversely affect an individual species or run, for its defined geographic area (e.g., upper Sacramento River, lower Feather River, etc.), in consideration of all evaluated impact indicators for all lifestages during the initial screening.

A substantial difference in mean monthly flow or in the probability of exceeding a WTI value over a portion of a particular species and lifestage-specific evaluation period does not necessarily constitute an impact. Impact determinations are based on USACE's consideration of all evaluated impact indicators for all lifestages for a particular species. USACE considers an impact to be potentially significant if implementing the Folsom WCM alternatives would adversely affect an individual species or run, for its defined geographic area, in consideration of all evaluated impact indicators for all lifestages.

The following section describes the analytical framework used by USACE to assess the effects of the Folsom WCM alternatives in the Far-Field as part of the initial evaluation.

1.1.5.1 Tools and Application of Model Output

Applications of output resulting from hydrologic and water temperature models and post-processing tools previously described in Section 1.1.4.1 for the lower American River generally pertain to the Far-Field. Hydrologic and water temperature model output are provided on a monthly timestep for the Far-Field.

1.1.5.2 River-Specific Assessment Approach

Changes in SWP/CVP operations resulting from the Folsom WCM alternatives could alter seasonal flows and water temperatures in the Sacramento River, the Feather River, and the Delta.

Because the fish species that inhabit, traverse, or use these areas could differ among regions, USACE's fisheries impact assessment approach varies among geographic areas. The river-specific impact assessment includes identification of fish species of focused evaluation, model output and node locations, and species and lifestage-specific evaluation methodologies for the Folsom WCM alternatives.

Where specific flow requirements have not been developed for species evaluated in a specific river, USACE based potential flow-related impacts determinations on an evaluation of the frequency and magnitude of change in modeled monthly mean flow with the Folsom WCM alternatives, relative to the basis of comparison. USACE based water temperature-related impact determinations on species- and lifestage-specific water temperature index values. The species- and lifestage-specific evaluation periodicities identified below in Section 1.1.5.3 are based on the reviews of river- and species/lifestage-specific literature summarized in Appendix 7A, Environmental Setting as well as on additional information presented below in Section 1.1.5.3.

1.1.5.3 Sacramento River

The Sacramento River below Keswick Dam is used by several fish species, either as habitat during one or more of their lifestages or as a migration corridor to one of its tributaries. Operation of Folsom Dam and Reservoir with the Folsom WCM alternatives could trigger changes in SWP/CVP operations, which could alter seasonal flows and water temperatures in the Sacramento River, which, in turn, could affect habitat conditions for fish species in the Sacramento River. Hence, USACE conducted species-specific impact assessments for the following species in the Sacramento River.

Table 4. Fish Species of Focused Evaluation in the Sacramento River.

Common Name	Status
• Sacramento River winter-run Chinook salmon ESU	Federally and state endangered
• Central Valley spring-run Chinook salmon ESU	Federally and state threatened
• Central Valley fall-/late fall-run Chinook salmon ESU	Federal species of concern State species of special concern Recreational and/or commercial importance
• Central Valley steelhead DPS	Federally threatened Recreational and/or commercial importance
• Southern DPS of North American green sturgeon	Federally threatened 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
• Hardhead	State species of special concern
• White sturgeon	Recreational and/or commercial importance
• American shad	Recreational and/or commercial importance
• Striped bass	Recreational and/or commercial importance

SPECIES-SPECIFIC ANALYTICAL APPROACH

Winter-run Chinook Salmon

Immigration and pre-spawning holding for adult winter-run Chinook salmon in the Sacramento River occurs from November through July (NMFS 2009, 2014). Winter-run Chinook salmon are unique because they spawn during the summer when air temperatures usually approach their yearly maximum (NMFS 2014). Spawning occurs primarily from mid-April to mid-August, with peak spawning during May and June in the Sacramento River reach between Keswick Dam (RM 302) and Red Bluff Diversion Dam (RBDD) (RM 243) (NMFS 2014; Vogel and Marine 1991). Chinook salmon embryo incubation in the Sacramento River can extend into September during wet water years (Vogel and Marine 1991). Winter-run fry begin to emerge from the gravel in late June and continue to emerge through October (Fisher 1994 as cited in NMFS 2009). Emigration of juvenile winter-run fry past RBDD can begin as early as mid-July, typically peaking in September and continuing through March in dry years (NMFS 1997 as cited in NMFS 2014; Vogel and Marine 1991).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on winter-run Chinook salmon in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration (November through July)
  - Flows below Keswick Dam, at Bend Bridge, at Verona, and at Freeport
  - Water temperatures below Keswick Dam, at Bend Bridge, below the Feather River confluence, and at Freeport
- ☐ Adult holding (November through July)
  - Flows below Keswick Dam and at Bend Bridge
  - Water temperatures below Keswick Dam and at Bend Bridge
- ☐ Spawning and embryo incubation (April through September)
  - Flows below Keswick Dam and at Bend Bridge
  - Water temperatures below Keswick Dam, at Ball's Ferry, at Jelly's Ferry, and at Bend Bridge
- ☐ Juvenile rearing and downstream movement (July through March)
  - Flows below Keswick Dam, at Bend Bridge, at Verona, and at Freeport
  - Water temperatures below Keswick Dam, at Bend Bridge, below the Feather River confluence, and at Freeport

Spring-run Chinook Salmon

Adult spring-run Chinook salmon enter the Sacramento River between March and September, primarily during May and June (Moyle 2002; Yoshiyama et al. 1998). Spring-run Chinook salmon spawn during September and October, depending on water temperature (NMFS 2009). Spawning and embryo incubation has been reported to occur primarily during September through mid-February, with spawning peaking in mid-September (Moyle 2002; Vogel and Marine 1991). Spring-run Chinook salmon fry emerge from the gravel from November through March (Moyle 2002).

Emigration timing for juvenile spring-run Chinook salmon varies based on life history. Juvenile spring-run Chinook salmon can begin emigrating soon after they emerge from the gravel as YOY, whereas others over-summer and emigrate as yearlings (CDFG 1998; NMFS 2009). As described in NMFS (2009), juvenile spring-run Chinook salmon emigration at RBDD occurs primarily from November through January and can extend into mid-May. Most spring-run Chinook salmon are believed to rear in the upper Sacramento River during the winter and spring and to emigrate as juveniles or smolts. Some spring-run Chinook salmon can spend as long as 18 months in freshwater and move downstream as smolts during the first high flows of the winter from November through January (CDFG 1998; USFWS 1995). In the Sacramento River, spring-run Chinook salmon smolt reportedly emigrate from October through March (CDFG 1998).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on spring-run Chinook salmon in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration (March through September)
  - Flows below Keswick Dam, at Bend Bridge, at Verona, and at Freeport
  - Water temperatures below Keswick Dam, at Bend Bridge, below the Feather River confluence, and at Freeport
- ☐ Adult holding (March through September)
  - Flows below Keswick Dam and at Bend Bridge
  - Water temperatures below Keswick Dam and at Bend Bridge
- ☐ Spawning and embryo incubation (September through January)
  - Flows below Keswick Dam and at Bend Bridge
  - Water temperatures below Keswick Dam, at Ball's Ferry, at Jelly's Ferry, and at Bend Bridge
- ☐ Juvenile rearing and downstream movement (year-round)
  - Flows below Keswick Dam, at Bend Bridge, and at Verona
  - Water temperatures below Keswick Dam, at Bend Bridge, and below the Feather River confluence
- ☐ Smolt emigration (October through May)
  - Flows at Red Bluff, Verona, and Freeport
  - Water temperatures at Red Bluff, below the Feather River confluence, and at Freeport

Fall-run Chinook Salmon

Migration of adult fall-run Chinook salmon into the Sacramento River begins in July, peaks in October, and ends in December (Vogel 2011). Fall-run Chinook salmon spawn from October through December (Reclamation 2008; Vogel 2011). In general, the fall-run Chinook salmon embryo incubation period extends from October through March (NMFS 2004; Vogel and Marine 1991). The rearing period for juvenile fall-run Chinook salmon in the Sacramento River extends from late December through June (Moyle 2002; Vogel and Marine 1991). Fall-run Chinook salmon juvenile emigration in the Sacramento River occurs from January through June (Moyle 2002; Vogel 2011; Vogel and Marine 1991). Juvenile fall-run Chinook salmon emigration at RBDD begins as early as December, peaks in January and February during winter flow events, decreases through the spring, and extends as late as July (Gaines and Martin 2001 as cited in USFWS and CDFG 2012).

Although fall- and late fall-run Chinook salmon are considered part of the same ESU, their lifestages were evaluated separately by USACE due to distinct differences in the timing of various lifestages.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on fall-run Chinook salmon in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration and staging (July through December)
  - Flows below Keswick Dam, at Red Bluff, at Verona, and at Freeport
  - Water temperatures below Keswick Dam, at Red Bluff, below the Feather River confluence, and at Freeport

- ☐ Spawning and embryo incubation (October through March)
  - Flows below Keswick Dam and at Bend Bridge
  - Water temperatures below Keswick Dam, at Ball's Ferry, at Jelly's Ferry, and at Bend Bridge
- ☐ Juvenile rearing and downstream movement (December through July)
  - Flows at Bend Bridge, Verona, and Freeport
  - Water temperatures at Bend Bridge, below the Feather River confluence, and at Freeport

Late Fall-run Chinook Salmon

Adult immigration of late fall-run Chinook salmon in the Sacramento River generally begins in late October and extends through March (USFWS and CDFG 2012). Late fall-run Chinook salmon spawning occurs from January through April in the Sacramento River (Moyle 2002; NMFS 2004; Vogel and Marine 1991). Late fall-run Chinook salmon embryo incubation extends from January through June (USFWS and CDFG 2012; Vogel and Marine 1991). Late-fall run Chinook salmon juveniles rear in the Sacramento River beginning in late April and continuing through the following December (USFWS and CDFG 2012). Downstream migration of juveniles occurs from April through December, with the primary movement of yearlings taking place during the late fall and early winter months (Reclamation 2008).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were by USACE conducted to identify the effects of the alternatives on late fall-run Chinook salmon in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration and holding (October through April)
  - Flows below Keswick Dam, at Red Bluff, at Verona, and at Freeport
  - Water temperatures below Keswick Dam, at Red Bluff, below the Feather River confluence, and at Freeport
- ☐ Spawning and embryo incubation (January through June)
  - Flows below Keswick Dam and at Bend Bridge
  - Water temperatures below Keswick Dam, at Ball's Ferry, at Jelly's Ferry, and at Bend Bridge
- ☐ Juvenile rearing and downstream movement (April through December)
  - Flows at Bend Bridge, Verona, and Freeport
  - Water temperatures at Bend Bridge, below the Feather River confluence, and at Freeport

Steelhead

Sacramento River steelhead immigration typically begins in August and continues into March or April (McEwan 2001; NMFS 2014), with peak immigration during January and February (Moyle 2002). Sacramento River steelhead spawning occurs from December through April, with peak spawning from January though March (NMFS 2009). McEwan (2001) reports that steelhead fry and fingerlings rear and move downstream in the Sacramento River year-round, although most steelhead smolts reportedly emigrate from January through June. Based on CDFW sampling at Knights Landing, juvenile steelhead emigration occurs primarily from January through May with peaks occurring during March and April (Snider and Titus 2000b).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on steelhead in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- Adult immigration (August through March)
  - Flows below Keswick Dam, at Red Bluff, at Verona, and at Freeport
  - Water temperatures below Keswick Dam, at Red Bluff, below the Feather River confluence, and at Freeport
- Adult holding (August through March)
  - Flows below Keswick Dam and at Bend Bridge
  - Water temperatures below Keswick Dam and at Bend Bridge
- Spawning and embryo incubation (December through May)
  - Flows below Keswick Dam and at Bend Bridge
  - Water temperatures below Keswick Dam and at Bend Bridge
- Juvenile rearing and downstream movement (year-round)
  - Flows below Keswick Dam, at Bend Bridge, and at Verona
  - Water temperatures below Keswick Dam, at Bend Bridge, and below the Feather River confluence
- Smolt emigration (January through June)
  - Flows at Red Bluff, Verona, and Freeport
  - Water temperatures at Red Bluff, below the Feather River confluence, and at Freeport

Green Sturgeon

North American green sturgeon adults in the Sacramento River begin their upstream spawning migrations into freshwater during late February, prior to spawning between March and July, with peak spawning believed to occur between April and June (Adams et al. 2002). Green sturgeon eggs in the Sacramento River incubate during April through August (NMFS 2009). At day 110 to day 118 after emergence, juvenile green sturgeon move downstream (Kynard et al. 2005). Juvenile green sturgeon are taken in traps at RBDD, primarily in May through August, with peak counts reported for June and July (68 FR 4433). Juvenile emigration reportedly extends through September (Environmental Protection Information Center et al. 2001).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on the Southern distinct population segment (DPS) of North American green sturgeon in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- Adult immigration and holding (February through July)

- Flows below Keswick Dam, at Red Bluff, and at Freeport
- Water temperatures below Keswick Dam, at Red Bluff, and at Freeport

☐ Spawning and embryo incubation (March through August)

- Flows below Keswick Dam, at Red Bluff, and at Wilkins Slough
- Water temperatures below Keswick Dam, at Red Bluff, and at Wilkins Slough

☐ Adult post-spawning and emigration (July through November)

- Flows below Keswick Dam, at Red Bluff, and at Freeport
- Water temperatures below Keswick Dam, at Red Bluff, and at Freeport

☐ Juvenile rearing and downstream movement (year-round)

- Flows at Red Bluff, Wilkins Slough, and Freeport
- Water temperatures at Red Bluff, Wilkins Slough, and Freeport

White Sturgeon

Adult white sturgeon upstream spawning movements are apparently triggered by photoperiod (Doroshov et al. 1997; Webb et al. 1999 as cited in Israel et al. 2011) and increases in river flow (Schaffter 1997). Adult white sturgeon initiate their upstream migration into the lower Sacramento River from the Delta and estuary during late fall and winter (Kohlhorst and Cech 2001). The relatively larger adults migrate to about a 90-kilometer section of the river to spawn between Knights Landing and several kilometers upstream of Colusa (Kohlhorst 1976; Schaffter 1997). White sturgeon spawning typically occurs between February and June when water temperatures are 46°F to 66°F (Moyle 2002), with peak spawning activity occurring during March and April (Kohlhorst 1976; Kohlhorst and Cech 2001). Juvenile rearing and emigration can occur year-round. For this Draft Technical Report, USACE assumes that white sturgeon adult immigration and holding occur primarily from November through May and that spawning and embryo incubation generally occur from February through June.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on white sturgeon in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

☐ Adult immigration and holding (November through May)

- Flows at Red Bluff, Wilkins Slough, and Freeport
- Water temperatures at Red Bluff, Wilkins Slough, and Freeport

☐ Spawning and embryo incubation (February through June)

- Flows at Red Bluff, Verona, and Freeport
- Water temperatures at Red Bluff, at Wilkins Slough, and below the Feather River confluence

☐ Juvenile rearing and downstream movement (year-round)

- Flows at Wilkins Slough, Verona, and Freeport
- Water temperatures at Wilkins Slough, below the Feather River confluence, and at Freeport

River Lamprey

Based on studies of river lampreys in British Columbia, adult upstream migration occurs in autumn (Moyle 2002), beginning in about September extending through late winter (Beamish 1980).The exact timing of upstream migration of adults in California is unknown (Moyle 2002). Adult river lampreys migrate into freshwater in the fall and spawn during the winter or spring in small tributary streams, although the timing and extent of their migration in California is poorly known (UC Davis 2012). For this Draft Technical Report, USACE assumes that river lamprey adult immigration occurs from September through June. River lampreys reportedly spawn during February through May (Moyle 2002). Ammocoete metamorphosis begins during the summer (Moyle 2002), which indicates that embryo incubation could extend into July. The length of the ammocoete lifestage is not known but is probably 3 to 5 years (Moyle 2002). Therefore, ammocoete rearing occurs year-round. Ammocoete emigration might be associated with large pulse flows during the winter. After reaching the Delta, ammocoetes are considered to be macropthalmia (i.e., juveniles).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on river lampreys in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration (September through June)
  - Flows below Keswick Dam, at Wilkins Slough, and at Freeport
  - Water temperatures below Keswick Dam, at Wilkins Slough, and at Freeport
- ☐ Spawning and embryo incubation (February through July)
  - Flows below Keswick Dam, at Red Bluff, and at Wilkins Slough
  - Water temperatures below Keswick Dam, at Red Bluff, and at Wilkins Slough
- ☐ Ammocoete rearing and downstream movement (year-round)
  - Flows below Keswick Dam, at Wilkins Slough, and at Freeport
  - Water temperatures below Keswick Dam, at Wilkins Slough, and at Freeport

Pacific Lamprey

Adult Pacific lampreys typically migrate into the Sacramento River in March through June (Moyle 2002), but upstream migrations have been observed during January and February (Entrix 1996 as cited in Moyle 2002; Trihey and Associates 1996a as cited in Moyle 2002). Pacific lampreys have been reported to spawn between March and July, depending on the location (USFWS 2008), which indicates that eggs could be incubating as late as August. The length of the Pacific lamprey ammocoete lifestage is not known but is estimated to be 5 to 7 years (Moyle 2002). Therefore, ammocoete rearing occurs year-round.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on Pacific lampreys in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration (January through June)
  - Flows below Keswick Dam, at Wilkins Slough, and at Freeport

- Water temperatures below Keswick Dam, at Wilkins Slough, and at Freeport

☐ Spawning and embryo incubation (March through August)

  - Flows below Keswick Dam, at Red Bluff, and at Wilkins Slough
  - Water temperatures below Keswick Dam, at Red Bluff, and at Wilkins Slough

☐ Ammocoete rearing and downstream movement (year-round)

  - Flows below Keswick Dam, at Wilkins Slough, and at Freeport
  - Water temperatures below Keswick Dam, at Wilkins Slough, and at Freeport

Sacramento Splittail

Sacramento splittail spawning can occur anytime between late February and early July, with peak spawning occurring during March and April (Moyle 2002). The California Department of Water Resources (DWR) reported that Sacramento splittail spawning, embryo incubation, and initial rearing occur primarily during February through May (DWR 2004). Therefore, for this Draft Technical Report, Sacramento splittail spawning and embryo incubation is evaluated during February through May.

Juvenile Sacramento splittail prefer shallow-water habitat with emergent vegetation during rearing (Meng and Moyle 1995). Although it has been generally reported that downstream movement of juvenile Sacramento splittail appears to coincide with drainage from the floodplains between May and July (Caywood 1974; Meng and Moyle 1995; Sommer et al. 1997), large numbers of YOY Sacramento splittail are typically captured in screw traps (set at the base of floodplains) in the Yolo and Sutter Bypasses in May, with diminishing numbers in June (Sommer et al. 2004).

Because Sacramento splittail occur primarily in the Yolo Bypass, and because of their tolerance for a wide range of water temperatures (e.g., 45°F–75°F), changes in habitat for Sacramento splittail were evaluated by USACE using simulated changes in Yolo Bypass outflow, as identified in the Yolo Bypass section, below.

Hardhead

Hardheads generally occur in large, undisturbed, low- to mid-elevation rivers and streams throughout the Sacramento River system (Moyle 2002). Hardheads mature during their third year and often make spawning migrations in the spring into smaller tributary streams (Moyle 2002; USFWS and CDFG 2012). Most hardhead spawning is reportedly restricted to Sacramento River tributaries and foothill streams (Wang and Reyes 2007). Hardheads reportedly spawn primarily during April and May (Grant and Maslin 1999; Reeves 1964); however, hardhead larvae have been collected in Clear Creek, Stony Creek, and Mud Creek during July (Wang and Reyes 2007), which indicates that spawning can occur during June. Because hardhead is a resident fish species, adult and juvenile lifestages might be present in the river year-round.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on hardheads in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

☐ Adults and other lifestages (year-round)

  - Flows below Keswick Dam, at Verona, and at Freeport
  - Water temperatures below Keswick Dam, below the Feather River confluence, and at Freeport

- ☐ Spawning (April through June)

  - Flows below Keswick Dam, at Wilkins Slough, and at Freeport
  - Water temperatures below Keswick Dam, at Wilkins Slough, and at Freeport

American Shad

Adult American shad enter the Sacramento River from April through early July (CDFG 1986), with the majority of immigration and spawning occurring from mid-May through June (Urquhart 1987). American shad larvae are planktonic for about 4 weeks and drift downstream from spawning areas during this time (Stier and Crance 1985 as cited in Moyle 2002). Outmigration of young American shad reportedly occurs from June through November (Stevens 1966 as cited in CDFG 2010). However, juvenile rearing and downstream movement in the Sacramento River can occur year-round (Moyle 2002).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on American shad in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration and spawning (April through June)

  - Flows at Red Bluff, Verona, and Freeport
  - Water temperatures at Red Bluff, below the Feather River confluence, and at Freeport

- ☐ Juvenile rearing and downstream movement (year-round)

  - Flows at Wilkins Slough, Verona, and Freeport
  - Water temperatures at Wilkins Slough, below the Feather River confluence, and at Freeport

Striped Bass

Adult striped bass are present in Central Valley rivers throughout the year, with peak abundance occurring during the spring. Spawning can begin in April but peaks during May and early June (Moyle 2002). In the Sacramento River, striped bass spawning is believed to generally occur between Sacramento and Princeton (CDFW 2015). Larval and initial juvenile striped bass nursery areas are located primarily in the Delta and in Suisun Bay (Hassler 1988). However, juvenile rearing can occur in the lower Sacramento River year-round.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on striped bass in the Sacramento River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult Immigration and Spawning (April through June)

  - Flows at Wilkins Slough and Verona
  - Water temperatures at Wilkins Slough and below the Feather River confluence

- ☐ Juvenile rearing (year-round)

- Flows at Wilkins Slough and Verona
- Water temperatures at Wilkins Slough and below the Feather River confluence

1.1.5.4 Feather River

The Feather River watershed in the Secondary Study Area includes Oroville Reservoir and the lower Feather River extending from the Fish Barrier Dam to the confluence with the Sacramento River. Because the Folsom WCM alternatives could change Feather River flows and water temperatures, the impact assessment focuses on these and other habitat-based elements.

1.1.5.4.1 Feather River

The lower Feather River begins at the river's Low Flow Channel, which extends 8 miles from the Fish Barrier Dam (RM 67) to the Thermalito Afterbay Outlet (RM 59). Water is released through a powerhouse, then through the Fish Barrier Dam into the Low Flow Channel. The Thermalito Afterbay has a dual purpose as an afterbay for upstream peaking power releases to ensure constant river and irrigation canal flows and as a warming basin for irrigation water being diverted to rice fields (NMFS 2009). Thus, water temperatures in the approximately 14 miles of salmon spawning area from the Thermalito Afterbay Outlet to the mouth of Honcut Creek (referred to as the High Flow Channel) are always higher than those in the 8 miles of the Low Flow Channel (USFWS 1995).

Through the Oroville Facilities Federal Energy Regulatory Commission (FERC) Relicensing, operational changes increase the minimum instream flow from the historic 600 cfs to 700 cfs in the Low Flow Channel during most of the year to increase the amount of available anadromous spawning habitat and decrease water temperatures. During the Chinook salmon spawning season (generally from September through March), the minimum instream flows in the Low Flow Channel are increased to 800 cfs (FERC 2006; SWRCB 2010).

The majority of the Low Flow Channel flows through a single channel contained by stabilized levees. Side-channel or secondary channel habitat is limited, occurring primarily in the Steep Riffle (located 2 miles upstream of the Thermalito Afterbay Outlet) and Eye Riffle areas between RM 60 and RM 61. The channel banks and streambed consist of armored cobble as a result of periodic flood flows and the absence of gravel recruitment. However, there are nine major riffles with suitable spawning-size gravel, and about two-thirds of the natural Chinook salmon spawning in the lower Feather River occurs in the Low Flow Channel, which extends between the Fish Barrier Dam and the Thermalito Afterbay Outlet (DWR 2007; NMFS 2009). Releases are made from the coldwater pool in Oroville Reservoir, and this cold water generally provides suitable water temperatures for spawning in the Low Flow Channel (DWR 2001).

The remaining amount (about one-third) of Chinook salmon spawning in the lower Feather River occurs in the High Flow Channel, which is located downstream of the Thermalito Afterbay Outlet to Honcut Creek (RM 59 to RM 44) (DWR 2007; NMFS 2009). Flows in the High Flow Channel are maintained between the minimum flow and a flow no greater than 2,500 cfs from October 15 through November 30 to prevent Chinook salmon redd dewatering in the event that flows were to decrease during the egg incubation period (FERC 2006). The High Flow Channel also is an important migration corridor for both juvenile and adult anadromous fish (NMFS 2004).

Releases from the Thermalito Afterbay Outlet vary according to operational requirements, and the flow regime in the reach of the Feather River extending from the Thermalito Afterbay Outlet (RM 59) to the confluence of the Feather and Sacramento Rivers (RM 0) varies depending on runoff and month (FERC 2006).

According to SWRCB (2010), studies have shown it is unlikely that adult Chinook salmon can use the lower Feather River below the Thermalito Afterbay Outlet except as a migration corridor. As a result of elevated water temperatures, increased incidence of disease, developmental abnormalities, increased in-vivo egg mortality, and temporary cessation of Chinook salmon and steelhead migration could occur in some areas of the lower Feather River (SWRCB 2010).

Currently, there are several temperature objectives for the Feather River downstream of the Thermalito Afterbay Outlet. From May through August, water temperature objectives address American shad, striped bass, and other warmwater fish. During the fall (e.g., after September 15), water temperature objectives address fall-run Chinook salmon (DWR 1983, 2007).

To protect spring-run Chinook salmon and steelhead, NMFS (2004, 2009) has previously established water temperature targets for the lower Feather River at the Feather River Fish Hatchery and for the Low Flow Channel, which is monitored near Robinson Riffle (RM 61.6). Water temperature targets for the Low Flow Channel at Robinson Riffle, located near where the Low Flow Channel meets the High Flow Channel, specify that mean daily water temperatures shall not exceed 65°F from June 1 to September 30 (SWRCB 2010). From June 1 through September 30, DWR is required to control Feather River water temperatures at RM 61.6 (Robinson Riffle in the Low Flow Channel) unless DWR consults with the Feather River Technical Team and receives approval from NMFS to deviate from the Biological Opinion temperature requirement (DWR 2007).

The Feather River Fish Hatchery’s water supply is diverted directly from the Thermalito Diversion Pool, which receives cold, hypolimnetic water (which is rarely warmer than the mid- to high 50s [°F]) from Oroville Reservoir. Because the hatchery’s water supply comes from stored water in the Thermalito Diversion Pool and does not come directly from the Feather River, it is not subject to the thermal warming effects of downstream in-channel transport. Thus, the hatchery and the Thermalito Diversion Pool are not specifically evaluated in this assessment.

EVALUATION SPECIES

The lower Feather River is used by several fish species of focused evaluation, primarily as habitat during one or more of their lifestages but also as a migration corridor to upstream habitat in other river systems (e.g., the Yuba River). Changes caused by the Folsom WCM alternatives could alter seasonal Oroville Reservoir operations and, thus, alter Feather River flows and water temperatures, which could change the relative habitat suitability for the following fish species of focused evaluation.

Table 5. Fish Species of Focused Evaluation in the Feather River.

Common Name	Status
• Central Valley spring-run Chinook salmon ESU	Federally and state threatened
• Central Valley fall-/late fall-run Chinook salmon ESU [a]	Federal species of concern State species of special concern Recreational and/or commercial importance
• Central Valley steelhead DPS	Federally threatened Recreational and/or commercial importance
• Southern DPS of North American green sturgeon	Federally threatened State species of special concern
• White sturgeon	Recreational and/or commercial importance
• River lamprey	State species of special concern
• Pacific lamprey	Federal species of 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

[a] Although the official designation of the ESU is Central Valley fall-/late fall-run Chinook salmon, the evaluation is for fall-run Chinook salmon on the lower Feather River because of the general absence of late fall-run Chinook salmon.

SPECIES-SPECIFIC ANALYTICAL APPROACH

Spring-run Chinook Salmon

Adult spring-run Chinook salmon enter the Sacramento River basin between March and September, primarily in May and June (Moyle 2002; Yoshiyama et al. 1998). Spring-run Chinook salmon adult immigration and holding in the lower Yuba River reportedly occur from April through September (RMT 2013). Thus, spring-run Chinook salmon in the lower Feather River also might be holding into September. Adult Chinook salmon in the lower Feather River exhibiting the typical life history of the spring run have been found holding at the Thermalito Afterbay Outlet and the Fish Barrier Dam as early as April (DWR 2007 as cited in NMFS 2014). Spring-run Chinook salmon spawning and embryo incubation in the lower Feather River might occur from September through February (NMFS 2014). Some spring-run Chinook salmon reportedly emigrate as smolts from the Feather River from October through June (Cavallo, pers. comm., 2004 as cited in YCWA et al. 2007).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on spring-run Chinook salmon in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

- ❑ Adult immigration (March through September)
    - Flows below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River
    - Water temperatures below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River

- Adult holding (March through September)
  - Flows below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
  - Water temperatures below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
- Spawning and embryo incubation (September through February)
  - Flows below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
  - Water temperatures below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
- Juvenile rearing and downstream movement (year-round)
  - Flows below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River
  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the lower Feather River
- Smolt emigration (October through June)
  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

Fall-run Chinook Salmon

In the Central Valley, adult fall-run Chinook salmon are reported to generally begin migrating upstream annually in July, with immigration continuing through December in most years (NMFS 2004; Vogel and Marine 1991). Fall-run Chinook salmon spawning and embryo incubation generally extend from October through February or March (Moyle 2002; SWRI 2001; Vogel and Marine 1991). The juvenile fall-run Chinook salmon rearing period in the Central Valley reportedly extends from late December through June (Moyle 2002; Vogel and Marine 1991). In the Feather River, fall-run Chinook salmon fry emergence has been reported to occur as early as November (Seesholtz et al. 2003). Therefore, for this evaluation, fall-run Chinook salmon juvenile rearing and downstream movement are evaluated during November through June.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on fall-run Chinook salmon in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

- Adult immigration and staging (July through December)
  - Flows below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River
  - Water temperatures below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River
- Spawning and embryo incubation (October through March)
  - Flows below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
  - Water temperatures below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
- Juvenile rearing and downstream movement (November through June)
  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River

  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

Steelhead

The majority of natural steelhead spawning in the Feather River is reported to occur in the Low Flow Channel, particularly in the upper reaches near Hatchery Ditch, although limited steelhead spawning also occurs below the Thermalito Afterbay Outlet (DWR 2007). Recently, RMT (2013) identified steelhead lifestage periodicities in the lower Yuba River (a tributary of the Feather River) based on various studies, including the use of VAKI Riverwatcher systems, which have not been implemented in the lower Feather River. Therefore, lower Yuba River steelhead periodicities were used by USACE to evaluate steelhead in the lower Feather River.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on steelhead in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration (August through March)
  - Flows below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River
  - Water temperatures below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River
- ☐ Adult holding (August through March)
  - Flows below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River
  - Water temperatures below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River
- ☐ Spawning and embryo incubation (January through May)
  - Flows below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
  - Water temperatures below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
- ☐ Juvenile rearing and downstream movement (year-round)
  - Flows below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
  - Water temperatures below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
- ☐ Smolt emigration (October through April)
  - Flows below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River
  - Water temperatures below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River

Green Sturgeon

Limited information is available regarding green sturgeon distribution, movement, and behavioral patterns, as well as lifestage-specific habitat utilization preferences, for the Feather River. Green sturgeon in the Sacramento River have been documented and studied more widely than they have in the Feather

River. For this Draft Technical Report, USACE assumes that green sturgeon in the Feather River share the same life history traits as green sturgeon in the Sacramento River as described previously in Section 1.1.4.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on green sturgeon in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

☐ Adult immigration and holding (February through November)

- Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
- Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

☐ Spawning and embryo incubation (March through August)

- Flows below the Thermalito Afterbay Outlet
- Water temperatures below the Thermalito Afterbay Outlet

☐ Juvenile rearing and downstream movement (year-round)

- Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
- Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

White Sturgeon

Although both green and white sturgeon are native to California, white sturgeon are more commonly observed in the Feather River (DWR 2003 as cited in DWR 2005) and are known to spawn in the Feather River (Moyle 2002). For this Draft Technical Report, USACE assumes that white sturgeon life history periodicities in the Feather River are the same as those previously discussed for the Sacramento River in Section 1.1.4.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on white sturgeon in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

☐ Adult immigration and holding (November through May)

- Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
- Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

☐ Spawning and embryo incubation (February through June)

- Flows below the Thermalito Afterbay Outlet
- Water temperatures below the Thermalito Afterbay Outlet

☐ Juvenile rearing and downstream movement (year-round)

- Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River

  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

River Lamprey

River lamprey life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed for the Sacramento River in Section 1.1.4.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on river lampreys in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

- Adult immigration (September through June)
  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River
- Spawning and embryo incubation (February through July)
  - Flows below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
  - Water temperatures below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
- Ammocoete rearing and downstream movement (year-round)
  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

Pacific Lamprey

Pacific lamprey life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed for the Sacramento River in Section 1.1.4.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on Pacific lampreys in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

- Adult immigration (January through June)
  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River
- Spawning and embryo incubation (March through August)
  - Flows below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
  - Water temperatures below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
- Ammocoete rearing and downstream movement (year-round)
  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River

  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

Sacramento Splittail

Sacramento splittail life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed in Section 1.1.4 for the Sacramento River. Sacramento splittail spawning, embryo incubation, and initial rearing lifestages in the lower Feather River occur from February through May.

Because Sacramento splittail occur primarily in the Yolo Bypass, and because of their tolerance for a wide range of water temperatures (e.g., 45°F–75°F), the evaluation of changes in habitat for Sacramento splittail was conducted for the Yolo Bypass and is presented in the Yolo Bypass section below.

Hardhead

Hardhead life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed in Section 1.1.4 for the Sacramento River.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on hardheads in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adults and other lifestages (year-round)
  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River
- ☐ Spawning (April through June)
  - Flows below the Fish Barrier Dam and below the Thermalito Afterbay Outlet
  - Water temperatures below the Fish Barrier Dam and below the Thermalito Afterbay Outlet

American Shad

American shad life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed in Section 1.1.4 for the Sacramento River. American shad spawning in the lower Feather River occurs from April through June (DWR 2007). American shad juvenile rearing reportedly occurs in the Feather River below Yuba City (USFWS 1995). Because American shad juvenile rearing can occur in the Sacramento River year-round, juvenile rearing in the lower Feather River is also evaluated year-round.

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on American shad in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

- ☐ Adult immigration and spawning (April through June)
  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River

  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

☐ Juvenile rearing and downstream movement (year-round)

  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

Striped Bass

Striped bass life history periodicities and habitat requirements in the lower Feather River are similar to those previously discussed in Section 1.1.4 for the Sacramento River. Striped bass spawning in the lower Feather River extends from April through June (DWR 2007).

Comparisons of modeling output for the Folsom WCM alternatives, relative to the basis of comparison, were conducted by USACE to identify the effects of the alternatives on striped bass in the Feather River for each of the following lifestages, life history periodicities, and modeled locations:

☐ Adult immigration and spawning (April through June)

  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

☐ Juvenile rearing (year-round)

  - Flows below the Thermalito Afterbay Outlet and at the mouth of the Feather River
  - Water temperatures below the Thermalito Afterbay Outlet and at the mouth of the Feather River

1.1.5.5 Sutter Bypass

Within the Sutter National Wildlife Refuge (NWR), native anadromous fish include steelhead and four distinct runs of Chinook salmon (USFWS 2009). Encompassing an area of about 2,600 acres, the Sutter NWR is located about 50 miles north of Sacramento, 10 miles southwest of Yuba City, and 5 miles south of Sutter, California. About 80 percent of the Sutter NWR is located within the Sutter Bypass, which is west of Yuba City, California (USFWS 2009). The east and west Sutter Bypass canals are part of lower Butte Creek and are tributary to the larger Sacramento River system.

During periods of high flows in the Sutter Bypass, large numbers of Chinook salmon and steelhead can use the Sutter NWR (USFWS 2009). When inundated, the relatively warmer waters of the floodplain become very productive and produce an abundance of prey, resulting in rapid growth rates and relatively large sizes of juvenile anadromous salmonids outmigrating to the Delta and the Pacific Ocean.

During periods of flooding, the Sutter NWR provides high-value rearing habitat for migrating juvenile Chinook salmon. Water enters the Sutter Bypass in several ways. First, Butte Creek, a non-SWP/CVP tributary of the Sacramento River, spills into Sutter Bypass via Butte Slough (Feyer et al. 2006). Second, when Sacramento River flows exceed between 90,000 and 100,000 cfs at Ord Ferry, water flows naturally over the banks into the Butte Basin. In addition to the Sacramento River overbank flows at Ord Ferry, the

Sutter Bypass receives inflow at weirs along the Sacramento River during high-flow events. Water enters Sutter Bypass at Tisdale Weir when Sacramento River flow exceeds 21,012 cfs, at Moulton Weir when flow exceeds 44,990 cfs, and at Colusa Weir when flow exceeds 65,014 cfs (Feyer et al. 2006).

Changed operations of the SWP/CVP could cause changes in flow in the Feather River associated with the Folsom WCM alternatives. Given the minor changes in the mean monthly flow modeling for the Far-Field, it is unlikely that high-flow events would exceed the weir overflow thresholds. Therefore, although USACE recognizes that the Sutter Bypass provides important habitat during high-flow events, USACE did not specifically evaluate spills into the Sutter Bypass for this Draft Technical Report.

1.1.5.6 Yolo Bypass

Several special-status fish species are reported to use the Yolo Bypass for adult immigration, spawning, and/or juvenile rearing. In particular, the Yolo Bypass provides high-quality rearing habitat as a result of high nutrient and invertebrate production when it is inundated (Sommer et al. 2001; Sommer et al. 2005).

To evaluate changes in rearing habitat in the Yolo Bypass, USACE used simulated changes in mean monthly flow out of the bypass as an indicator of floodplain inundation and changes in Yolo Bypass flow with the Folsom WCM alternatives, relative to the basis of comparison. Applicable lifestages of fish species of focused evaluation were evaluated in the Yolo Bypass during their respective lifestage periodicities, restricted to the months during which the Yolo Bypass generally floods. Spills from the Sacramento River into the Yolo Bypass generally occur during November through May. Therefore, changes in mean monthly Yolo Bypass outflow were evaluated only for November through May.

For anadromous fish, including runs of Chinook salmon, steelhead, and green and white sturgeon, Yolo Bypass outflow was evaluated during the Sacramento River juvenile rearing and downstream movement period (restricted to the November through May evaluation period). Delta smelt were evaluated during the reported period of adult rearing in the Yolo Bypass, and Sacramento splittail were evaluated during both the reported spawning and embryo incubation lifestage and the juvenile rearing and downstream movement lifestage (restricted to the November through May evaluation period). Floodplain habitat in the Yolo Bypass is particularly important to Sacramento splittail, which is discussed in more detail below in this section.

During winter and spring, adult splittail move upstream onto floodplains to forage and spawn (Meng and Moyle 1995; Sommer et al. 1997). Splittail spawn generally between late February and early July (Moyle 2002), laying their eggs on submerged vegetation. Age-0 splittail abundance has been significantly correlated to mean Delta outflow during February through May and to the number of days of Yolo Bypass floodplain inundation (Meng and Moyle 1995; Sommer et al. 1997). USACE's evaluation of floodplain habitat availability in the Yolo Bypass addresses all splittail lifestages because floodplain habitat is important to all lifestages.

Flows through the Yolo Bypass of about 10,000 cfs reportedly could provide the greatest area of shallow habitat in the Yolo Bypass (Moyle et al. 2004, Sommer et al. 2004, Harrell and Sommer 2003, and Harrell et al. 2009, all as cited in Fleenor et al. 2010). It has been reported that 30 days is the estimated minimum time required for the development of splittail eggs to emigrating juveniles, based on estimated values reported in the literature (e.g., Feyrer et al. 2004, Feyrer et al. 2006, Moyle et al. 2004, and Sommer et al.

2007, all as cited in ICF 2013). Year-class abundance of splittail is reportedly determined primarily by floodplain spawning and rearing habitat conditions during February 1 through June 30 (Sommer et al. 1997). SWRCB (2010) and CDFG (2010) recommend that the Yolo Bypass be inundated for at least 30 consecutive days between late February and May of wet and above-normal water years to benefit splittail spawning and recruitment.

The availability of splittail floodplain habitat was evaluated by USACE by comparing CalSim II–simulated mean monthly Yolo Bypass flow (downstream of Fremont and Sacramento Weirs) with the Folsom WCM alternatives, relative to the basis of comparison, during February through May of wet and above-normal water years. Although CalSim II–simulated mean monthly flows do not necessarily indicate the duration of inundation of the Yolo Bypass, the frequency of inundation is indicated. Additionally, although NMFS (2009) stated that the floodplain is fully activated at 8,000 cfs, USACE assumes that increases in inundation frequency, regardless of flow volume in the bypass, would provide additional habitat for splittail even if the floodplain were not fully activated. Therefore, USACE's analysis of Yolo Bypass flows with the Folsom WCM alternatives, relative to the basis of comparison, does not specifically focus on flows above 8,000 cfs.

EVALUATION SPECIES

Yolo Bypass outflow was evaluated by USACE for the following species and lifestage-specific periods (restricted to the November through May evaluation period):

- ☐ Sacramento River winter-run Chinook salmon
  - Juvenile rearing and downstream movement (November through March)
- ☐ Central Valley spring-run Chinook salmon
  - Juvenile rearing and downstream movement (year-round)
- ☐ Central Valley fall-run Chinook salmon
  - Juvenile rearing and downstream movement (December through May)
- ☐ Central Valley late fall-run Chinook salmon
  - Juvenile rearing and downstream movement (November through May)
- ☐ Central Valley steelhead
  - Juvenile rearing and downstream movement (November through May)
- ☐ Green sturgeon
  - Juvenile rearing and downstream movement (November through May)
- ☐ White sturgeon
  - Juvenile rearing and downstream movement (April and May)
- ☐ Delta smelt

- Adult rearing (December through May)

- ❑ Sacramento splittail
  - Spawning and embryo incubation (February through May)
  - Juvenile rearing and downstream movement (April and May)

1.1.5.7 Sacramento–San Joaquin Delta

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

1.1.5.7.1 Evaluation Species

The current assemblages of fish in the Delta and watersheds upstream include a mixture of native and introduced species. Although there is limited knowledge of the ecology of native fish in the past, the historical assemblages of fish upstream of and in the Delta were different from the current assemblages (Moyle 2002). For example, the Sacramento perch, once abundant in sloughs off main channels, was extirpated from the Delta (Rutter 1908). Conversely, a large number of nonnative species of fish have been either intentionally (e.g., striped bass, channel catfish, American shad, threadfin shad, and largemouth bass) or unintentionally (e.g., goldfish) introduced into the system.

Although many fish species inhabit the Delta for all or part of their lifecycles, the following species of focused evaluation 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 6. Fish Species of Focused Evaluation in the Sacramento–San Joaquin Delta.

Common Name	Status
• Sacramento River winter-run Chinook salmon ESU	Federally and state endangered
• Central Valley spring-run Chinook salmon ESU	Federally and state threatened
• Central Valley fall-/late fall-run Chinook salmon ESU	Federal species of concern State species of special concern Recreational and/or commercial importance
• Central Valley steelhead DPS	Federally threatened Recreational and/or commercial importance
• Delta smelt	Federally threatened State endangered
• Longfin smelt	Federal candidate State threatened
• American shad	Recreational and/or commercial importance
• Striped bass	Recreational and/or commercial importance

The habitat requirements and distribution for the above species are largely representative of the habitat requirements and distribution of other Delta fish species. Therefore, USACE's analysis of effects on the above species covers the range of effects on other Delta fishery resources.

SPECIES EXCLUDED FROM EVALUATION

Hardhead

Hardhead, a California species of special concern, is widely distributed throughout the Sacramento–San Joaquin River system, although it is absent from the valley reaches of the San Joaquin River (Moyle 2002). Hardheads generally occur in large, undisturbed, low- to mid-elevation rivers and streams of the region (Moyle 2002). The precise historical distribution and abundance patterns of hardheads are unknown, but the presence of their remains in Indian middens (mounds or deposits containing shells, animal bones, and other refuse) suggests that they were common in the general Delta region when the Delta was still a largely undisturbed intertidal swamp (The Bay Institute 1998).

However, based on USACE's evaluation of recent and historical fish surveys in the Delta, it is unlikely that hardheads occur in appreciable numbers in the Delta. Specifically, very few hardheads were reported in salvage data collected at the SWP and CVP fish salvage facilities. For example, from April 1, 2000, through March 31, 2003, the average annual salvage of hardheads at the Tracy Fish Facility was four individuals. Between 1993 and 2000, only 38 hardheads were counted at the SWP and CVP fish salvage facilities (BDAT 2010). Therefore, USACE anticipates that water operations would not substantively affect hardheads in the Delta. Thus, no further evaluation of hardheads in the Delta was conducted by USACE.

Northern Anchovy and Starry Flounder

Northern anchovy and starry flounder are managed as "monitored species" by the Coastal Pelagic Species Fishery Management Plan and the Pacific Coast Groundfish Fishery Management Plan of the Pacific Fishery Management Council (PFMC), respectively, and are subject to Essential Fish Habitat consultation as a result (PFMC 1998a and 1998c as cited in Reclamation 2008).

Northern Anchovy

Northern anchovies occur from British Columbia to Baja California (Reclamation 2008) and are reported to be common in surveys of the lower tidal portions of the Sacramento and San Joaquin Rivers (Herrgesell 1994 as cited in Reclamation 2008). However, because of their salinity requirements, northern anchovies have not been recorded above brackish water within these systems. This species typically is found from seawater to mesohaline waters (moderately brackish with salinity range of 5 to 18 parts per thousand [ppt]) and occasionally in oligohaline areas (brackish water with low salinity range of 0.5 to 5 ppt) (Reclamation 2008).

Reclamation (2008) determined that, because the northern anchovy is primarily a marine species and because integrated SWP/CVP operations have little effect on marine conditions, it is unlikely that changes in SWP/CVP operations would affect the northern anchovy. Northern anchovies made up less than 1 percent of the total fish captured by otter trawl and beach seine in Suisun Marsh between 1979 and 1999 (Matern et al. 2002 as cited in Reclamation 2008). However, this species was the fourth most common fish larvae collected in a 1991 survey of Suisun Bay, and northern anchovies also are common in San Pablo Bay (Herrgesell 1994 as cited in Reclamation 2008). Reclamation (2008) also reported that there are no records of northern anchovy salvage at the SWP/CVP fish salvage facilities. Therefore, USACE anticipates that water operations would not substantively affect northern anchovies in the Delta. Thus, no further detailed evaluation of northern anchovies in the Delta was conducted by USACE.

Starry Flounder

Starry flounders are known to occur in coastal waters of the Pacific and Arctic Oceans and connecting seas. In the eastern Pacific Ocean, the southern limit of its range is the mouth of the Santa Ynez River (Santa Barbara County, California) to as far north as the Alaskan Peninsula (Reclamation 2008). In northern California, this species can occur as far east as Suisun Bay and the lower portion of the San Joaquin River in the Delta. Further, Reclamation (2008) considered starry flounder primarily a marine and estuarine species.

Starry flounder is one of the most common flatfish in the San Francisco Bay and Delta and is an important component of the nearshore (inner continental shelf and shallow sublittoral) communities (Haugen and Thomas 2001 as cited in Reclamation 2008). The distribution of starry flounders tends to shift with growth. Younger juveniles are typically found in fresh or brackish water of Suisun Bay, Suisun Marsh, and the Delta, while older juveniles range from brackish to marine waters in Suisun and San Pablo Bays. Adults tend to live in shallow marine waters within and outside San Francisco Bay before returning to estuaries to spawn (Goals Project 2000 as cited in Reclamation 2008).

Starry flounders are not targeted by central California commercial fisheries. Most individuals are taken as incidental catch by bottom trawls, gill nets, and trammel nets. Recreational catch typically occurs by hook-and-line methods from piers, boats, and shore in estuarine and rocky areas (Reclamation 2008).

Salvage of starry flounders has been documented at the SWP and CVP fish salvage facilities in the Delta. Specifically, it has been reported that fish salvage records for the Sacramento–San Joaquin Delta between 1981 and 2002 indicated average monthly salvage of 187 fish per month at CVP and 77 at SWP (Foss 2003 as cited in Reclamation 2008). Recent salvage data indicate that substantially fewer starry flounders have been salvaged.

Specifically, salvage data obtained from the CDFG Salvage FTP (file-transfer) website during 2010 showed that, from 1995 through 2006, most starry flounder salvage at both facilities occurred during May, June, and July. CDFG salvage data indicate that most starry flounder salvage during 2008 and 2009 occurred during April and May. At the time the data were retrieved, data for 2007 were unavailable. The average monthly starry flounder salvage at the SWP and CVP facilities combined from 1995 through 2006 was 51 fish during May, 79 fish during June, and 30 fish during July (CDFG, no date).

From 2008 through 2009, the average combined SWP and CVP starry flounder salvage was 10 and 12 fish during April and May, respectively. Additionally, the next-highest average salvage estimate was four fish salvaged during March, April, and August. However, the highest single month salvage estimate occurred during June 1997 with an average of 427 fish salvaged at both facilities combined. The highest single-month starry flounder salvage at either facility was 696 fish at the CVP facility during May 1997.

Because starry flounders are not listed as threatened or endangered under the Federal or state ESAs, are not listed as species of special concern by CDFW or as species of concern by the U.S. Fish and Wildlife Service (USFWS), are not targeted by commercial fisheries, do not support a large recreational fishery, and are generally salvaged in relatively low numbers, no further evaluation of starry flounders in the Delta was conducted by USACE.

1.1.5.7.2 Fish Salvage and Entrainment Loss

In order to determine whether the Folsom WCM alternatives could cause substantial changes in fish salvage and entrainment, relative to the basis of comparison, at the Skinner Fish Protection Facility (part of the SWP) and the Tracy Fish Collection Facility (part of the CVP), USACE compared mean monthly total fish export volumes from these two facilities. USACE conducted further detailed evaluation of fish salvage and entrainment loss for fish species of focused evaluation if substantial changes in exports would occur with the alternatives, relative to the basis of comparison.

1.1.5.7.3 Species-Specific Analytical Approach

DELTA SMELT

Delta smelt are endemic to the San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta) estuary (Moyle 2002). Delta smelt are primarily found downstream of Isleton on the Sacramento River, downstream of Mossdale on the San Joaquin River, and in Suisun Bay and Suisun Marsh. Delta smelt adults occur primarily in the tidally influenced low-salinity region of Suisun Bay and the freshwater regions of the Delta and the Sacramento and San Joaquin Rivers (Moyle 2002). The downstream location of the low-salinity habitat for delta smelt is typically located in Suisun Bay, extending farther to the west in response to high Delta outflows and farther to the east in response to low Delta outflows. Delta smelt have been collected in Carquinez Strait, in the Napa River, and even as far downstream as San Pablo Bay in wet years (Moyle 2002).

During September or October, adults begin upstream movement toward the freshwater sloughs and channels of the western Delta to spawn. Spawning takes place between February and July but appears to be greatest during mid-April and May (Bennett 2005). Spawning can occur in the Sacramento River as far upstream as Sacramento, the Mokelumne River system, and the Cache Slough region (Moyle 2002). Since 1982, the center of adult delta smelt abundance in the fall has been the northwestern Delta in the channel of the Sacramento River near Decker Island. In any month, two or more lifestages (adult, larvae, and juveniles) of delta smelt can be present in Suisun Bay (DWR and Reclamation 1994; Moyle 2002; Wang 1991). Delta smelt are also found seasonally in Suisun Marsh.

Eggs and Embryos

Based on reported delta smelt spawning timing, USACE evaluated the effects of the Folsom WCM alternatives on delta smelt eggs and embryos for the period of February through May (Moyle 2002; USFWS 2008).

Water Temperature

Water temperature reportedly is an important factor in the development of eggs and newly hatched delta smelt (Bennett 2005; Swanson and Cech 1995). Recent studies show that optimal delta smelt hatching success and larval survival in aquaculture occurs at 15°C to 17°C (B. Baskerville-Bridges, pers. comm, no date, as cited in Bennett 2005). Although incubation temperatures below 15°C have generally lower hatching success, water temperatures exceeding 20°C decrease the egg incubation period, mean hatch length, and time to first feeding as well as larval feeding success, resulting in higher mortality (B. Baskerville-Bridges, pers. comm., no date, as cited in Bennett 2005). Therefore, delta smelt spawning success might be variable when temperatures fall below 15°C, but can be more sharply limited by water temperatures that are above 20°C (Bennett 2005). Temperatures above 20°C during spring can also lead to higher mortality of newly spawned larvae (Bennett 2005).

Although water temperature is an important factor in the egg development and hatching success of delta smelt, the Folsom WCM alternatives have limited opportunity to affect water temperatures in the Delta. However, changes in SWP and CVP reservoir releases and operations at the South Delta pumping facilities could alter Delta inflow and outflow in the Sacramento River, which could alter residence times and water temperatures in delta smelt spawning areas.

USACE simulated monthly Sacramento River water temperatures at Freeport with the Folsom WCM alternatives and with the basis of comparison using Reclamation's average monthly water temperature model. For the purpose of conducting an impact assessment on delta smelt eggs and embryos, USACE evaluated average monthly water temperatures at Freeport for the period of February through May (Moyle 2002; USFWS 2008) with the Folsom WCM alternatives, relative to the basis of comparison. Specifically, because egg and embryo hatching success and survival decreases below 15°C (59°F) and above 20°C (68°F), exceedance probability distributions were used to calculate the proportion of time that simulated water temperatures occur within this range with the Folsom WCM alternatives, relative to the basis of comparison.

Larvae

Based on the reported onset of delta smelt spawning and embryo incubation durations, USACE evaluated the effects of the Folsom WCM alternatives on delta smelt larvae for the period of March through June (Moyle 2002; USFWS 2008).

Water Temperature

Similar to the egg and embryo lifestage, delta smelt larval survival reportedly is optimized when water temperatures are within the range of about 15°C to 20°C (Bennett 2005) and decreases when temperatures rise above 20°C (Bennett 2005; Swanson and Cech 1995). Different parts of the Delta experience different water temperature conditions, with water temperatures increasing in the central and south Delta more than they do in the northern Delta or Suisun Bay. Because the Delta has a large water surface area and covers a large geographic extent, water temperature is influenced by ambient weather and climatic conditions more than by the operation of the SWP and CVP facilities.

For this reason, it is unlikely that the Folsom WCM alternatives would influence water temperatures in the Delta substantially during the March through June analytical period. However, changes in flows caused by the Folsom WCM alternatives and operations at the South Delta pumping facilities could alter Delta inflow and outflow in the Sacramento River, which could alter Delta water residence times and temperatures, which could alter Delta water temperatures and affect delta smelt larvae.

USACE simulated monthly Sacramento River water temperatures at Freeport with the Folsom WCM alternatives and with the basis of comparison using Reclamation's average monthly water temperature model. For the purpose of conducting an impact assessment on delta smelt larvae, USACE evaluated average monthly water temperatures at Freeport for the period of March through June (Moyle 2002; USFWS 2008) with the Folsom WCM alternatives, relative to the basis of comparison. Specifically, because embryo hatching success and survival decreases below 15°C (59°F) and above 20°C (68°F), exceedance probability distributions were used to calculate the proportion of time that simulated water temperatures occur within this range with the Folsom WCM alternatives, relative to the basis of comparison.

Entrainment

Larval delta smelt are considered weak swimmers that reportedly exercise some control of their position in the Delta through vertical migrations in the water column (Bennett 2005). Their initial distribution in the Delta depends on the location of spawning. Larval delta smelt are generally observed in the Delta between March and June, with a peak during April and May (Bennett 2005; Moyle 2002). The fish screens associated with the fish salvage facilities are not effective for fish less than 20 millimeters (mm) in length, and any screened larval delta smelt likely suffer high rates of mortality during the collection, handling, transport, and release phases of the salvage process. Therefore, larval delta smelt entrained at the SWP and CVP facilities are generally presumed by USACE to be killed.

Old and Middle River (OMR) Flows

SWRCB (2010) and CDFG (2010) recommended that OMR flows be more positive than –1,500 cfs during March through June of dry and critically dry years to protect the delta smelt population from entrainment at the SWP and CVP export facilities during years with relatively low Delta outflow. Therefore, for the purpose of assessing the effects of the Folsom WCM alternatives, flows less than (i.e., more negative than) –1,500 cfs were used as an impact indicator for delta smelt. Specifically, USACE evaluated the percentage of time from March through June when OMR flows are less than –1,500 cfs during dry and critical years with the Folsom WCM alternatives, relative to the basis of comparison.

Transport Flows

Larval delta smelt might rely on flow patterns to facilitate their movement from one area to another when conditions in their existing location become unsuitable. The geographic distribution of larval and early juvenile lifestages of delta smelt reportedly appears to be influenced by freshwater inflows to the Delta during the late winter and spring.

It has been hypothesized that higher Delta inflows result in faster larval planktonic transport rates from the upstream spawning habitat to the downstream estuarine portions of the Delta. Specifically, this movement occurs from the Delta downstream to the low-salinity zone, generally located downstream of the confluence of the Sacramento and San Joaquin Rivers or in Suisun Bay (Bennett 2005).

The importance of transport flows for larval delta smelt depends on the distribution of larvae in the Delta and ambient water temperature and food supply conditions. If water temperatures are suitable and food supply is sufficient to provide adequate nourishment during the period when delta smelt first begin feeding (5 to 8 days after hatching), transport flows would likely be unimportant. However, when water temperatures become too warm (i.e., exceed 22°C [about 72°F]) or when food supplies in the area where delta smelt hatch are inadequate, transport flows likely are more important. Because food quantity is generally higher in the low-salinity zone compared to upstream areas, USACE expects that delta smelt would be in more suitable conditions if they move into this region before exogenous feeding begins.

Additionally, although there is no known positive correlation between Delta outflow and delta smelt abundance, Delta outflow does reportedly have significant positive effects on several measures of delta smelt habitat (Kimmerer et al. 2009 as cited in SWRCB 2010), and spring outflow is positively correlated with spring abundance of the calanoid copepod *Eurytemora affinis* (Kimmerer 2002a as cited in SWRCB 2010), an important delta smelt prey item. Therefore, changes in Delta outflow from the Folsom WCM alternatives could affect delta smelt.

Effects on the downstream transport of larval delta smelt were estimated by USACE by evaluating simulated average monthly Delta outflow during the latter portion (May and June) of the larval delta smelt evaluation period when water temperatures in the Central and South Delta begin to warm. Higher Delta outflow is generally assumed to be a result of greater inflow and increased movement of water through the Delta, thus resulting in increased transport and survival of larval delta smelt.

Food Availability

Production of larval and juvenile delta smelt reportedly is presently food limited in the Delta, and food limitation during these lifestages is an important contributing cause of the species' recent declines and is an impediment to its recovery (Sommer et al. 2007). Suppressed food supply during late spring and early summer (roughly May through June) might be contributing to reduced growth rates of larval and juvenile delta smelt, which have declined in connection with recent declines in the abundance of key copepod species (Bennett 2005; Sweetnam 1999).

In recent decades, significant changes have been reported in the composition of the phytoplankton community within Suisun Bay and the interior Delta (Brown 2009). Diatoms of the genus *Thalassiosira*, which are important in the diet of calanoid copepods (an important food item of delta smelt), have declined substantially, while the abundance of less beneficial phytoplankton, such as flagellates, green algae, and cyanobacteria, have increased. Smaller, slower-growing smelt reportedly are generally subject to higher rates of predation and are ultimately less fecund as adults.

USACE does not anticipate that changes in SWP and CVP operations associated with the Folsom WCM alternatives would substantially affect food availability because the alternatives would generally cause insubstantial changes in Delta outflow.

Juveniles

USACE evaluated the effects of the Folsom WCM alternatives on delta smelt juveniles for the period of May through July (Moyle 2002; USFWS 2008).

Water Temperature

Water temperature tolerance thresholds for juvenile delta smelt are not commonly reported in readily available literature. However, survival of newly spawned larvae and older delta smelt appears to decrease at temperatures over 20°C (68°F) (Bennett 2005; Swanson and Cech 1995). Additionally, delta smelt of all sizes are found in the main channels of the Delta and Suisun Marsh and the open waters of Suisun Bay, where the waters are well-oxygenated and temperatures are relatively cool, usually lower than 20°C to 22°C (68°F to about 72°F) in summer. Specifically, over 90 percent of juvenile and pre-adult delta smelt caught in the CDFG Summer Townet Survey and CDFG Fall Mid-Water Trawl Survey were collected at water temperatures lower than 20°C (68°F) (Bennett 2005). Additionally, water temperatures over about 25°C (77°F) are reportedly lethal for delta smelt and can constrain delta smelt habitat, particularly during summer and early fall (Swanson et al. 2000 as cited in Bennett 2005).

USACE simulated monthly Sacramento River water temperatures at Freeport with the Folsom WCM alternatives and with basis of comparison using Reclamation's average monthly water temperature model. For the purpose of conducting an impact assessment on delta smelt juveniles, USACE evaluated average monthly water temperatures at Freeport for the period of May through July (Moyle 2002; USFWS 2008) with the Folsom WCM alternatives, relative to the basis of comparison. Specifically, because egg and embryo hatching success and survival decreases below 15°C (59°F), USACE assumed that juvenile growth and survival would also be reduced. Additionally, because over 90 percent of juvenile delta smelt are found in CDFW surveys at water temperatures below 20°C (68°F), exceedance probability distributions were used to calculate the proportion of time that simulated water temperatures occur within this range with the Folsom WCM alternatives, relative to the basis of comparison.

Food Availability

Refer to the discussion of Food Availability for delta smelt larvae, above.

Rearing Habitat

The suitability of delta smelt rearing habitat increases when the location of the low-salinity zone during the fall is downstream of the confluence of the Sacramento and San Joaquin Rivers (SWRCB 2010). This corresponds to Delta outflow being greater than about 7,500 cfs between September and November, which would have to be achieved by releasing water from upstream reservoirs during most years (SWRCB 2008). USFWS (2008) recommended that the low-salinity zone be maintained in Suisun Bay during the fall of above-normal and wet water years. Specifically, the USFWS (2008) RPA Action 4 prescribed an X2 location of 74 river kilometers (RKm) during wet water years and an X2 location of 81 RKm during above-normal water years. (The term *X2* is used to define the distance from the Golden Gate Bridge upstream to the location in the Delta or the Sacramento River where salinity near the bottom of the water column is about 2 ppt.) This action was restricted to wetter water years to ensure that sufficient coldwater pool availability remained for steelhead and salmon during drier water years (USFWS 2008). Presumably based on USFWS (2008), CDFG (2010) recommended that X2 be maintained in between 74 RKm and 81 RKm between September and November during wet and above-normal water year types.

Because X2 is considered an indicator of delta smelt habitat availability, USACE evaluated changes in X2 with the Folsom WCM alternatives, relative to the basis of comparison. Specifically, Feyrer et al. (2010)

concluded that, as X2 increases, predicted delta smelt habitat declines, but the association is nonlinear. Information presented in Feyrer et al. (2010) indicates that changes in X2 might particularly affect delta smelt habitat suitability between about RKm 65 and RKm 80. Therefore, USACE evaluated changes in X2 of 0.5 kilometer (km) or more specifically between RKm 65 and RKm 80 with the Folsom WCM alternatives, relative to the basis of comparison.

Adults

USACE evaluated the effects of the Folsom WCM alternatives on delta smelt adults for the period of December through May (Moyle 2002; USFWS 2008).

Water Temperature

Delta smelt of all sizes are found in the main channels of the Delta and Suisun Marsh and the open waters of Suisun Bay, where the waters are well-oxygenated and temperatures are relatively cool, usually lower than 20°C to 22°C (68°F to about 72°F) in summer. Additionally, delta smelt spawning success appears to be confined to water temperatures between about 15°C to 20°C (59°F to 68°F) (Bennett 2005), and over 90 percent of delta smelt caught in the CDFG Summer Townet Survey and CDFG Fall Mid-Water Trawl Survey were collected at water temperatures lower than 20°C (68°F) (Bennett 2005). Water temperatures over about 25°C are reportedly lethal for delta smelt and can constrain delta smelt habitat, particularly during summer and early fall (Swanson et al. 2000 as cited in Bennett 2005). Sommer and Meija (2013) report that 25°C (77°F) is used as a general guideline to assess the upper limits for delta smelt habitat (Wagner et al. 2011 and Cloern et al. 2011 as cited in Sommer and Meija 2013).

USACE simulated monthly Sacramento River water temperatures at Freeport with the Folsom WCM alternatives and with the basis of comparison using Reclamation’s average monthly water temperature model. For the purpose of conducting an impact assessment on delta smelt adults, USACE evaluated average monthly water temperatures at Freeport for the period of December through May (Moyle 2002; USFWS 2008) with the Folsom WCM alternatives, relative to the basis of comparison. Because delta smelt spawning success reportedly appears to be confined to water temperatures between about 15°C to 20°C (59°F to 68°F) (Bennett 2005), exceedance probability distributions were used to calculate the proportion of time that simulated water temperatures occur within this range with the Folsom WCM alternatives, relative to the basis of comparison.

OMR Flows

In addition to analyzing adult delta smelt salvage, USACE also evaluated OMR flows. The USFWS (2008) *Biological Opinion on the Proposed Coordinated Operations of the Central Valley Project and State Water Project* provides net negative OMR flow restrictions to protect spawning adult delta smelt. The USFWS (2008) RPA Action 1 restricts OMR flow during the fall to –2,000 cfs for 14 days when a turbidity or salvage trigger has been met; both triggers have previously been correlated with the upstream movement of spawning adult delta smelt. RPA Action 2 is initiated immediately after Action 1 to protect adult delta smelt after migration, but prior to spawning, by restricting net OMR flows to between –1,250 and –5,000 cfs, based on the recommendations of the Smelt Working Group (USFWS 2008).

SWRCB (2010) and CDFG (2010) recommended that OMR flows be more positive than –5,000 cfs between December and February of all water year types to protect upstream migrating adult delta smelt.

Therefore, for the purpose of assessing the effects of the Folsom WCM alternatives, flows less than (i.e., more negative than) –5,000 cfs were used as an impact indicator for migrating adult delta smelt. Specifically, USACE evaluated the percentage of time from December through February when OMR flows would be less than –5,000 cfs with the Folsom WCM alternatives, relative to the basis of comparison.

Food Availability

Refer to the discussion of Food Availability for delta smelt larvae, above.

Longfin Smelt

Populations of longfin smelt occur along the Pacific Coast of North America, from Hinchinbrook Island, Prince William Sound, Alaska to the San Francisco estuary. Although individual longfin smelt have been caught in Monterey Bay (Moyle 2002), available data suggest that the Bay-Delta population is the southernmost, and also the largest, spawning population in California.

Longfin smelt larvae have a widespread distribution in the San Francisco estuary and are detected each year in the western Delta, Suisun Bay, and Suisun Marsh (Baxter et al. 1999). Larval longfin smelt are also frequently caught in San Pablo Bay, and they are sometimes caught in the Central and South Bays and in the eastern and southern Delta (Baxter et al. 1999). In many years, longfin smelt are caught in the Napa River estuary as well. Larval sampling in the South Bay is not extensive enough to characterize the presence or abundance (if any) of larval longfin smelt.

Longfin smelt are widespread within the Delta and, historically, they were found seasonally in all of its major open-water habitats and Suisun Marsh. Longfin smelt are believed to spawn at the transition zone between freshwater and saltwater, but exact spawning locations and conditions that support egg deposition and incubation are unknown. Spawning almost certainly occurs in the Sacramento River mainstem, probably near Rio Vista and downstream.

Eggs and Embryos

Spawning longfin smelt scatter adhesive eggs on sand substrates from December through May (CDFG 2010).

Water Temperature

Studies are not readily available that document a relationship between hatching success and developmental rate with water temperature, dissolved oxygen, or salinity for the longfin smelt population of the San Francisco estuary. The only known study on this topic (Lake Washington population) found that longfin smelt eggs hatched in about 42 days at about 45°F (Dryfoos 1965). Because the San Francisco estuary population is at the southern edge of the species' range, this population might have evolved a tolerance for warmer temperatures than have populations farther north.

Because reputable information regarding longfin smelt egg and embryo water temperature tolerances is not readily available, USACE used water temperature ranges for delta smelt eggs and embryos as impact indicators. Specifically, because delta smelt egg and embryo hatching success and survival decrease below 15°C (59°F) and above 20°C (68°F), exceedance probability distributions were used to calculate the proportion of time that simulated water temperatures occur within this range with the Folsom WCM alternatives, relative to the basis of comparison. These exceedance probability distributions were evaluated from December through April.

Larvae and Juveniles

Water Temperature

Juvenile longfin smelt reportedly attempt to migrate to avoid water temperatures greater than 20°C (68°F) (Baxter et al. 2009). The distribution of larval smelt (and the subsequent distribution of juveniles) is generally associated with the position of X2. Larval smelt are frequently caught in San Pablo Bay, and during high-outflow years they appear in the Central and South Bays (Rosenfield 2010).

Because reputable information regarding longfin smelt larvae and juvenile water temperature tolerances is not readily available, USACE used the upper limit of the water temperature range for delta smelt larvae and juveniles as an impact indicator. Specifically, because delta smelt larval survival reportedly is optimized when water temperatures are within the range of about 15°C to 20°C (59°F to 68°F), exceedance probability distributions were used to calculate the proportion of time that simulated water temperatures occur below 20°C (68°F) with the Folsom WCM alternatives, relative to the basis of comparison. These exceedance probability distributions were evaluated from December through June.

Entrainment – SWP/CVP

Young longfin smelt are thought to be influenced by tidal and net currents while migrating downstream. Larval longfin smelt, which are less than 20 mm, pass through the louvers at the SWP or CVP export facilities and are not counted or salvaged (CDFG 2010; SWRCB 2010). Entrainment of larval longfin smelt is reported to likely be greatest during March and April (The Bay Institute 2010). High export pumping rates can cause reverse OMR flows, which can passively move all age groups of longfin smelt, particularly larvae, toward the export facilities (SWRCB 2010).

Young longfin smelt are most vulnerable to entrainment during drier water years with low Delta outflow and high net negative OMR flows (CDFG 2010; SWRCB 2010). CDFG's (2009) particle-tracking modeling for larval longfin smelt predicted that larval entrainment at the SWP might be 2 percent to 10 percent during the relatively low outflow conditions that were modeled, assuming that input data approximated actual longfin smelt hatching densities and that the particle-tracking modeling with surface-oriented particles roughly represented movement of longfin smelt larvae (CDFG 2009).

However, CDFG (2009) reports that such a high percentage of larvae entrained would be expected only during periods of low downstream transport flows during which Qwest (a broad indication of the net direction and quantity of flow in the San Joaquin River at Jersey Point) was generally negative (i.e., the net direction and quantity of flow in the San Joaquin River at Jersey Point was upstream). Despite a high negative net OMR flow, particle entrainment substantially decreased when the Sacramento River flows at Rio Vista increased above about 40,000 cfs (CDFG 2009b as cited in CDFG 2010). Entrainment of particles was generally low at flows of 55,000, despite very high exports and negative OMR flows (CDFG 2009). If these high-flow conditions were to occur throughout the primary hatching period of January through March, the expected percentage of larvae entrained at the SWP would be less than 1 percent, given the assumed relative San Joaquin River spawning densities (CDFG 2009).

CDFG (2009) reportedly identified a significant relationship between spring (April through June) net negative OMR flows and total SWP and CVP juvenile longfin smelt salvage. Juvenile longfin smelt salvage reportedly increased rapidly as OMR flows became more negative than –2,000 cfs (CDFG 2009). However, as winter and spring, or only spring, outflows increased (shifting X2 downstream), the salvage of juvenile longfin smelt reportedly decreased significantly. Grimaldo (no date, as cited in CDFG 2009) found that the best models explaining inter-annual winter (December through March) salvage of longfin smelt included combining Old and Middle River flows. Plotting combined salvage on average December-through-March OMR flows indicates rapidly increasing salvage of OMR flows approaching, and more negative than, –5000 cfs (CDFG 2009).

CDFG (2009) suggests that the pelagic nature of larval and juvenile longfin smelt and their similar responses to outflows and OMR flows indicate that similar actions would benefit both lifestages, including periodic pulse flows through the central Delta during January through June to transport larvae and juveniles away from the region of entrainment risk, and less-negative OMR flows.

CDFG (2010) recommends the following OMR flow criteria to benefit longfin smelt:

- At no time should OMR flows be more negative than –5,000 cfs during December through March.
- During April and May of dry and critical water years, OMR flows should be more positive than –1,500 cfs when the longfin smelt Fall Midwinter Trawl Survey (FMWT) index is more than 500, and should be positive when the longfin smelt FMWT index is less than 500.

Therefore, USACE evaluated changes in the frequency with which mean monthly OMR flows are greater than –5,000 cfs during December through March with the Folsom WCM alternatives, relative to the basis of comparison. In addition, changes in the frequency with which mean monthly OMR flows are greater than –1,500 cfs and greater than 0 cfs were evaluated during April and May of dry and critical water years with the Folsom WCM alternatives, relative to the basis of comparison.

Transport Flows

Longfin smelt abundance has been reported to be positively correlated with Delta outflow (as measured by X2 position) (Kimmerer et al. 2009; Rosenfeld and Baxter 2007; Sommer et al. 2007). Kimmerer et al. (2009) related the log of the longfin smelt annual abundance index for each of three surveys (i.e., Fall Midwater Trawl, Bay Midwater Trawl, and Bay Otter Trawl) to X2 position averaged over several spring months when longfin smelt are most vulnerable to freshwater flow effects. Increased habitat quantity associated with increased Delta outflow might contribute to an increase in longfin smelt abundance; however, the primary mechanism for the positive relationship between longfin smelt abundance and Delta outflow is not well understood (Kimmerer et al. 2009). Kimmerer et al. (2009) hypothesize that it might be related to the shift by young longfin smelt toward greater depth at higher salinity, possibly implying a retention mechanism.

The effects of transport flows (i.e., Delta outflow) on larval longfin smelt were estimated by USACE by evaluating changes in simulated X2. CDFG (2010) recommends that X2 be maintained between 64 km and 75 km during January through June in order to provide longfin smelt with low-salinity habitat within or downstream of Suisun Bay.

USACE evaluated simulated mean monthly X2 location exceedance probability distributions during January through June to examine the change in frequency with which mean monthly X2 would be maintained at or downstream of 75 RKm during January through June with the Folsom WCM alternatives, relative to the basis of comparison. Exceedance probability distributions were evaluated over the entire simulation period and specifically over the lowest 25 percent of the cumulative probability distribution (i.e., low-flow conditions).

Although CDFG (2009b as cited in CDFG 2010) describes the longfin smelt larvae evaluation period as December through May, CDFG (2010) provides X2 recommendations during January through June to protect multiple lifestages of longfin smelt including larvae, juveniles, and adults.

Food Availability

Food limitation for longfin smelt in the estuary is reportedly an important contributing cause of their recent declines and also is thought of as a substantial impediment to their recovery (Sommer et al. 2007). Rosenfield and Baxter (2007) observed that the response of both age-1 and age-2 longfin smelt to Delta outflow was muted after the Corbula clam introduction. Orsi and Mecum (1996) noted that the primary prey species for juvenile longfin smelt (*Neomysis mercedis*) had been similarly affected by the clam introduction as a result of the clam’s grazing on phytoplankton and copepods. Because changes in Delta outflow with the Folsom WCM alternatives would be generally insubstantial, USACE does not anticipate that changes in SWP and CVP operations with the Folsom WCM alternatives, relative to the basis of comparison, would substantially affect food availability.

Adults

Based on the identified presence of newly hatched larvae and an assumed 25-day incubation period, CDFG (2009b as cited in CDFG 2010) estimated that longfin smelt likely spawn during November through April, with a peak in January.

Water Temperature

Longfin smelt spawning is believed to occur in the Sacramento River mainstem near Rio Vista and downstream (The Bay Institute 2007). As water temperatures drop below 18°C (about 64°F) during the fall, maturing adult longfin smelt migrate from the lower estuary to the Low Salinity Zone and congregate prior to spawning (CDFG 2009). Spawning reportedly starts when water temperatures drop below 16°C (about 61°F) and becomes consistent when water temperatures drop below 13°C (about 55°F) (CDFG, no date, as cited in CDFG 2009). Moyle (2002) states that longfin smelt inhabiting the Bay-Delta estuary are thought to spawn in freshwater or slightly brackish water over sandy or gravel substrates at temperatures ranging from 7°C to 14.5°C (about 45°F to 58°F).

Movement patterns based on catches in CDFW fishery sampling suggest that longfin smelt actively avoid water temperatures greater than 22°C (about 72°F). In addition, sampling data suggest that longfin smelt do not occupy areas with temperatures greater than 22°C (about 72°F) in combination with salinities greater than 26 ppt. Therefore, USACE used water temperature exceedance probability distributions to calculate the proportion of time that simulated water temperatures exceed 72°F with the Folsom WCM alternatives, relative to the basis of comparison, during November through April.

Entrainment

As discussed above in this section, CDFG (2010) recommended that OMR flows be no more negative than –5,000 cfs at any time during January through March in order to protect adult and juvenile longfin smelt from being entrained. The frequency with which OMR flows are –5,000 cfs or higher during December through March were compared by USACE with the Folsom WCM alternatives, relative to the basis of comparison.

Food Availability

Adult longfin smelt prey primarily on the small shrimp *Neomysis mercedis* (Moyle 2002). As discussed above in this section, food availability might be a limiting factor for the longfin smelt population in the estuary. However, because changes in Delta outflow with the Folsom WCM alternatives would be generally insubstantial, USACE does not anticipate that changes in water operations with the Folsom WCM alternatives, relative to the basis of comparison, would substantially affect food availability.

WINTER-RUN CHINOOK SALMON

Fry and Juveniles

Rearing of juvenile winter-run Chinook salmon in the Delta reportedly occurs primarily from November through early May (NMFS 2014). Therefore, USACE evaluated winter-run Chinook salmon in the Delta during November through May.

Delta Emigration and Rearing Habitat

The assessment of changes in winter-run Chinook salmon rearing habitat in the Delta includes USACE's evaluation of changes in seasonal flows in the lower Sacramento River (at Rio Vista), Delta outflow, and OMR flows.

USACE compared long-term average flows, average flows by water year type, and monthly exceedance probability distributions (November through May) of simulated Sacramento River flow at Rio Vista with the Folsom WCM alternatives, relative to the basis of comparison.

Hydrodynamic conditions in the interior Delta likely affect the quality and availability of juvenile salmonid rearing habitat. Two general indicators of habitat conditions within the interior Delta were used to assess changes in habitat conditions for juvenile salmonid rearing: Delta outflow and OMR reverse flows. Decreased flows through the Delta might decrease the migration rate of juvenile salmonids moving downstream, thereby increasing their exposure time to unsuitable water temperatures, entrainment into the interior Delta, entrainment in water diversions, contaminants, and predation (CDFG 2010).

USACE evaluated changes in CalSim II–simulated mean monthly Delta outflow during November through May with the Folsom WCM alternatives, relative to the basis of comparison. USACE assumes that an increase in Delta outflow might contribute to improved rearing conditions and survival of juvenile

Chinook salmon in the Delta and Suisun Bay. Monthly probability-of-exceedance distributions of Delta outflow were compared with the Folsom WCM alternatives, relative to the basis of comparison.

The behavioral response and effects of reducing OMR reverse flows on juvenile winter-run Chinook salmon migration, rearing, survival, and growth are not clearly known. However, for this analysis, USACE assumes that a reduction in OMR reverse flows might contribute to improved rearing and emigration conditions for juvenile winter-run Chinook salmon in the interior Delta. Specifically, it is likely that recommendations to reduce the effects of negative and low OMR flows on San Joaquin River Chinook salmon also would reduce effects on winter-run Chinook salmon.

Specifically, to reduce the risk of juvenile Chinook salmon entrainment and straying into the central Delta, CDFG (2010) recommends that OMR flows be greater than 2,500 cfs during November through June. However, because there is no specific OMR flow recommendation for winter-run Chinook salmon, USACE compared probability-of-exceedance distributions of CalSim II–simulated mean monthly OMR reverse flows with the Folsom WCM alternatives and evaluated them relative to the basis of comparison. Simulated mean monthly changes in the magnitude of OMR reverse flows were compared with the Folsom WCM alternatives, relative to the basis of comparison, during November through May.

Adults

Seasonal Flows – Attraction

Adult winter-run Chinook salmon migrate upstream through the Delta on spawning migrations. The Folsom WCM alternatives might change the proportion of water reaching the Delta that originates in the Sacramento River, relative to the San Joaquin River watershed. Quantitative information on the relationship between Sacramento and San Joaquin river flow and adult steelhead attraction and upstream migration is not available. Therefore, in the absence of quantitative relationships for adult winter-run Chinook salmon, USACE conducted a qualitative assessment based on the magnitude of flow changes estimated to occur in the lower Sacramento River during the migration period.

SPRING-RUN CHINOOK SALMON

Fry and Juveniles

Most juvenile spring-run Chinook salmon emigrate through the Delta during November to early May (NMFS 2009), but juveniles have reportedly been found at Chipps Island primarily during December through June. Therefore, USACE evaluated juvenile spring-run Chinook salmon in the Delta during November through June.

Delta Emigration and Rearing Habitat

The assessment of changes in spring-run Chinook salmon rearing habitat in the Delta includes the same evaluations as described for winter-run Chinook salmon, including changes in seasonal flows in the lower Sacramento River (at Rio Vista), Delta outflow, and OMR flows.

USACE compared long-term average flows, average flows by water year type, and monthly exceedance probability distributions (November through June) of simulated Sacramento River flow at Rio Vista with the Folsom WCM alternatives, relative to the basis of comparison.

Similar to the methods described for winter-run Chinook salmon, USACE evaluated changes in CalSim II–simulated mean monthly Delta outflow during November through June with the Folsom WCM alternatives, relative to the basis of comparison. Simulated mean monthly changes in the magnitude of OMR reverse flows also were compared with the Folsom WCM alternatives, relative to the basis of comparison, during November through June.

Adults

Seasonal Flows – Attraction

Adult spring-run Chinook salmon migrate upstream through the Delta on spawning migrations. As described for winter-run Chinook salmon, USACE conducted a qualitative assessment regarding the effects of the Folsom WCM alternatives on adult attraction flows for spring-run Chinook salmon based on the magnitude of flow changes estimated to occur in the lower Sacramento River during the upstream migration period.

FALL AND LATE FALL-RUN CHINOOK SALMON

Fry and Juveniles

In general, fall and late fall-run Chinook salmon juveniles occur primarily in the Delta during November through June (ICF International 2013). Therefore, USACE evaluated juvenile fall-run and late fall-run Chinook salmon in the Delta during November through June.

Delta Emigration and Rearing Habitat

The assessment of changes in fall- and late fall-run Chinook salmon rearing habitat in the Delta includes the same evaluations as for winter-run Chinook salmon, including changes in seasonal flows in the lower Sacramento River (at Rio Vista), Delta outflow, and OMR flows.

USACE compared long-term average flows, average flows by water year type, and monthly exceedance probability distributions (November through June) of simulated Sacramento River flow at Rio Vista with the Folsom WCM alternatives, relative to the basis of comparison.

Similar to the methods described for winter-run Chinook salmon, USACE evaluated changes in CalSim II–simulated mean monthly Delta outflow during November through June with the Folsom WCM alternatives, relative to the basis of comparison. Simulated mean monthly changes in the magnitude of OMR reverse flows also were compared with the Folsom WCM alternatives, relative to the basis of comparison, during November through June.

Adults (Sacramento River Basin)

Seasonal Flows – Attraction

Adult fall- and late fall-run Chinook salmon migrate upstream through the Delta on spawning migrations. As described for winter-run Chinook salmon, USACE conducted a qualitative assessment regarding the effects of the Folsom WCM alternatives on adult attraction flows for fall and late fall-run Chinook salmon to the Sacramento River based on the magnitude of flow changes estimated to occur in the lower Sacramento River during the upstream migration period.

Adults (San Joaquin River Basin)

OMR Flows

USACE evaluated simulated mean monthly changes in the magnitude of OMR reverse flows with the Folsom WCM alternatives, relative to the basis of comparison, during December through February. To prevent straying of adult San Joaquin basin Chinook salmon, CDFG (2010) recommends that OMR flows be greater than –5,000 cfs during December through February. USACE evaluated exceedance probability distributions to identify changes in OMR flows with the Folsom WCM alternatives. Specifically, USACE evaluated the percentage of time from December through February when OMR flows would be less than –5,000 cfs with the Folsom WCM alternatives, relative to the basis of comparison.

STEELHEAD

Juveniles

Steelhead outmigration and rearing in the Delta were evaluated by USACE during October through July (NMFS 2009).

Delta Emigration and Rearing Habitat

The assessment of changes in steelhead rearing habitat in the Delta includes evaluation of changes in seasonal flows in the lower Sacramento River (at Rio Vista), Delta outflow, and OMR flows.

USACE compared long-term average flows, average flows by water year type, and monthly exceedance probability distributions (October through July) of simulated Sacramento River flow at Rio Vista with the Folsom WCM alternatives, relative to the basis of comparison.

Hydrodynamic conditions in the interior Delta likely affect the quality and availability of juvenile salmonid rearing habitat. Two general indicators of habitat conditions within the interior Delta were used to assess changes in habitat conditions for juvenile salmonid rearing: Delta outflow and OMR reverse flows. Decreased flows through the Delta might decrease the migration rate of juvenile salmonids moving downstream, thereby increasing their exposure time to unsuitable water temperatures, entrainment into the interior Delta, entrainment in water diversions, contaminants, and predation (CDFG 2010).

USACE evaluated changes in CalSim II–simulated mean monthly Delta outflow during October through July with the Folsom WCM alternatives, relative to the basis of comparison. Although there are no known statistical relationships between Delta outflow and juvenile steelhead survival or adult abundance, USACE assumes that an increase in Delta outflow might contribute to improved rearing conditions and survival of juvenile steelhead in the Delta and Suisun Bay. Monthly probability-of-exceedance distributions of Delta outflow were compared with the Folsom WCM alternatives, relative to the basis of comparison.

The behavioral response and effects of reducing OMR reverse flows on juvenile steelhead migration, rearing, survival, and growth are not clearly known. However, for this analysis, USACE assumes that a reduction in OMR reverse flows might contribute to improved rearing and emigration conditions for juvenile steelhead in the interior Delta. Specifically, it is likely that recommendations to reduce the effects of negative and low OMR flows on Chinook salmon also would reduce effects on Central Valley steelhead.

Specifically, to reduce the risk of juvenile Chinook salmon entrainment and straying into the central Delta, CDFG (2010) recommends that OMR flows be greater than 2,500 cfs during November through June. However, because there is no specific OMR flow recommendation for steelhead, USACE compared probability-of-exceedance distributions of CalSim II–simulated mean monthly OMR reverse flows with the Folsom WCM alternatives and evaluated them relative to the basis of comparison. Simulated mean monthly changes in the magnitude of OMR reverse flows were compared with the Folsom WCM alternatives, relative to the basis of comparison, during October through July.

Adults

Seasonal Flows – Attraction

Adult steelhead migrate upstream through the Delta on spawning migrations. The Folsom WCM alternatives might change the proportion of water reaching the Delta that originates in the Sacramento River, relative to the San Joaquin River watershed. Quantitative information on the relationship between Sacramento and San Joaquin river flow and adult steelhead attraction and upstream migration is not available. Therefore, in the absence of quantitative relationships for adult steelhead, USACE conducted a qualitative assessment based on the magnitude of flow changes estimated to occur in the lower Sacramento River during the migration period.

AMERICAN SHAD

Although salinity is an important habitat component for many species within the Delta, changes in salinity that could occur with the Folsom WCM alternatives likely would not adversely affect American shad. Specifically, adult American shad enter the Delta from San Francisco Bay via Suisun and Honker Bays on spawning migrations and return to the ocean after spawning in freshwater. During this portion of their lifecycle, individual fish can tolerate a wide range of salinities. Therefore, changes in Delta salinity with Folsom WCM alternatives likely would not adversely affect adult American shad.

Juvenile American shad are reported to sometimes rear for extended periods in the Delta. However, little information exists regarding the distribution of juvenile American shad in the Delta throughout the extended rearing duration. Curing their extended Delta rearing period, juvenile American shad grow and endure osmoregulatory and salinity tolerance changes that allow them to select appropriate habitat. For this reason, it is not likely that salinity is a limiting habitat component for juvenile American shad. Therefore, changes in salinity with the Folsom WCM alternatives are not likely to adversely affect rearing juvenile shad habitat availability and are not further evaluated.

Eggs and Larvae

X2

CDFG (2010) recommended an X2 location from RKm 75 to RKm 64 (approximately equivalent to a net Delta outflow of 11,400 to 29,200 cfs) from April through June of all water years to support American shad egg and larval survival. Because the Folsom WCM alternatives have little ability to limit flows at the high end of the recommended range (i.e., Delta outflow could be above 29,200 cfs regardless of project operations), USACE evaluated the effects of the Folsom WCM alternatives on American shad by evaluating the frequency with which the average monthly X2 position would be maintained at or downstream of RKm 75 during April through June with the Folsom WCM alternatives, relative to the basis of comparison.

STRIPED BASS

Most larvae and fry are transported from the spawning areas to the Delta within days of spawning. Mortality due to entrainment and reduced rearing habitat availability has been associated with SWP and CVP project-related effects on Delta hydrodynamics (Sommer et al. 2005).

Eggs and Larvae

X2

USACE compared changes in the upstream or downstream movement of simulated mean monthly X2 location year-round with the Folsom WCM alternatives, relative to the basis of comparison. Simulated changes in X2 were used to qualitatively estimate the effects on striped bass survival and distribution within the Delta with the Folsom WCM alternatives, relative to the basis of comparison.

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Appendix 7C

1.1 Water Temperature Index Value Selection Rationale and Justification

1.1.1 Introduction

Water temperature is one of the most important environmental parameters affecting the distribution, growth, and survival of fish populations. Lethal water temperatures control fish populations by directly reducing population size, while sub-lethal water temperatures affect fish populations via indirect physiologic influences. Water temperatures can particularly regulate fish populations that are near their latitudinal distributional extremes, because environmental conditions (e.g., water temperature) at distributional extremes also can be near the boundaries of conditions that allow the populations to persist. For example, California's Central Valley is at the southern limit of Chinook salmon distribution, and studies have demonstrated that direct effects of high water temperatures are an important source of juvenile Chinook salmon mortality in the Central Valley (Baker et al. 1995).

Technical evaluation guidelines have been developed to assess the effects of water diversion and water-use projects in a consistent and effective manner. In order to successfully evaluate the effects of water temperature regimes on a given lifestage, it is necessary to gain a broad understanding of how fish species respond to water temperature regimes. This appendix presents the results of a literature review that was conducted by the U.S. Army Corps of Engineers (USACE) to: (1) interpret the available literature on the effects of water temperature on the various lifestages of fish species of focused evaluation, (2) consider the effects of short-term and long-term exposure to constant or fluctuating temperatures, and (3) establish biologically defensible water temperature index (WTI) values to be used as guidelines for assessing the effects of the Folsom Water Control Manual (WCM) Project alternatives.

1.1.2 Methods

To the extent that literature describing thermal tolerances for each species was available, USACE established WTI values from a comprehensive literature review. The types of literature examined included scientific journals, master's theses and PhD dissertations, literature reviews, and agency publications. With respect to water temperature, the primary concern in the Central Valley relates to water temperatures that can exceed upper water temperature tolerance limits rather than lower limits; therefore, USACE established index values only for water temperatures at and above the warmer tolerance or optimal zone for each species. For non-salmonid species, USACE assumes that sufficient warmwater habitat is available in Central Valley waterbodies such that effects resulting from exposure to cold water likely would not occur.

To the extent that information was available, USACE determined WTI values by emphasizing the results of laboratory experiments that examined how water temperature affects fish in Central Valley watersheds being evaluated as well as by considering field studies documenting habitat use and regulatory documents such as biological opinions.

When local studies were not available, USACE used studies on fish from outside the Central Valley to establish index values. To avoid unwarranted specificity, only whole integers were selected as index values; thus, support for index values was, in some cases, partially derived from literature supporting a water temperature that varied from the resulting index value by several tenths of a degree. For example, Combs and Burrows (1957) reported that constant incubation temperatures between 42.5 degrees Fahrenheit (°F) and 57.5°F resulted in normal development of Chinook salmon eggs, and their report was referenced as support for a WTI value of 58°F. Rounding for the purpose of selecting index values is appropriate because the daily variation of experimental treatment temperatures is often high. For example, temperature treatments in Marine (1997) consisted of control (55.4°F to 60.8°F), intermediate (62.6°F to 68.0°F), and extreme (69.8°F to 75.2°F) treatments that varied daily by whole degrees.

USACE's inspection of the available literature on the effects of water temperature on fish species of focused evaluation revealed the need to interpret each document with caution and to verify the appropriateness of statements supported by references to other literature. Often source studies are cited incorrectly and sometimes repeatedly. For example, Hinze (1959) actually examines the effects of water temperature on incubating Chinook salmon eggs, yet Hinze (1959) is cited in Boles et al. (1988); Marine (1992); and NMFS (1997) in statements regarding the effects of water temperature on holding Chinook salmon adults. Boles et al. (1988) and Marine (1992) were then further cited by McCullough et al. (2001) in support of a section detailing how water temperature affects the viability of gametes developing in adults.

Most of the literature on water temperature requirements refers to "stressful," "tolerable," "preferred," or "optimal" water temperatures or water temperature ranges. Spence et al. (1996) defined the tolerable water temperature range as the range at which fish can survive indefinitely. Thermal stress to fish is any water temperature change that alters the biological functions of the fish and that decreases the probability of survival (McCullough 1999). Optimal water temperatures provide for feeding activity, normal physiological response, and behavior void of thermal stress symptoms (McCullough 1999). Preferred water temperature ranges are those that are most frequently selected by fish when they are allowed to freely choose locations along a thermal gradient (McCullough 1999).

For Chinook salmon and steelhead, USACE took WTI values from Bratovich et al. (2012). 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 describe development of the upper optimum (UO) WTI values and upper tolerance (UT) WTI values. Bratovich et al. (2012) is the most recent, comprehensive literature review available and particularly emphasizes the Central Valley. Therefore, the lifestage-specific UO and UT WTI values identified by Bratovich et al. (2012) were used by USACE for all runs of Chinook salmon and steelhead in this evaluation (Table 1).

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 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). Refer to Appendix A in Bratovich et al. (2012) for a detailed literature review of Chinook salmon and steelhead water temperature preferences and tolerances.

Table 1. 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 & outmigration	61°F	65°F	Juv. rearing & outmigration	65°F	68°F
Smolt emigration	63°F	68°F	Smolt emigration	52°F	55°F

For the remaining fish species of focused evaluation, USACE developed lifestage-specific water temperature impact indicator values or ranges to be used as evaluation guidelines, the basis of which are described in this appendix. For some species and lifestages, water temperature ranges were developed instead of individual values when water temperature suitabilities or tolerances were reported as a range, and not in terms of particular values.

The WTI values and ranges are not meant to serve as significance thresholds, but instead serve as a mechanism by which to compare the Folsom WCM alternatives to a baseline condition. Differences in the frequency of exceeding a particular WTI value between a Folsom WCM alternative and the baseline condition do not necessarily constitute an impact. Impact determinations will be based on USACE's consideration of all evaluated impact indicators for all lifestages for a particular species.

1.1.3 Results

1.1.3.1 North American Green Sturgeon

1.1.3.1.1 Adult Immigration and Holding

The habitat requirements of North American green sturgeon are not well known. In the Klamath River, the water temperature tolerance of immigrating adult green sturgeon reportedly ranges from 44.4°F to 60.8°F. Reportedly, no green sturgeon were found in areas of the river outside this surface water temperature range (USFWS 1995). Additionally, water temperatures ranging from 61°F to 66°F are reportedly tolerable (Mayfield and Cech 2004 and NMFS 2006, both as cited in NMFS 2009). Therefore, a WTI value of 61°F is used to evaluate green sturgeon adult immigration and holding in this evaluation.

1.1.3.1.2 Spawning and Embryo Incubation

Green sturgeon reportedly spawn in water temperatures ranging from about 50°F to 70°F (CDFG 2001). Suitable water temperatures for green sturgeon during spawning and egg incubation have been reported to range between 46°F to 57°F (74 Federal Register 52300), while water temperatures ranging from 57°F to 65°F are reported as tolerable (Mayfield and Cech 2004 and NMFS 2006, both as cited in NMFS 2009). Similarly, suitable water temperatures for egg incubation in green sturgeon were reported by Van Eenennaam et al. (2005) to be between 52°F and 63°F, with the upper limit of optimal water temperatures ranging from 63°F to 64°F. Further, Van Eenennaam et al. (2005) reported that water temperatures greater than about 73°F led to complete mortality of embryos prior to hatching.

Water temperatures not exceeding 62.6°F have been reported to permit normal North American green sturgeon larval development (Van Eenennaam et al. 2005). Werner et al. (2007) suggest that temperatures remain below 68°F for larval development. Temperatures of about 59°F are believed to be optimal for larval growth, whereas temperatures below about 52°F or above about 66°F might be detrimental for growth (Cech et al. 2000). Water temperatures above 68°F are reportedly lethal to North American green sturgeon embryos (Beamesderfer and Webb 2002; Cech et al. 2000).

In addition to available literature evaluating empirical studies, USACE reviewed the Sacramento River Ecological Flow Tool (SacEFT) Record of Design (v.2.00) (ESSA Technologies, Ltd. 2011) to identify water temperature thresholds used by the California Department of Water Resources (DWR), The Nature Conservancy, and others for evaluating effects on green sturgeon eggs in the Sacramento River. The SacEFT Record of Design states, “The best information we were able to use is based on in vitro studies (Cech et al. 2000) of larval development, which we adapted to create a quasi-mortality model in which larvae experience no mortality at temperatures below 17°C [degrees Celsius] and complete mortality at temperatures at and above 20°C.” These temperatures correspond to 62.6°F and 68°F, respectively.

Because available literature is not entirely in agreement regarding appropriate thermal tolerances for North American green sturgeon, USACE used a bulk-of-evidence approach to identify an appropriate index value to be used for evaluating water temperature effects on green sturgeon spawning and embryo incubation. Based on the above literature, USACE selected a WTI value of 63°F.

1.1.3.1.3 Juvenile Rearing and Downstream Movement

The National Marine Fisheries Service (NMFS) (74 Federal Register 52300) reports optimal water temperatures for the development of green sturgeon egg, larval, and juvenile lifestages ranging between 52°F and 66°F. Growth of juvenile green sturgeon is reportedly optimal at 59°F and is reduced at both 51.8°F and 66.2°F (Cech et al. 2000). According to NMFS (74 Federal Register 52300), suitable water temperatures for juvenile green sturgeon should be below about 75°F. At temperatures above about 75°F, juvenile green sturgeon exhibit decreased swimming performance (Mayfield and Cech 2004 as cited in NMFS 2009) and increased cellular stress (Allen et al. 2006).

Optimum water temperatures for green sturgeon larvae reportedly are less than about 63°F (Israel and Klimley 2008). Reproductive success and young-of-the-year recruitment might be negatively affected when larvae are exposed to water temperatures greater than 68°F (Israel and Klimley 2008). Optimal juvenile green sturgeon water temperatures reportedly range from 59°F to 66°F (Israel and Klimley

2008). Because several sources report that optimal green sturgeon larvae and juvenile growth occurs below about 66°F, it was selected by USACE as a WTI value for evaluating green sturgeon juvenile rearing and downstream movement.

1.1.3.2 White Sturgeon

1.1.3.2.1 Adult Immigration and Holding

Similar to North American green sturgeon, little detailed information exists regarding thermal tolerances in white sturgeon. In fact, very little is known about adult white sturgeon habitat in the Sacramento River or in the San Francisco Bay/Sacramento–San Joaquin River Delta (Bay-Delta), though they are present throughout the river and delta during the spring, fall, and winter (Gleason et al. 2008 as cited in Israel et al. 2011). However, recent publication of the Delta Regional Ecosystem Regional Implementation Plan (DRERIP) conceptual model for white sturgeon (www.dfg.ca.gov/ERP/conceptual_models.asp) indicated that, although adult white sturgeon begin to show signs of stress at temperatures above 68°F (20°C) (Cech et al. 1984 and Geist et al. 2005, both as cited in Israel et al. 2011), the upper limit of suitable water temperatures for adult white sturgeon is reportedly 25°C (77°F) (Israel et al. 2011). Therefore, USACE used a WTI value of 77°F for evaluating white sturgeon adult immigration and holding.

1.1.3.2.2 Spawning and Embryo Incubation

White sturgeon spawning occurs from mid-February to late May when water temperatures are between 46°F and 72°F, with peak spawning activity occurring during March and April (Kohlhorst 1976 and Kohlhorst and Cech 2001, both as cited in Israel et al. 2011).

Incubation length and success in white sturgeon is largely temperature-dependent. Field studies have found eggs when water temperatures appear optimal for egg incubation on the Sacramento River (14°C to 16°C) (Kohlhorst 1976 as cited in Israel et al. 2011). Additionally, white sturgeon egg incubation occurs between 11°C and 20°C (about 52°F to 68°F), with optimal egg incubation occurring at water temperatures ranging from 14°C to 16°C (about 57°F to 61°F) (Wang et al. 1987 as cited in Israel et al. 2011, Table 1). Incubation water temperatures above 17°C (about 63°F) reportedly result in premature hatching and higher mortality (Wang et al. 1985, 1987, both as cited in Israel et al. 2011). Wang (1985 as cited in Israel et al. 2011) showed that the size of a white sturgeon larva was inversely related to water temperature during egg incubation in experiments. In experiments, incubation temperatures above 17°C resulted in premature hatching with higher mortality and no hatching at temperatures above 20°C (Wang et al. 1985, 1987, both as cited in Israel et al. 2011).

Because the upper end of optimal embryo incubation for white sturgeon is reported to be 61°F (Wang et al. 1987 as cited in Israel et al. 2011), USACE selected a WTI value of 61°F for this lifestage.

1.1.3.2.3 Juvenile Rearing and Downstream Movement

Cech et al. (1984 as cited in Israel et al. 2011) observed slow growth and some mortality in juvenile white sturgeon kept in water temperatures above 20°C (68°F), while larger juveniles were reported to show signs of stress above 19°C (about 66°F) (Geist et al. 2005 as cited in Israel et al. 2011). Additionally, in experiments reported by Cech et al. (1984 as cited in Israel et al. 2011), young juvenile white sturgeon (0.5 gram to 0.6 gram) grew significantly greater at 20°C than at 15°C. However, no growth difference was observed between 20°C and 25°C, though increased temperatures led to increased activity in juvenile white sturgeon (Cech et al. 1984 as cited in Israel et al. 2011). Temperatures higher than 25°C are not tolerated by juvenile white sturgeon, and stress is observed near 20°C (Cech et al. 1984 and Geist et al. 2005, both as cited in Israel et al. 2011).

Because stress is observed in white sturgeon juveniles above about 66°F (19°C), USACE selected this temperature as a WTI value for evaluation.

1.1.3.3 River Lamprey and Pacific Lamprey

Generally, lamprey biology is less well studied and understood than that of other fish in the Central Valley. However, where literature is available and specifically is available for California streams and rivers, the majority of information available is for Pacific lamprey. Specifically, Moyle (2002) stated that the biology of river lamprey has not been studied in California. However, Pacific and river lamprey use similar habitats for spawning and ammocoete rearing in the Sacramento River system and have similar lifestage periodicities for spawning and ammocoete rearing, which indicates that their habitat requirements are likely similar. Therefore, for the purpose of evaluating water temperatures for Pacific lamprey and river lamprey, USACE used the same WTI values.

1.1.3.3.1 Adult Immigration

Little information is available regarding water temperature preferences and tolerances of adult lampreys. However, reported water temperature extremes in which migrating adult Pacific lampreys can survive range from 41.9°F to 59.9°F, as observed under laboratory conditions (Close 2001). Therefore, USACE used a range of 42°F to 60°F to evaluate river and Pacific lamprey adult immigration.

1.1.3.3.2 Spawning and Embryo Incubation

River lampreys are reported to spawn at water temperatures ranging from 55.4°F to 56.3°F (Wang 1986). However, it is not likely that the species requires a water temperature range of 1.1°F. Therefore, USACE did not rely on these water temperatures to develop WTI values for evaluation.

Pacific lampreys reportedly spawn where water temperatures are typically 12°C to 18°C (53.6°F to 64.4°F) (Moyle 2002). Additionally, Moyle (2002) reported that Pacific lamprey embryos hatch in about 19 days at 15°C (59°F). Pacific lamprey laboratory studies and analyses in the Columbia River basin suggest that consistently high survival and low occurrence of embryonic developmental abnormalities occur as water temperatures increase from 10°C to 18°C (50°F to 64.4°F), with a significant decrease in survival and increase in developmental abnormalities at 22°C (about 72°F) (Meeuwig et al. 2002; Meeuwig et al. 2005).

Therefore, USACE used a range of 50°F to 64°F to evaluate river and Pacific lamprey spawning and embryo incubation.

1.1.3.3.3 Ammocoete Rearing and Downstream Movement

Meeuwig et al. (2002) and Meeuwig et al. (2005) found a significant decrease in survival and increase in developmental abnormalities of Pacific lamprey larvae at 22°C (71.6°F) in a laboratory setting.

Laboratory studies and analyses suggest that consistently high survival and low occurrence of embryonic developmental abnormalities occur in Pacific lamprey and western brook lamprey at water temperatures ranging from 50°F to 64.4°F, with a significant decrease in survival and increase in developmental abnormalities at 71.6°F (Meeuwig et al. 2002; Meeuwig et al. 2005), which could indicate similar water temperature effects on river lamprey. Meeuwig et al. (2002) and Meeuwig et al. (2005) identified 64.4°F as the most beneficial temperature for survival of Pacific and western brook lampreys, which is similar to the thermal optima reported for survival of sea lampreys (Meeuwig et al. 2002; Meeuwig et. al 2005).

Moyle et al. (1995) indicate that river lamprey eggs and ammocoetes might require water temperatures that do not exceed 25°C (77°F). However, the effect of temperatures exceeding this threshold on river lamprey eggs is unknown. The effects on this species are likely similar to and, for the purpose of this evaluation, are assumed to be similar to those for Pacific lamprey when water temperatures exceed 22°C (71.6°F) as described by Meeuwig et al. (2002) and Meeuwig et al. (2005).

Therefore, in consideration of available information, USACE used a WTI value of 72°F to evaluate river and Pacific lamprey ammocoete rearing and downstream movement.

1.1.3.4 Hardhead

1.1.3.4.1 Spawning

Little is known about the lifestage-specific water temperature requirements of hardhead. Furthermore, hardhead spawning has not been documented, and documentation regarding water temperatures associated with hardhead spawning is not widely available. However, Wang (1986) reported that temperatures for hardhead spawning range from 59°F to 64.4°F. Therefore, USACE used a range of 59°F to 64°F to evaluate hardhead spawning.

1.1.3.4.2 Adults and Other Lifestages

Using samples of hardheads taken at 10 locations within water bodies of the San Joaquin drainage, USACE determined that adults prefer water temperatures of 68°F (Brown and Moyle 1993 as cited in Moyle 2002). Hardheads are reportedly found in streams with summer water temperatures above 20°C (68°F) (Moyle 2002), while water temperatures ranging from 65°F (about 18°C) to 75°F (about 24°C) are believed to be suitable (Cech et al. 1990). Under laboratory conditions, juvenile hardheads preferred water temperatures ranging from 75.2°F to 82.4°F (24°C to 28°C) (Knight 1985 as cited in Moyle 2002). Baltz et al. (1987 as cited in Moyle 2002) stated that hardhead generally selected water temperatures of 17°C to 21°C (62.6°F to 69.8°F) in a thermal plume in the Pit River.

In a recent laboratory study on the thermal preferences and tolerances of juvenile and adult hardheads, Thompson et al. (2012) found that hardheads perform well (behaviorally and physiologically) at moderate temperatures (i.e., above 16°C [60.8°F] and below 25°C [77.0°F]). In their thermal preference experiments, Thompson et al. (2012) found that, regardless of thermal acclimation history, adult hardheads tended to prefer an overall mean water temperature of 20.5°C (68.9°F), and juvenile hardheads preferred a mean water temperature of 19.5°C (67.1°F). Overall, hardheads appear to be particularly well suited to water temperatures below 25°C (77.0°F) and clearly avoided water temperatures above 26°C (78.8°F) (Thompson et al. 2012).

Based on the lowest and highest water temperatures reported in the body of literature related to hardhead, USACE used a water temperature range of 61°F to 77°F to evaluate hardhead adults and other lifestages.

1.1.3.5 Sacramento Splittail

1.1.3.5.1 Spawning

Floodplain inundation during March and April appears to be the primary factor contributing to splittail abundance (DWR 2004). Moyle et al. (2003) report that moderate-to-strong year classes of splittail develop when floodplains are inundated for 6 to 10 weeks between late February and late April.

Although floodplain inundation is the dominant factor in splittail spawning success, a literature review of thermal tolerance studies and field observations conducted by DWR (2004) suggests that water temperatures between 45°F and 75°F are considered to constitute the range of suitable splittail spawning water temperatures.

For the purpose of this evaluation, USACE evaluated Sacramento splittail primarily in the Yolo Bypass because of the dominant effect of Yolo Bypass hydrologic conditions on the population of Sacramento splittail. Because the suitable water temperature range for splittail is so large, and because USACE does not expect water temperatures to occur outside of this range with increased frequency with the Folsom WCM alternatives, relative to the basis of comparison, water temperatures are not further evaluated for Sacramento splittail.

1.1.3.6 American Shad

1.1.3.6.1 Adult Immigration and Spawning

Water temperature is an important factor influencing the timing of spawning. American shad are reported to spawn at water temperatures ranging from about 46°F to 79°F (USFWS 1967), although optimal spawning temperatures are reported to range from about 60°F to 70°F (Bell 1986; CDFG 1980; Leggett and Whitney 1972; Painter et al. 1979; Rich 1987). The optimal water temperature for egg development is reported to occur at 62°F (16.7°C). At this temperature, eggs hatch in 6 to 8 days; at water temperatures near 75°F, eggs would hatch in 3 days (MacKenzie et al. 1985 as cited in Moyle 2002).

Based on the available information, USACE used a water temperature range 60°F to 70°F to evaluate American shad adult immigration and spawning.

1.1.3.6.2 Juvenile Rearing and Downstream Movement

Juvenile American shad have reportedly been found in water temperatures ranging from 10°C to 31°C (50.0°F to 87.8°F), although only one fish was found at 31°C (Marcy et al. 1972 as cited in Stier and Crance 1985). In the Sacramento River, juvenile American shad reportedly prefer water temperatures between 62.6°F and 77°F (17°C and 25°C) (Moyle 2002).

Based on the available information, USACE used a water temperature range 63°F to 77°F to evaluate American shad juvenile rearing and downstream movement.

1.1.3.7 Striped Bass

1.1.3.7.1 Adult Immigration and Spawning

Adult striped bass are present in Central Valley rivers throughout the year, with peak abundance occurring during the spring. Adult and juvenile striped bass can survive temperatures as high as 34°C (93.2°F) for short periods, although they are under stress after temperatures exceed 25°C (77°F), and temperatures over 30°C (86°F) are usually lethal (Moyle 2002). Spawning reportedly does not occur until water temperatures reach 14°C (57.2°F), while optimal water temperatures for striped bass spawning are reported to range from about 15°C to 20°C (59°F to 68°F), and spawning ceases above 21°C (69.8°F) (Moyle 2002).

Based on the available information, USACE used a water temperature range 59°F to 68°F to evaluate striped bass adult immigration and spawning.

1.1.3.7.2 Juvenile Rearing

Regan et al. (1968 as cited in Fay et al. 1983, Table 7) reported that striped bass larvae can tolerate water temperatures from 12°C to 23°C (53.6°F to 73.4°F), while optimum water temperatures range from 16°C to 19°C (60.8°F to 66.2°F). Davies (1970 as cited in Fay et al. 1983, Table 7) reported that striped bass larvae can tolerate water temperatures from 10°C to 25°C (50°F to 77°F), while optimum water temperatures range from 15°C to 22°C (59°F to 71.6°F). Rogers et al. (1977 as cited in Fay et al. 1983, Table 7) also reported a larval striped bass tolerance range of 10°C to 25°C (50°F to 77°F) but an optimum water temperature tolerance range of 18°C to 21°C (64.4°F to 69.8°F). Bogdanov et al. (1967 as cited in Fay et al. 1983, Table 8) reported that juvenile striped bass can tolerate water temperatures from 10°C to 27°C (50°F to 80.6°F), while optimum water temperatures range from 16°C to 19°C (60.8°F to 66.2°F). Optimal water temperatures for juvenile striped bass rearing also have been reported to range from about 16°C to 22°C (61°F to 71°F) (Fay et al. 1983).

Based on the available information, USACE used a water temperature range 61°F to 71°F to evaluate striped bass juvenile rearing.

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Appendix 7D

1.1 Analysis of Spawning Weighted Usable Area for Upper Sacramento River and Feather River Salmonids

The *term flow-dependent habitat availability* refers to the quantity and quality of habitat available to individual species and lifestages for a particular instream flow. Typically, the relationship between instream flow and the quantity and quality of instream habitat is expressed in terms of weighted usable area (WUA) produced at a particular flow level.

For the Chinook salmon and steelhead adult spawning lifestages, the term *flow-dependent habitat availability* refers to the amount of appropriate spawning habitat, including the suitable 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 appropriate spawning habitat (SWRI 2002). In general, the amount of habitat suitable for spawning increases as flows increase from very low flows up to a certain flow, and then the amount of suitable spawning habitat generally decreases as flows increase because of excessive velocities, depths, etc. In addition, excessive stream flows can cause scouring of the substrate, resulting in mortality to developing eggs and embryos (Spence et al. 1996).

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 WUA and 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.

1.1.1 Scaled Composite Annual Spawning WUA Indices

In the upper Sacramento and Feather Rivers, available spawning habitat for Chinook salmon and steelhead is expressed by scaled composite WUA indices that correspond to the spawning habitat available to the species under simulated monthly flows occurring during their spawning seasons. In general, the scaled composite WUA annual index $CWUA_Y$) is calculated as the sum of the WUAs that correspond to the monthly flows during the species' spawning season at the sampled reaches within the species' spawning area, multiplied by a temporal weighting coefficient that represents the expected relative spawning intensity in the particular month of the spawning season, divided by the maximum WUA for the sum of the sampled spawning reaches, over the flow range for which the WUA-flow relationship was developed.

The U.S. Army Corps of Engineers (USACE) used four different formulae to calculate the scaled composite WUA annual indices for Chinook salmon and steelhead spawning in the upper Sacramento and Feather Rivers.

For winter-run Chinook salmon, late fall-run Chinook salmon, and steelhead spawning in the upper Sacramento River, the scaled composite annual spawning WUA index ($CWUA_Y$) is expressed by the following formula:

$$CWUA_Y = \frac{\sum_{m=1}^{K} w_m \times \left(\sum_{h=1}^{3} WUA_h \left(Q_{m,Y} \right) \right)}{\max \left(\sum_{h=1}^{3} WUA_h \left(Q \right) \right)} \qquad \textbf{(1)}$$

where $WUA_h\,(Q_{m,Y})$ is the WUA of reach h at the monthly Keswick flow release $Q_{m,Y}$ obtained from the WUA-flow relationships developed for the three species by the most recent Instream Flow Incremental Methodology (IFIM) studies (Gard 2003) performed at three sampled spawning reaches extending from Keswick Dam (river mile [RM] 301) through the confluence with Battle Creek (RM 271). The denominator of the equation that serves to scale the expression is the maximum achievable WUA for all three spawning reaches combined over the flow range for which the WUA-flow relationships were developed. Finally, w_m are the temporal weighting coefficients for winter-run Chinook salmon, late fall-run Chinook salmon, or steelhead for each of the months in the K-month spawning periods of the species.

For fall-run Chinook salmon spawning in the upper Sacramento River, the scaled composite annual spawning WUA index has a slightly more complex formula:

$$CWUA_Y = \frac{\sum_{m=1}^{K} w_m \times \left(\sum_{h=1}^{3} WUA_h \left(Q_{m,Y} \right) + \sum_{l=1}^{2} WUA_l \left(Q_{m,Y} \right) \right)}{\max \left(\sum_{h=1}^{3} WUA_h \left(Q \right) \right) + \max \left(\sum_{l=1}^{2} WUA_l \left(Q \right) \right)} . \qquad \textbf{(2)}$$

For Sacramento River fall-run Chinook salmon, the WUA-flow relationships developed in a more recent IFIM study (Gard 2005) for two additional spawning reaches extending from the confluence with Battle Creek (RM 270) through the confluence with Deer Creek (RM 220) were included by USACE with the WUA-flow relationships developed in Gard (2003). In formula 2, $WUA_l\,(Q_{m,Y})$ is the WUA for these additional reaches at monthly flow $Q_{m,Y}$. This monthly flow corresponds to simulated monthly flows in the Sacramento River immediately downstream of the confluence with Battle Creek. As in the previous equation, w_m are the temporal weighting coefficients for fall-run Chinook salmon for each of the months in the K-month spawning periods of the species.

For steelhead spawning in the Feather River, the scaled composite annual spawning WUA index is computed as:

$$CWUA_Y = \frac{\sum_{m=1}^{K} w_m \times \left(WUA_h\left(Q_{m,Y}\right) + WUA_l\left(Q_{m,Y}\right) \right)}{\max\left(WUA_h\left(Q\right)\right) + \max\left(WUA_l\left(Q\right)\right)} \tag{3}$$

where $WUA_l\,(Q_{m,Y})$ is the WUA for steelhead spawning in the Feather River Low Flow Channel (LFC) (i.e., the reach extending from the Fish Barrier Dam [RM 67.3] to the Thermalito Afterbay Outlet [RM 59]) at the simulated monthly flow $Q_{m,Y}$ measured at the Fish Barrier Dam. Similarly, $WUA_h\,(Q_{m,Y})$ is the WUA for steelhead spawning in the Feather River High Flow Channel (HFC) (i.e., the reach extending from the Thermalito Afterbay Outlet to the confluence with Honcut Creek [RM 44]) at the simulated monthly flow $Q_{m,Y}$ measured below the Thermalito Afterbay Outlet. The denominator of the equation that serves to scale the expression is the sum of the maximum achievable WUAs in the Feather River LFC ($\max(WUA_l\,(Q))$) and in the Feather River HFC ($\max(WUA_h(Q))$) resulting from the WUA-flow relationships for the two Feather River reaches, developed by the California Department of Water Resources (DWR 2004). The w_m are the temporal weighting coefficients for steelhead spawning.

For spring-run and fall-run Chinook salmon in the Feather River, the scaled composite annual spawning WUA index is computed as:

$$CWUA_Y = w_h \times \left[\sum_{m=1}^{K} w_m \times \frac{WUA_h\left(Q_{m,Y}\right)}{\max\left(WUA_h\left(Q\right)\right)} \right] + w_l \times \left[\sum_{m=1}^{K} w_m \times \frac{WUA_l\left(Q_{m,Y}\right)}{\max\left(WUA_l\left(Q\right)\right)} \right] \tag{4}$$

where $WUA_l\,(Q_{m,Y})$, $WUA_h\,(Q_{m,Y})$, $\max(WUA_l\,(Q))$ and $\max(WUA_h(Q))$ are defined as previously identified with respect to the WUA-flow relationships developed for Chinook salmon spawning in the Feather River (DWR 2004). The coefficients w_l and w_h are spatial weighting coefficients for the LFC and HFC that integrate both the relative importance of the reach in terms of maximum achievable WUA and the relative use of the reach by the species as the average proportion of carcasses found in the reach during the DWR 2000–2014 carcass surveys (DWR, no date). Details on the calculation of these spatial weighting coefficients are provided in Section E-5.

Table 1 summarizes the calculation of annual spawning habitat availability in the upper Sacramento and Feather Rivers by species. The table lists the months and river reaches over which the scaled composite annual spawning WUA index was calculated.

Table 1. Summary of Calculations of Annual Spawning Habitat Availability Indices in the Upper Sacramento and Feather Rivers.

River	Species	WUA Equation	Months (k)	Reaches
Upper Sacramento River	Winter-run Chinook salmon	1	8 (Mar – Aug)	3 (from RM 301 through RM 271)
	Fall-run Chinook salmon	2	3 (Oct – Dec)	3 (from RM 301 through RM 271) plus 2 (from RM 270 through RM 220)
	Late fall-run Chinook salmon	1	4 (Jan – Apr)	3 (from RM 301 through RM 271)
	Steelhead	1	7 (Nov – May)	3 (from RM 301 through RM 271)
Feather River	Spring-run Chinook salmon	3	2 (Sep – Oct)	2 (from RM 67.3 through RM 59, and from RM 59 through RM 44)
	Fall-run Chinook salmon	3	3 (Oct – Dec)	2 (from RM 67.3 through RM 59, and from RM 59 through RM 44)
	Steelhead	3	4 (Jan – Apr)	2 (from RM 67.3 through RM 59, and from RM 59 through RM 44)

RM – River Mile

The following sections describe the data and calculations that USACE used to develop the main components of $CWUA_Y$ in formulae 1, 2, 3, and 4:

- Spawning WUA-flow relationships by river and species/run ($WUA_k(Q)$)
- Temporal weighting coefficients (w_m)
- Spatial weighting coefficients (w_l and w_h)

1.1.2 Upper Sacramento River WUA-Flow Relationships

To describe the habitat available to winter-run, fall-run, and late fall-run Chinook salmon and steelhead spawning in the upper Sacramento River, this analysis uses the spawning WUA-flow relationships that were developed by two recent IFIM studies (Gard 2003, 2005).

In the first IFIM study (Gard 2003), the Physical Habitat Simulation (PHABSIM) component of the IFIM was used to model WUA for the three uppermost reaches of the studied area (reaches 6 through 4; **Table 2**). Gard (2003) reported two spawning WUA-flow relationships per species for the uppermost reach (reach 6). One corresponds to the period when the Anderson-Cottonwood Irrigation District (ACID) dam boards are installed (approximately April through October), and the other corresponds to the period when the ACID dam boards are removed (approximately from November 1 through March). The dates of installation and removal of the boards can vary depending on hydrologic conditions.

Table 2. Summary of the Upper Sacramento River Reaches with WUA-Flow Relationships for Spawning Salmonids Developed by Gard (2003, 2005) and Locations of the Modeled Flows Used in the Analysis of Spawning WUA.

Reach Number	Reach Description	Upper Limit (RM)	Lower Limit (RM)	Flow Site Location (CALSIM II node)
6	Keswick Dam to Anderson-Cottonwood Irrigation District (ACID) Dam	301	298	Below Keswick Dam (C 5)
5	ACID Dam to the confluence with Cow Creek	297.5	280	Below Keswick Dam (C 5)
4	Confluence with Cow Creek to the confluence with Battle Creek	279.1	271	Below Keswick Dam (C 5)
3	Confluence with Battle Creek to above Lake Red Bluff	270.3	258	Battle Creek confluence (C 108)
2	Red Bluff Diversion Dam to the confluence with Deer Creek	242	220	Battle Creek confluence (C 108)

By contrast with the Gard (2003) IFIM study that used PHABSIM, the second IFIM study (Gard 2005) used a two-dimensional hydraulic and habitat model (RIVER2D) to model spawning WUA in the two lowermost reaches (reaches 3 and 2; Table 2) of the study area for fall-run Chinook salmon. Gard (2003) reported the spawning WUA-flow relationships for the three uppermost reaches (reaches 6, 5, and 4) for steelhead and for fall-run, late fall-run, and winter-run Chinook salmon, while Gard (2005) reported the spawning WUA-flow relationships in the two lower most reaches (reaches 3 and 2) only for fall-run Chinook salmon.

No spawning WUA-flow relationship has been produced in any analysis for spring-run Chinook salmon in the Sacramento River, primarily because: (1) very few Chinook salmon redds were catalogued as spring-run redds during the 1989–1994 California Department of Fish and Wildlife (CDFW) aerial redd counts; (2) fish identified as spring-run Chinook salmon in the mainstem Sacramento River are considered hybrids that display the migration timing of both spring-run and fall-run Chinook salmon; (3) spring-run Chinook salmon are thought to be primarily tributary spawners, and it has not been feasible to differentiate potential spring-run Chinook salmon that do spawn in the mainstem Sacramento River from fall-run Chinook salmon; and (4) spring-run Chinook salmon habitat suitability criteria are not available from streams similar to the Sacramento River (Gard 2003).

Given the availability of WUA-flow relationships for salmonids spawning in the upper Sacramento River described in the previous paragraphs, the evaluation of habitat availability for flows modeled with the Folsom Water Control Manual (WCM) Project alternatives and basis-of-comparison scenarios are based on the following assumptions:

1. The steelhead spawning WUA-flow relationships for reaches 6, 5, and 4 (Gard 2003) were applied to modeled flows downstream of Keswick Dam to assess the habitat availability for steelhead spawning in the upper Sacramento River.
2. The winter-run Chinook salmon spawning WUA-flow relationships for reaches 6, 5, and 4 (Gard 2003) were applied to modeled flows downstream of Keswick Dam to assess the habitat availability for winter-run Chinook salmon spawning in the upper Sacramento River.
3. The late fall-run Chinook salmon spawning WUA-flow relationships for reaches 6, 5, and 4 (Gard 2003) were applied to modeled flows downstream of Keswick Dam to assess the habitat availability for late fall-run Chinook salmon spawning in the upper Sacramento River.
4. The fall-run Chinook salmon WUA-flow relationships for reaches 6, 5, and 4 (Gard 2003) were applied to modeled flows downstream of Keswick Dam, and the fall-run Chinook salmon spawning WUA-flow relationships for reaches 3 and 2 (Gard 2005) were applied to modeled flows downstream of the confluence with Battle Creek to assess the habitat availability for fall-run Chinook salmon spawning in the upper Sacramento River.
5. The spawning habitat availability of spring-run Chinook salmon was not evaluated in the upper Sacramento River.

For each species/run, the spawning WUA values of each of the five study reaches at a particular monthly flow $Q_{m,Y}$ were obtained from the WUA-flow relationships developed by the two IFIM studies and were summed to calculate composite values ($\sum_{h=1}^{3} WUA_h\left(Q_{m.Y}\right)$ and $\sum_{l=1}^{2} WUA_l\left(Q_{m.Y}\right)$ in formulae 1 and 2). For $\sum_{h=1}^{3} WUA_h\left(Q_{m.Y}\right)$ that combines the values for reaches 6, 5, and 4, the monthly flow $Q_{m,Y}$ is the flow modeled with the Folsom WCM alternatives and the bases of comparison for the particular month *m* and year for a location immediately below Keswick Dam, the uppermost boundary of the five study reaches (CALSIM II node C5). For $\sum_{l=1}^{2} WUA_l\left(Q_{m.Y}\right)$ that combines the values for reaches 3 and 2, the monthly flow $Q_{m,Y}$ is the modeled flow for a location downstream of the confluence with Battle Creek that constitutes the limit between reaches 4 and 3 (CALSIM II node C108).

Because the WUA-flow relationships developed by the most recent IFIM studies present WUA values within particular flow ranges at particular variable steps (e.g., in the upper Sacramento River the WUA-flow relationships were developed for a flow range of 3,250 cubic feet per second [cfs] to 31,000 cfs, with increasing steps of 250 cfs, 500 cfs, 1,000 cfs, and 2,000 cfs), the modeled monthly flow $Q_{m,Y}$ for which the composite WUA needs to be computed often falls between two flows for which there are WUA values in the WUA-flow relationships. Therefore, the composite WUA value was determined by linear interpolation between the available WUA values for the flows immediately below and above the target flow $Q_{m,Y}$. In those cases when the target flow $Q_{m,Y}$ was lower than the lowest flow value in the WUA-flow relationship (3,250 cfs) or higher than the highest flow value in the WUA-flow relationship (31,000 cfs), series of extrapolated WUA values were generated from fitting a polynomial and a power or exponential function to the closest WUA and flow values in the available WUA-flow relationships, as summarized below.

A polynomial function was fitted to the WUA values for the 12 lowest flows in the available WUA-flow relationship (Q = 3,250 cfs, 3,500 cfs, 3,750 cfs, 4,000 cfs, 4,250 cfs, 4,500 cfs, 4,750 cfs, 5,000 cfs, 5,250 cfs, 5,500 cfs, 6,000 cfs, and 6,500 cfs) to generate 33 extrapolated WUA values for flows ranging from Q = 0 cfs to Q = 3,200 cfs in increasing steps of 100 cfs.

Power and exponential functions were fitted to the WUA values for the eight or 10 highest flows in the available WUA-flow relationships (Q = 17,000 cfs, 19,000 cfs, 21,000 cfs, 23,000 cfs, 25,000 cfs, 27,000 cfs, 29,000 cfs, and 31,000 cfs for winter-run and fall-run Chinook salmon, with the addition of Q = 14,000 cfs and Q = 15,000 cfs for steelhead and late fall-run Chinook salmon). The fitted function that produced a better fit was then used to generate 49 extrapolated WUA values for Q ranging from 32,000 cfs through 80,000 cfs in increasing steps of 1,000 cfs.

Details of the extrapolation procedure and available WUA-flow relationships for winter-run, fall-run, and late fall-run Chinook salmon and steelhead spawning in the upper Sacramento River are provided in the following sections.

1.1.2.1 Winter-run Chinook Salmon

Figure 1 shows the WUA-flow relationships for winter-run Chinook salmon spawning in the upper Sacramento River (Gard 2003). Figure 1 shows the WUA-flow relationships for the three uppermost study reaches extending from Keswick Dam to the confluence with Battle Creek (reaches 6, 5, and 4 in Table 2) as connected colored circles. The WUA-flow relationship for reach 6 with ACID dam boards installed was applied because the ACID dam boards are installed approximately from April through October, a period that covers most of winter-run Chinook salmon spawning (March through August).

The composite WUA-flow relationship, resulting from the sum of the three reach specific relationships, is indicated as a black line in Figure 1. The maximum WUA value for this composite line is 1,718,329 square feet (ft²) corresponding to a flow Q = 9,000 cfs. This maximum WUA value corresponds to the denominator $\max\left(\sum_{h=1}^{3} WUA_h\left(Q\right)\right)$ in formula 1 that is used to scale the composite annual spawning WUA index. The composite WUA curve has 30 data points corresponding to flows ranging from 3,250 cfs through 31,000 cfs that were used for the direct linear interpolation of simulated flows $Q_{m,Y}$ downstream of Keswick Dam between 3,250 cfs and 31,000 cfs with the Folsom WCM alternatives and the bases of comparison during the entire simulation period.

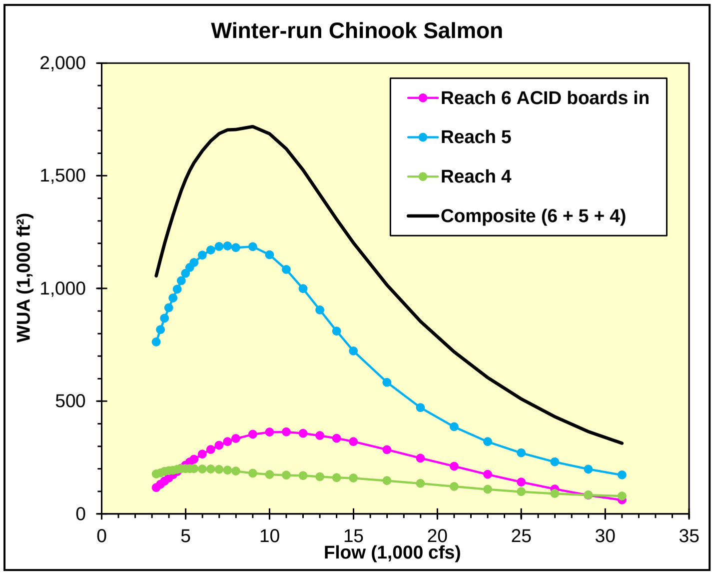


Figure 1. Relationship between Winter-run Chinook Salmon Spawning WUA and Flow for the Three Upper Study Reaches in the Upper Sacramento River Extending from Keswick Dam to the Confluence with Battle Creek and for the Composite of the Three Reaches.

To interpolate target monthly flows lower than 3,250 cfs, a polynomial function was first fitted to the WUA values for the 12 lowest flows in the composite WUA-flow relationship (*Q* = 3,250 cfs, 3,500 cfs, 3,750 cfs, 4,000 cfs, 4,250 cfs, 4,500 cfs, 4,750 cfs, 5,000 cfs, 5,250 cfs, 5,500 cfs, 6,000 cfs, and 6,500 cfs). The equation of the fitted polynomial was $WUA = 243.307 \times Q + 0.063593 \times Q^2 - 1.42 \times 10^{-5} \times Q^3 + 7.20 \times 10^{-10} \times Q^4$, which had a coefficient of determination R² = 0.999998. The polynomial equation was used to generate 33 extrapolated WUA values for flows ranging from *Q* = 0 cfs to *Q* = 3,200 cfs in increasing steps of 100 cfs that were in turn used to interpolate target monthly flows lower than 3,250 cfs. These extrapolated WUA values were plotted in **Figure 2**.

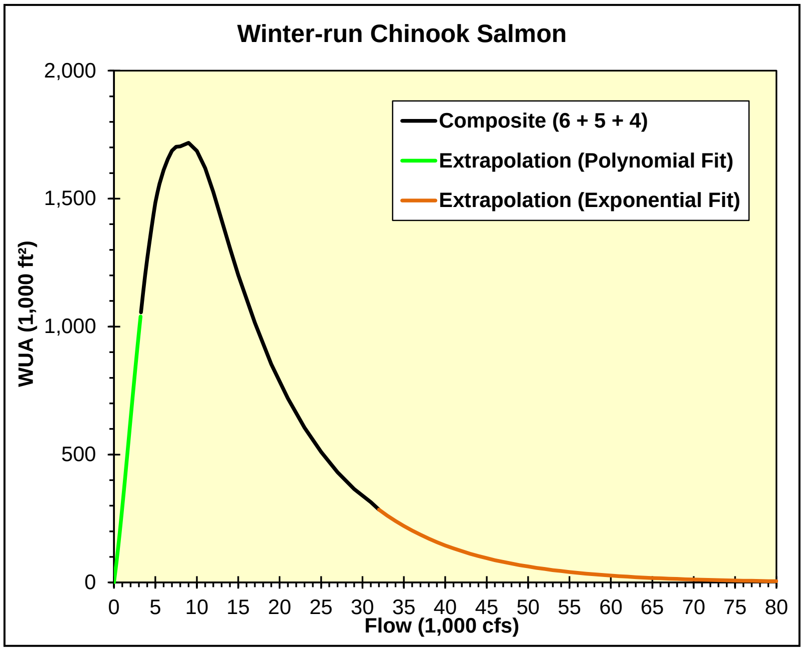


Figure 2. Final Relationship between the Composite WUA and Flow for Winter-run Chinook Salmon Spawning in the Upper Sacramento River.

To interpolate WUA values at simulated flows higher than 31,000 cfs, an exponential function was fitted to the WUA values for the eight highest flows in the composite WUA-flow relationship (*Q* = 17,000 cfs, 19,000 cfs, 21,000 cfs, 23,000 cfs, 25,000 cfs, 27,000 cfs, 29,000 cfs, and 31,000 cfs). The fitted exponential function was $\ln(WUA) = 15.258 - 0.000084 \times Q$, which had a coefficient of determination $R^2 = 0.999707$. The regression equation was used to generate 49 extrapolated WUA values for *Q* ranging from 32,000 cfs through 80,000 cfs in increasing steps of 1,000 cfs that were in turn used to interpolate target monthly flows greater than 31,000 cfs (Figure 2).

The 33 WUA values extrapolated from the fitted polynomial and the 49 WUA values extrapolated from the fitted exponential function were combined with the 30 values of the original composite WUA-flow relationship into a look-up table used for the linear interpolation of WUA values for monthly flows below Keswick Dam generated with the Folsom WCM alternatives and the bases of comparison over the entire simulation period (**Table 3**).

Table 3. Extrapolated Composite Spawning WUA-Flow Relationship for Winter-run Chinook Salmon in the Upper Sacramento River.

Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)
0	0	2,800	912,297	19,000	853,248	53,000	48,368
100	24,952	2,900	944,932	21,000	719,101	54,000	44,455
200	51,093	3,000	977,095	23,000	604,650	55,000	40,858
300	78,338	3,100	1,008,751	25,000	509,956	56,000	37,553
400	106,607	3,200	1,039,868	27,000	431,024	57,000	34,515
500	135,821	3,250	1,055,578	29,000	365,165	58,000	31,722
600	165,903	3,500	1,130,004	31,000	313,612	59,000	29,156
700	196,776	3,750	1,201,239	32,000	284,444	60,000	26,797
800	228,368	4,000	1,265,116	33,000	261,431	61,000	24,629
900	260,604	4,250	1,324,175	34,000	240,280	62,000	22,636
1,000	293,416	4,500	1,382,024	35,000	220,840	63,000	20,805
1,100	326,734	4,750	1,437,000	36,000	202,973	64,000	19,122
1,200	360,491	5,000	1,484,122	37,000	186,551	65,000	17,575
1,300	394,622	5,250	1,522,893	38,000	171,458	66,000	16,153
1,400	429,063	5,500	1,557,427	39,000	157,586	67,000	14,846
1,500	463,753	6,000	1,611,679	40,000	144,837	68,000	13,645
1,600	498,630	6,500	1,654,507	41,000	133,119	69,000	12,541
1,700	533,638	7,000	1,687,002	42,000	122,349	70,000	11,526
1,800	568,718	7,500	1,703,166	43,000	112,450	71,000	10,594
1,900	603,816	8,000	1,704,798	44,000	103,352	72,000	9,737
2,000	638,879	9,000	1,718,329	45,000	94,990	73,000	8,949
2,100	673,855	10,000	1,686,744	46,000	87,305	74,000	8,225
2,200	708,695	11,000	1,619,130	47,000	80,242	75,000	7,559
2,300	743,350	12,000	1,525,890	48,000	73,750	76,000	6,948
2,400	777,775	13,000	1,416,716	49,000	67,783	77,000	6,386
2,500	811,923	14,000	1,307,088	50,000	62,299	78,000	5,869
2,600	845,754	15,000	1,201,694	51,000	57,259	79,000	5,394
2,700	879,225	17,000	1,015,402	52,000	52,626	80,000	4,958

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

🟧 WUA values obtained through extrapolation using an exponential function (see text for details).

1.1.2.2 Fall-run Chinook Salmon

Figure 3 shows the WUA-flow relationships for fall-run Chinook salmon spawning in the upper Sacramento River developed by Gard (2003, 2005). Figure 3 shows the WUA-flow relationships for the three uppermost studied reaches extending from Keswick Dam to the confluence with Battle Creek (reaches 6, 5, and 4) as connected colored circles. The WUA-flow relationship for reach 6 with ACID dam boards removed was preferred over the relationship for reach 6 with ACID boards installed, because the ACID boards are removed approximately from November through March, a period that covers most of the fall-run Chinook salmon spawning period (October through December). Figure 3 also displays the WUA-flow relationships for the two lower reaches (reaches 3 and 2), presented in Gard (2005), that extend from the confluence with Battle Creek to the confluence with Deer Creek.

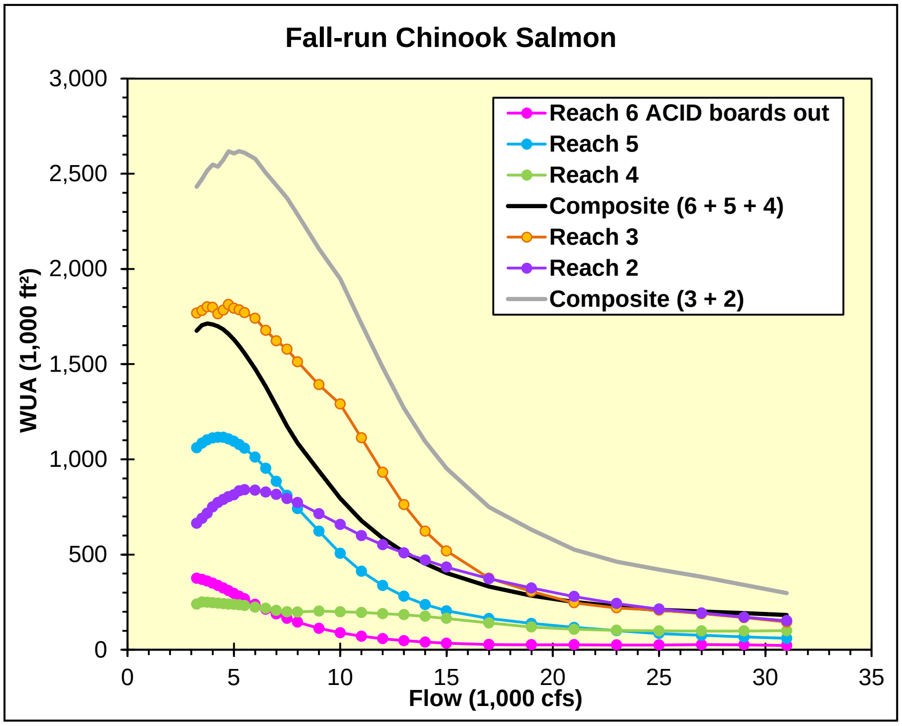


Figure 3. Relationship between Fall-run Chinook Salmon Spawning WUA and Flow for the Three Upper Study Reaches in the Upper Sacramento River Extending from Keswick Dam to the Confluence with Battle Creek (Reaches 6, 5, and 4) and for the Two Lowermost Reaches Extending from the Confluence with Battle Creek to the Confluence with Deer Creek (Reaches 3 and 2), and the Corresponding Composite Relationships.

For the purpose of this analysis, the individual reach-specific WUA-flow relationships were combined into two composite relationships. One composite WUA-flow relationship, resulting from the sum of the relationships for reaches 6, 5, and 4, is indicated as a black line in Figure 3. The maximum WUA value for this composite line is 1,713,275 ft² corresponding to a flow Q = 3,750 cfs. This maximum WUA value corresponds to the denominator $\max\left(\sum_{h=1}^{3} WUA_h\left(Q\right)\right)$ in formula 2 that is used to scale the composite annual spawning WUA index. This composite WUA relationship has 30 data points corresponding to flows ranging from 3,250 cfs through 31,000 cfs that were used for the direct linear interpolation of WUA values at simulated flows $Q_{m,Y}$ downstream of Keswick Dam between 3,250 cfs and 31,000 cfs with the Folsom WCM alternatives and the bases of comparison over the entire simulation period.

The second composite annual spawning WUA-flow relationship, resulting from the sum of the relationships for reaches 3 and 2, is indicated as a gray line in Figure 3. The maximum WUA value for this composite line is 2,619,093 ft² corresponding to a flow Q = 5,250 cfs. This maximum WUA value corresponds to the denominator $\max\left(\sum_{l=1}^{2} WUA_l\left(Q\right)\right)$ in formula 2 that is also used to scale the composite WUA index. This second composite WUA-flow relationship also was used for the direct linear interpolation of WUA values at simulated flows $Q_{m,Y}$ downstream of the confluence with Battle Creek.

To interpolate WUA values at simulated monthly flows lower than 3,250 cfs, two polynomial functions were first fitted to the WUA values for the 12 lowest flows of each composite WUA-flow relationship (Q = 3,250 cfs, 3,500 cfs, 3,750 cfs, 4,000 cfs, 4,250 cfs, 4,500 cfs, 4,750 cfs, 5,000 cfs, 5,250 cfs, 5,500 cfs, 6,000 cfs, and 6,500 cfs).

For Composite (6 + 5 + 4), the equation of the fitted polynomial was $WUA = 1{,}042.313 \times Q - 0.195906 \times Q^2 + 1.06 \times 10^{-5} \times Q^3 - 1.25 \times 10^{-11} \times Q^4$, which had a coefficient of determination $R^2 = 0.9999978$. For Composite (3 + 2), the equation of the fitted polynomial was $WUA = 1{,}820.780 \times Q - 0.530362 \times Q^2 + 7.58 \times 10^{-5} \times Q^3 - 4.33 \times 10^{-9} \times Q^4$, which had a coefficient of determination $R^2 = 0.9999827$. Both polynomial equations were used to generate 33 extrapolated WUA values for flows ranging from Q = 0 cfs to Q = 3,200 cfs in increasing steps of 100 cfs that were in turn used to interpolate WUA values at simulated monthly flows lower than 3,250 cfs. These extrapolated WUA values were plotted in **Figure 4**.

To interpolate WUA values at simulated flows higher than 31,000 cfs, two power functions were fitted to the WUA values for the eight highest flows in the composite WUA-flow relationships (Q = 17,000 cfs, 19,000 cfs, 21,000 cfs, 23,000 cfs, 25,000 cfs, 27,000 cfs, 29,000 cfs, and 31,000 cfs). For Composite (6 + 5 + 4), the fitted function was $\ln(WUA) = 22.145 - 0.972993 \times \ln(Q)$, which had a coefficient of determination $R^2 = 0.9756057$. For Composite (3 + 2), the fitted function was $\ln(WUA) = 27.917 - 1.478628 \times \ln(Q)$, which had a coefficient of determination $R^2 = 0.9958651$.

The regression equations were used to generate 49 extrapolated WUA values for Q ranging from 32,000 cfs through 80,000 cfs in increasing steps of 1,000 cfs (Figure 4) that were in turn used to interpolate WUA values at simulated monthly flows greater than 31,000 cfs.

The 33 WUA values extrapolated from the fitted polynomial and the 49 WUA values extrapolated from the fitted power function were combined with the 30 values of the Composite (6 +5 +4) WUA-flow relationship into a look-up table used for the linear interpolation of WUA values for simulated monthly flows below Keswick Dam with the Folsom WCM alternatives and the bases of comparison (**Table 4**). **Table 5** displays the comparable look-up table used for the linear interpolation of WUA values for monthly flows downstream of the confluence with Battle Creek with the Folsom WCM alternatives and the bases of comparison.

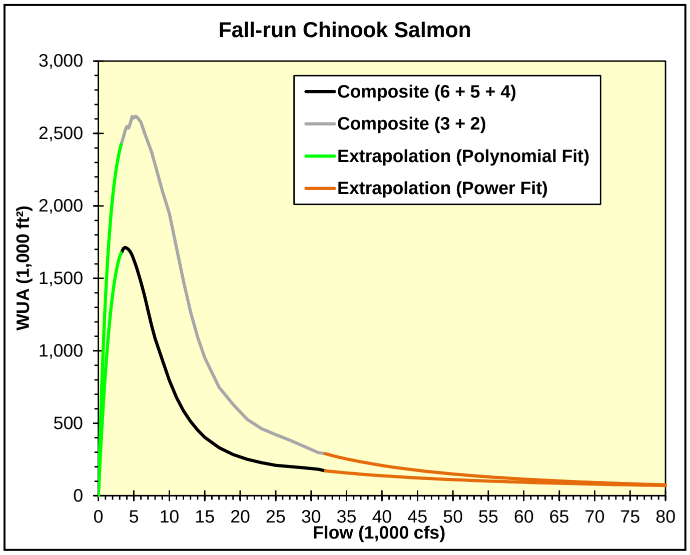


Figure 4. Final Relationships between the Composite WUA and Flow for Fall-run Chinook Salmon Spawning in the Upper Sacramento River Downstream of Keswick Dam, Composite (6 + 5 + 4), and Downstream of the Confluence with Battle Creek, Composite (3 + 2).

Table 4. Extrapolated Composite Spawning WUA-Flow Relationship for Fall-run Chinook Salmon in the Upper Sacramento River between Keswick Dam and the Confluence with Battle Creek.

Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)
0	0	2,800	1,614,269	19,000	284,576	53,000	104,879
100	102,283	2,900	1,632,525	21,000	251,595	54,000	102,989
200	200,711	3,000	1,648,693	23,000	227,845	55,000	101,167
300	295,348	3,100	1,662,836	25,000	209,999	56,000	99,409
400	386,258	3,200	1,675,016	27,000	201,205	57,000	97,711
500	473,503	3,250	1,675,371	29,000	192,657	58,000	96,072
600	557,147	3,500	1,705,121	31,000	183,143	59,000	94,487
700	637,254	3,750	1,713,275	32,000	171,356	60,000	92,954
800	713,887	4,000	1,709,027	33,000	166,301	61,000	91,471
900	787,109	4,250	1,698,553	34,000	161,540	62,000	90,036
1,000	856,984	4,500	1,682,514	35,000	157,048	63,000	88,645
1,100	923,574	4,750	1,658,083	36,000	152,801	64,000	87,297
1,200	986,944	5,000	1,628,690	37,000	148,782	65,000	85,990
1,300	1,047,155	5,250	1,595,354	38,000	144,971	66,000	84,722
1,400	1,104,272	5,500	1,557,715	39,000	141,353	67,000	83,491
1,500	1,158,357	6,000	1,474,361	40,000	137,913	68,000	82,296
1,600	1,209,474	6,500	1,382,883	41,000	134,639	69,000	81,136
1,700	1,257,686	7,000	1,278,772	42,000	131,519	70,000	80,008
1,800	1,303,055	7,500	1,174,572	43,000	128,542	71,000	78,911
1,900	1,345,645	8,000	1,084,717	44,000	125,699	72,000	77,844
2,000	1,385,519	9,000	938,728	45,000	122,980	73,000	76,807
2,100	1,422,739	10,000	795,801	46,000	120,378	74,000	75,797
2,200	1,457,369	11,000	678,263	47,000	117,885	75,000	74,813
2,300	1,489,471	12,000	585,960	48,000	115,495	76,000	73,855
2,400	1,519,109	13,000	512,660	49,000	113,201	77,000	72,922
2,500	1,546,345	14,000	453,412	50,000	110,997	78,000	72,012
2,600	1,571,242	15,000	403,338	51,000	108,879	79,000	71,125
2,700	1,593,862	17,000	332,231	52,000	106,841	80,000	70,260

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

🟧 WUA values obtained through extrapolation using a power function (see text for details).

Table 5. Extrapolated Composite Spawning WUA-Flow Relationship for Fall-run Chinook Salmon in the Upper Sacramento River between the Confluence with Battle Creek and the Confluence with Dry Creek.

Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)
0	0	2,800	2,337,177	19,000	630,753	53,000	137,601
100	176,850	2,900	2,361,474	21,000	526,365	54,000	133,850
200	343,541	3,000	2,383,976	23,000	462,509	55,000	130,267
300	500,512	3,100	2,404,829	25,000	421,614	56,000	126,843
400	648,192	3,200	2,424,171	27,000	382,837	57,000	123,566
500	787,000	3,250	2,432,159	29,000	340,721	58,000	120,429
600	917,343	3,500	2,472,408	31,000	298,265	59,000	117,423
700	1,039,618	3,750	2,517,107	32,000	290,154	60,000	114,541
800	1,154,212	4,000	2,548,379	33,000	277,248	61,000	111,775
900	1,261,503	4,250	2,537,270	34,000	265,276	62,000	109,120
1,000	1,361,856	4,500	2,572,156	35,000	254,146	63,000	106,569
1,100	1,455,627	4,750	2,617,635	36,000	243,777	64,000	104,116
1,200	1,543,162	5,000	2,607,065	37,000	234,098	65,000	101,756
1,300	1,624,796	5,250	2,619,093	38,000	225,047	66,000	99,485
1,400	1,700,853	5,500	2,610,395	39,000	216,567	67,000	97,297
1,500	1,771,648	6,000	2,578,633	40,000	208,610	68,000	95,189
1,600	1,837,485	6,500	2,504,604	41,000	201,130	69,000	93,156
1,700	1,898,656	7,000	2,438,632	42,000	194,090	70,000	91,195
1,800	1,955,446	7,500	2,372,848	43,000	187,453	71,000	89,302
1,900	2,008,126	8,000	2,285,308	44,000	181,188	72,000	87,474
2,000	2,056,959	9,000	2,106,590	45,000	175,266	73,000	85,708
2,100	2,102,198	10,000	1,948,099	46,000	169,662	74,000	84,001
2,200	2,144,082	11,000	1,712,607	47,000	164,352	75,000	82,351
2,300	2,182,844	12,000	1,483,279	48,000	159,314	76,000	80,754
2,400	2,218,704	13,000	1,269,818	49,000	154,530	77,000	79,208
2,500	2,251,873	14,000	1,094,316	50,000	149,982	78,000	77,711
2,600	2,282,550	15,000	952,887	51,000	145,655	79,000	76,261
2,700	2,310,925	17,000	749,112	52,000	141,532	80,000	74,855

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

🟧 WUA values obtained through extrapolation using a power function (see text for details).

1.1.2.3 Late Fall-run Chinook Salmon

Figure 5 shows the WUA-flow relationships for late fall-run Chinook salmon spawning in the upper Sacramento River developed by Gard (2003). Figure 5 shows the WUA-flow relationships for the three uppermost studied reaches extending from Keswick Dam to the confluence with Battle Creek (reaches 6, 5, and 4) as connected colored circles. The WUA-flow relationship for reach 6 with ACID dam boards removed was preferred over the relationship for reach 6 with ACID dam boards installed, because the ACID dam boards are removed approximately from November through March, a period that encompasses most of late fall-run Chinook salmon spawning (January through April).

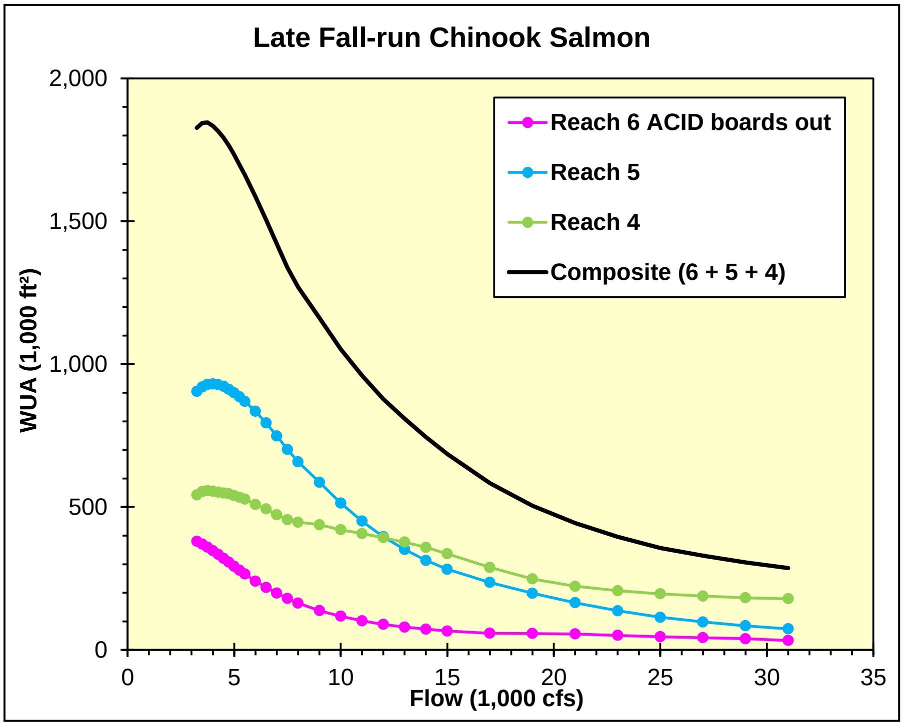


Figure 5. Relationship between Late Fall-run Chinook Salmon Spawning WUA and Flow for the Three Upper Study Reaches in the Upper Sacramento River Extending from Keswick Dam to the Confluence with Battle Creek and for the Composite of the Three Reaches.

The composite spawning WUA-flow relationship resulting from the sum of the three reach-specific relationships is indicated as a black line in Figure 5. The maximum WUA value for this composite line is 1,845,325 ft² corresponding to a flow Q = 3.750 cfs. This maximum WUA value corresponds to the denominator $\max\left(\sum_{h=1}^{3} WUA_h\left(Q\right)\right)$ in formula 1 that is used to scale the composite WUA annual index.

The composite WUA curve has 30 data points corresponding to flows ranging from 3,250 cfs through 31,000 cfs, which were used for the direct linear interpolation of WUA values at simulated monthly flows $Q_{m,Y}$ downstream of Keswick Dam between 3,250 cfs and 31,000 cfs with the Folsom WCM alternatives and the bases of comparison over the entire simulation period.

To interpolate WUA values at monthly flows lower than 3,250 cfs, a polynomial function was first fitted to the WUA values for the 12 lowest flows in the composite WUA-flow relationship (Q = 3,250 cfs, 3,500 cfs, 3,750 cfs, 4,000 cfs, 4,250 cfs, 4,500 cfs, 4,750 cfs, 5,000 cfs, 5,250 cfs, 5,500 cfs, 6,000 cfs, and 6,500 cfs). The equation of the fitted polynomial was $WUA = 1,281.425 \times Q - 0.296674 \times Q^2 + 2.58 \times 10^{-5} \times Q^3 - 7.67 \times 10^{-10} \times Q^4$, which had a coefficient of determination R² = 0.9999985. The polynomial equation was used to generate 33 extrapolated WUA values for flows ranging from Q = 0 cfs to Q = 3,200 cfs in increasing steps of 100 cfs that were in turn used to interpolate WUA values at simulated monthly flows lower than 3,250 cfs. These extrapolated WUA values were displayed as a green line in **Figure 6**.

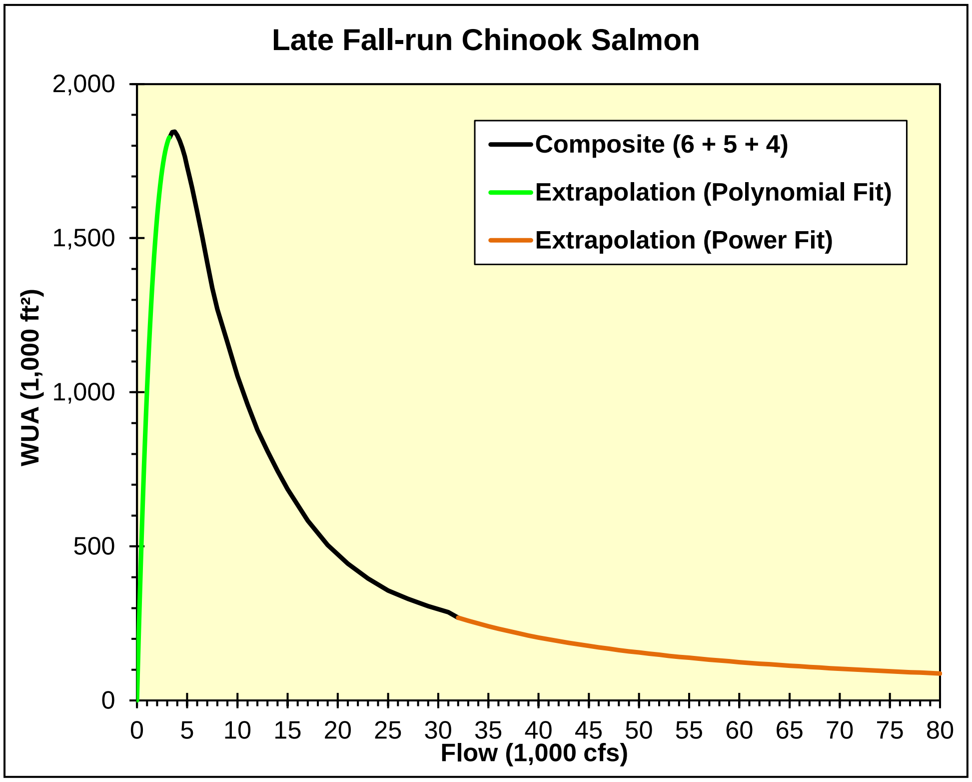


Figure 6. Final Relationship between the Composite Spawning WUA and Flow for Late Fall-run Chinook Salmon in the Upper Sacramento River.

To interpolate WUA values at simulated monthly flows higher than 31,000 cfs, a power function was fitted to the WUA values for the 10 highest flows in the composite WUA-flow relationship (*Q* = 14,000 cfs, 15,000 cfs, 17,000 cfs, 19,000 cfs, 21,000 cfs, 23,000 cfs, 25,000 cfs, 27,000 cfs, 29,000 cfs, and 31,000 cfs). The fitted power function was $\ln(WUA) = 25.176 - 1.221799 \times \ln(Q)$, which had a coefficient of determination R² = 0.9983288. The regression equation was used to generate 49 extrapolated WUA values for *Q* ranging from 32,000 cfs through 80,000 cfs in increasing steps of 1,000 cfs, which were used to interpolate WUA values at simulated monthly flows greater than 31,000 cfs (orange line in Figure 6). The 33 WUA values extrapolated from the fitted polynomial and the 49 WUA values extrapolated from the fitted power function were combined with the 30 values of the original composite WUA-flow relationship into a look-up table used for the linear interpolation of WUA values for monthly flows below Keswick Dam with the Folsom WCM alternatives and the bases of comparison over the entire simulation period (**Table 6**).

Table 6. **Extrapolated Composite Spawning WUA-Flow Relationship for Late Fall-run Chinook Salmon in the Upper Sacramento River between Keswick Dam and the Confluence with Battle Creek.**

Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)
0	0	2,800	1,780,891	19,000	504,202	53,000	145,058
100	125,201	2,900	1,795,657	21,000	444,296	54,000	141,782
200	244,623	3,000	1,808,202	23,000	395,583	55,000	138,639
300	358,417	3,100	1,818,625	25,000	356,862	56,000	135,620
400	466,732	3,200	1,827,026	27,000	329,502	57,000	132,719
500	569,719	3,250	1,826,424	29,000	306,142	58,000	129,929
600	667,522	3,500	1,843,894	31,000	286,239	59,000	127,243
700	760,286	3,750	1,845,325	32,000	268,701	60,000	124,657
800	848,154	4,000	1,833,079	33,000	258,786	61,000	122,165
900	931,268	4,250	1,814,978	34,000	249,517	62,000	119,761
1,000	1,009,765	4,500	1,792,412	35,000	240,834	63,000	117,443
1,100	1,083,784	4,750	1,764,982	36,000	232,686	64,000	115,205
1,200	1,153,460	5,000	1,732,190	37,000	225,026	65,000	113,043
1,300	1,218,925	5,250	1,698,171	38,000	217,812	66,000	110,954
1,400	1,280,312	5,500	1,662,923	39,000	211,008	67,000	108,934
1,500	1,337,751	6,000	1,584,827	40,000	204,580	68,000	106,980
1,600	1,391,370	6,500	1,505,518	41,000	198,501	69,000	105,089
1,700	1,441,294	7,000	1,420,648	42,000	192,741	70,000	103,257
1,800	1,487,649	7,500	1,337,801	43,000	187,279	71,000	101,483
1,900	1,530,556	8,000	1,269,219	44,000	182,092	72,000	99,764
2,000	1,570,137	9,000	1,162,217	45,000	177,160	73,000	98,096
2,100	1,606,510	10,000	1,052,319	46,000	172,466	74,000	96,479
2,200	1,639,792	11,000	960,010	47,000	167,993	75,000	94,910
2,300	1,670,098	12,000	878,320	48,000	163,727	76,000	93,386
2,400	1,697,541	13,000	809,172	49,000	159,654	77,000	91,907
2,500	1,722,234	14,000	745,047	50,000	155,761	78,000	90,469
2,600	1,744,285	15,000	685,114	51,000	152,038	79,000	89,072
2,700	1,763,802	17,000	583,594	52,000	148,473	80,000	87,713

🟨	WUA values obtained through extrapolation using a polynomial function (see text for details).
🟧	WUA values obtained through extrapolation using a power function (see text for details).

1.1.2.4 Steelhead

Figure 7 shows the spawning WUA-flow relationships for steelhead in the upper Sacramento River developed by Gard (2003). Figure 7 shows the WUA-flow relationships for the three uppermost studied reaches extending from Keswick Dam to the confluence with Battle Creek (reaches 6, 5, and 4) as connected colored circles. The WUA-flow relationship for reach 6 with ACID dam boards removed was preferred over the relationship for reach 6 with ACID dam boards installed, because the ACID dam boards are removed approximately from November through March, a period that encompasses most of the expected steelhead spawning period (November through April).

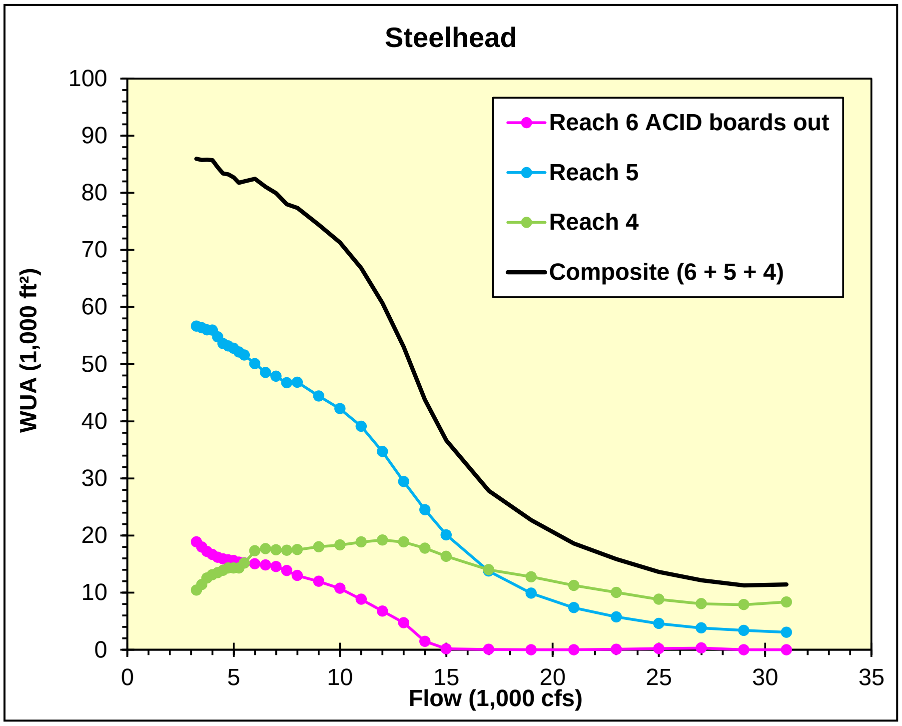


Figure 7. Relationship between Steelhead Spawning WUA and Flow for the Three Upper Study Reaches in the Upper Sacramento River Extending from Keswick Dam to the Confluence with Battle Creek and for the Composite of the Three Reaches.

The steelhead composite spawning WUA-flow relationship resulting from the sum of the three reach-specific relationships is indicated as a black line in Figure 7. The maximum WUA value for this composite line is 85,953 ft² corresponding to a flow Q = 3.250 cfs. This maximum WUA value corresponds to the denominator $\max\left(\sum_{h=1}^{3} WUA_h\left(Q\right)\right)$ in formula 1 that is used to scale the composite annual spawning WUA index. To interpolate WUA values at simulated monthly flows lower than 3,250 cfs, a polynomial function was first fitted to the WUA values for the 12 lowest flows in the composite WUA-flow relationship (Q = 3,250 cfs, 3,500 cfs, 3,750 cfs, 4,000 cfs, 4,250 cfs, 4,500 cfs, 4,750 cfs, 5,000 cfs, 5,250 cfs, 5,500 cfs, 6,000 cfs, and 6,500 cfs). The equation of the fitted polynomial was $WUA = 76.538 \times Q - 0.024229 \times Q^2 + 3.23 \times 10^{-6} \times Q^3 - 1.56 \times 10^{-10} \times Q^4$, which had a coefficient of determination $R^2 = 0.9999785$. The polynomial equation was used to generate 33 extrapolated WUA values for flows ranging from Q = 0 cfs to Q = 3,200 cfs in increasing steps of 100 cfs which were used to interpolate WUA values at simulated monthly flows lower than 3,250 cfs. These extrapolated WUA values were plotted in **Figure 8**.

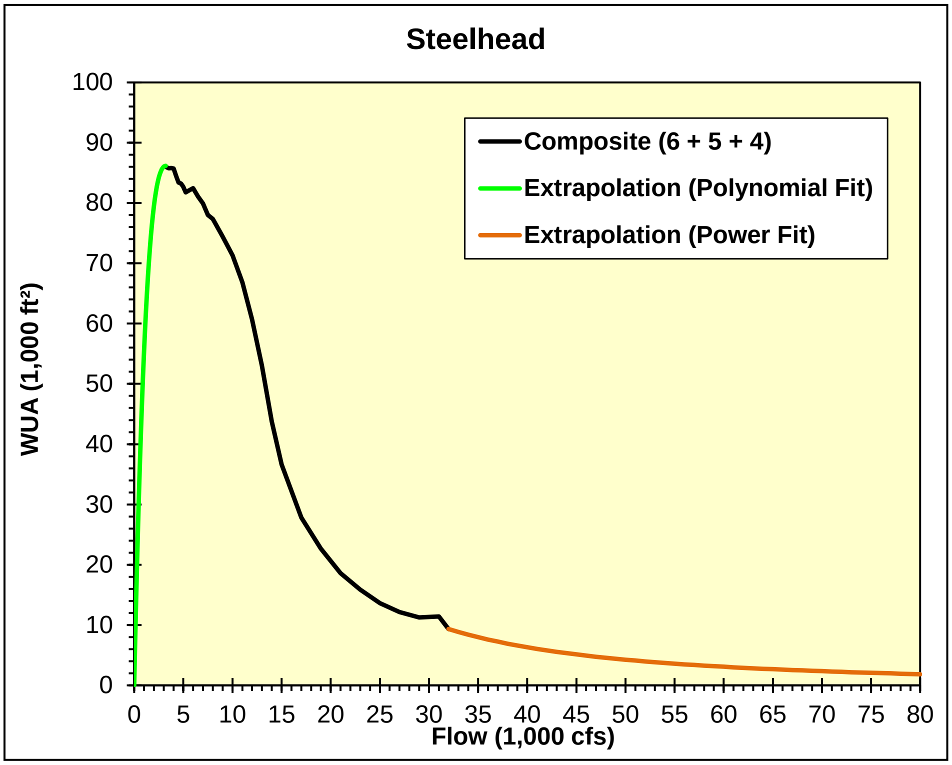


Figure 8. Final Relationship between the Composite WUA and Flow for Steelhead Spawning in the Upper Sacramento River.

To interpolate WUA values at simulated monthly flows higher than 31,000 cfs, a power function was fitted to the WUA values for the 10 highest flows in the composite WUA-flow relationship (Q = 14,000 cfs, 15,000 cfs, 17,000 cfs, 19,000 cfs, 21,000 cfs, 23,000 cfs, 25,000 cfs, 27,000 cfs, 29,000 cfs, and 31,000 cfs). The fitted power function was $\ln(WUA) = 27.424 - 1.762036 \times \ln(Q)$, which had a coefficient of determination $R^2 = 0.9808943$. The 33 WUA values extrapolated from the fitted polynomial and the 49 WUA values extrapolated from the fitted power function were combined with the 30 values of the original composite WUA-flow relationship into a look-up table used for the linear interpolation of WUA values for simulated monthly flows below Keswick Dam with the Folsom WCM alternatives and the bases of comparison over the entire simulation period (**Table 7**).

Table 7. Extrapolated Composite Spawning WUA-Flow Relationships for Steelhead in the Upper Sacramento River between Keswick Dam and the Confluence with Battle Creek.

Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)
0	0	2,800	85,576	19,000	22,675	53,000	3,852
100	7,415	2,900	85,836	21,000	18,629	54,000	3,728
200	14,364	3,000	86,016	23,000	15,877	55,000	3,609
300	20,867	3,100	86,123	25,000	13,630	56,000	3,496
400	26,941	3,200	86,165	27,000	12,183	57,000	3,389
500	32,605	3,250	85,953	29,000	11,286	58,000	3,287
600	37,877	3,500	85,759	31,000	11,436	59,000	3,189
700	42,773	3,750	85,787	32,000	9,372	60,000	3,096
800	47,312	4,000	85,714	33,000	8,878	61,000	3,007
900	51,508	4,250	84,469	34,000	8,423	62,000	2,922
1,000	55,379	4,500	83,395	35,000	8,003	63,000	2,841
1,100	58,940	4,750	83,237	36,000	7,616	64,000	2,763
1,200	62,207	5,000	82,692	37,000	7,257	65,000	2,689
1,300	65,194	5,250	81,755	38,000	6,924	66,000	2,617
1,400	67,917	5,500	81,982	39,000	6,614	67,000	2,549
1,500	70,389	6,000	82,440	40,000	6,325	68,000	2,483
1,600	72,625	6,500	81,071	41,000	6,056	69,000	2,420
1,700	74,638	7,000	79,903	42,000	5,804	70,000	2,360
1,800	76,442	7,500	78,000	43,000	5,569	71,000	2,301
1,900	78,048	8,000	77,362	44,000	5,347	72,000	2,245
2,000	79,470	9,000	74,421	45,000	5,140	73,000	2,191
2,100	80,720	10,000	71,289	46,000	4,945	74,000	2,140
2,200	81,809	11,000	66,808	47,000	4,761	75,000	2,090
2,300	82,749	12,000	60,684	48,000	4,587	76,000	2,041
2,400	83,550	13,000	53,053	49,000	4,424	77,000	1,995
2,500	84,224	14,000	43,771	50,000	4,269	78,000	1,950
2,600	84,779	15,000	36,637	51,000	4,123	79,000	1,907
2,700	85,227	17,000	27,844	52,000	3,984	80,000	1,865

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

🟧 WUA values obtained through extrapolation using a power function (see text for details).

1.1.3 Feather River Spawning WUA Flow Relationships

The spawning WUA-flow relationships developed for the salmonid species spawning in the lower Feather River were obtained from DWR (2004). This IFIM study for the lower Feather River generated WUA-flow relationships for two reaches: (1) reach 1, typically referred to as the Feather River LFC; and (2) reach 2, typically referred to as the Feather River HFC (**Table 8**).

Table 8. Summary Description of the Feather River Reaches with WUA-Flow Relationships for Spawning Salmonids Developed by DWR (2004) and Locations for the Modeled Flows used in the Analysis of Spawning Habitat Availability.

Reach Number	Reach Description	Upper Limit (RM)	Lower Limit (RM)	Flow Site Location (CALSIM II node)
1	LFC from Fish Barrier Dam to Thermalito Afterbay Outlet	67.25	59	Feather River at Fish Barrier Dam (C200-A)
2	HFC from Thermalito Afterbay Outlet to the confluence with Honcut Creek	59	44	Feather River below Thermalito Afterbay (C203)

The WUA-flow relationships developed by DWR (2004) were based on the merging of IFIM data collected by DWR in 1992 and reviewed in TRPA (2002), with new depth, velocity, substrate, and cover data collected along supplemental PHABSIM cross-section transects in 2002 and 2003, the calibration of revised PHABSIM computer models, and the updating of habitat suitability index (HSI) curves for spawning Chinook salmon and steelhead.

1.1.3.1 Chinook Salmon

The WUA-flow relationships developed for spawning Chinook salmon (**Figure 9**) were based on HSI curves obtained from depth and velocity data collected on 212 Chinook salmon redds measured in October 1991, and on 205 Chinook salmon redds measured in the fall of 1995, and an additional 200 measurements of depth and velocity taken at “unoccupied” locations to represent the “availability” of habitat conditions that were not chosen by spawners. Substrate habitat suitability criteria for the analysis were created from the October 1991 data because substrate data were not collected in 1995. Because DWR (2004) did not presented separate WUA-flow relationships for spawning fall-run and spring-run Chinook salmon, the current assessment of flow-dependent spawning habitat availability used the WUA-flow relationships in Figure 9 for both fall-run and spring-run Chinook salmon spawning in the lower Feather River.

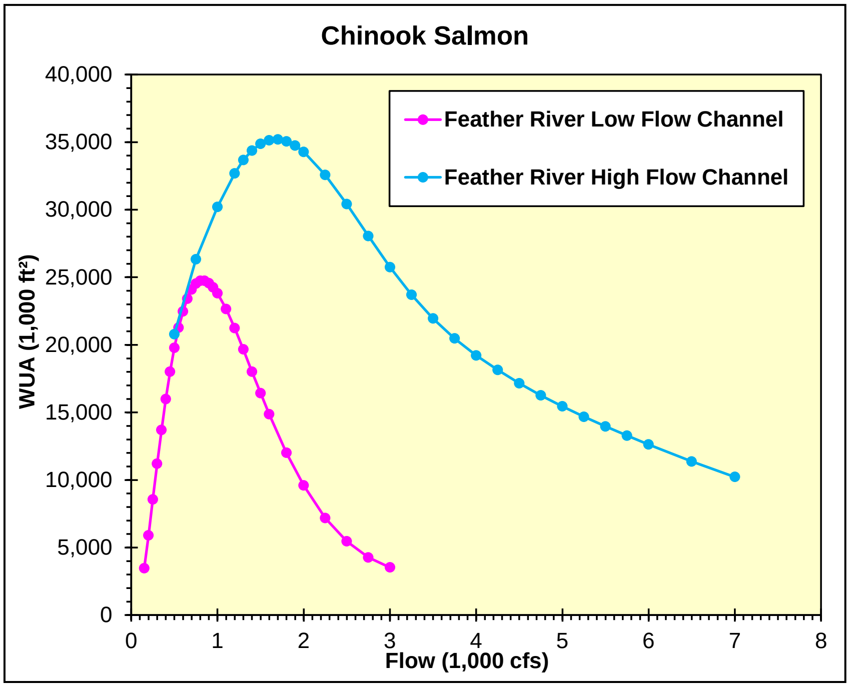


Figure 9. Relationship between Chinook Salmon Spawning WUA and Flow for the Two Study Reaches in the Lower Feather River Extending from the Fish Barrier Dam to the Confluence with Honcut Creek.

The WUA-flow relationship developed for the LFC, indicated as connected pink circles in Figure 9, has a maximum WUA value of 24,741,090 ft² corresponding to a flow Q = 850 cfs. This maximum WUA value corresponds to the denominator $\max\left(WUA_l\left(Q\right)\right)$ in formula 4 that is used to scale the composite annual spawning WUA index. The WUA-flow relationship has 30 data points corresponding to flows ranging from 150 cfs through 3,000 cfs at increasing steps of 50 cfs, 100 cfs, 200 cfs, and 250 cfs. These data points were used for the direct linear interpolation of WUA values at simulated monthly flows $Q_{m,Y}$ immediately downstream of the Fish Barrier Dam (CALSIM II node C203) with the Folsom WCM alternatives and the bases of comparison over the entire simulation period.

The WUA-flow relationship developed for the HFC, indicated as connected blue circles in Figure 9, has a maximum WUA value of 35,198,090 ft² corresponding to a flow Q = 1,700 cfs. This maximum WUA value corresponds to the denominator $\max\left(WUA_h\left(Q\right)\right)$ in formula 4 and is also used to scale the composite annual spawning WUA index. The HFC WUA-flow relationship also has 30 data points corresponding to flows ranging from 500 cfs through 7,000 cfs at increasing steps of 100 cfs, 200 cfs, 250 cfs, and 500 cfs. These data points were used for the direct linear interpolation of WUA values at simulated monthly flows $Q_{m,Y}$ immediately downstream of the Thermalito Afterbay (CALSIM II node C200-A) with the Folsom WCM alternatives and the bases of comparison over the entire simulation period.

To interpolate WUA values at simulated monthly flows lower than 150 cfs in the LFC and lower than 500 cfs in the HFC, two polynomial functions were fitted to some of the WUA values of the WUA-flow relationships illustrated in Figure 9. To interpolate WUA values at simulated monthly flows lower than

150 cfs in the LFC, the polynomial function was fitted to the 14 lowest flows in the LFC WUA-flow relationship (the flows ranging from Q = 150 cfs to Q = 800 cfs). The equation of the fitted polynomial was $WUA = -1.618 \times Q + 0.223482 \times Q^2 - 3.70 \times 10^{-4} \times Q^3 + 1.77 \times 10^{-7} \times Q^4$, which had a coefficient of determination $R^2 = 0.9999756$. The polynomial equation was used to generate 15 extrapolated WUA values for flows ranging from Q = 0 cfs to Q = 140 cfs in increasing steps of 10 cfs, which were used to interpolate WUA values at simulated monthly flows lower than 150 cfs. These extrapolated WUA values are plotted as a green line in **Figure 10**.

To interpolate WUA values at simulated monthly flows lower than 500 cfs in the HFC, the polynomial function was fitted to the 14 lowest flows in the HFC WUA-flow relationship (the flows ranging from Q = 500 cfs through Q = 2,500 cfs). The equation of the fitted polynomial was $WUA = 54.074 \times Q - 0.030685 \times Q^2 + 8.41 \times 10^{-6} \times Q^3 - 1.14 \times 10^{-9} \times Q^4$, which had a coefficient of determination $R^2 = 0.9999505$. The polynomial equation was used to generate 50 extrapolated WUA values for flows ranging from Q = 0 cfs to Q = 490 cfs in increasing steps of 10 cfs, which were used to interpolate WUA values at simulated monthly flows lower than 500 cfs. These extrapolated WUA values also are plotted as a green line in Figure 10.

Because flows in the LFC rarely exceed 800 cfs, it was not necessary for this analysis to obtain WUA values for flows greater than the 3,000-cfs upper limit of the LFC WUA-flow relationship. By contrast, flows in the HFC do exceed the upper limit of the HFC WUA-flow relationship. To interpolate WUA values at simulated monthly flows higher than 7,000 cfs in the HFC, an exponential function was fitted to the WUA values for the 10 highest flows in the HFC WUA-flow relationship (the flows ranging from Q = 4,250 cfs to Q = 7,000 cfs). The fitted exponential function was $\ln(WUA) = 10.680 - 0.000207 \times Q$, which had a coefficient of determination $R^2 = 0.9998532$. The regression equation was then used to generate 70 extrapolated WUA values for Q ranging from 7,500 cfs through 42,000 cfs in increasing steps of 500 cfs, which were used to interpolate WUA values at simulated monthly flows greater than 31,000 cfs (orange line in Figure 10).

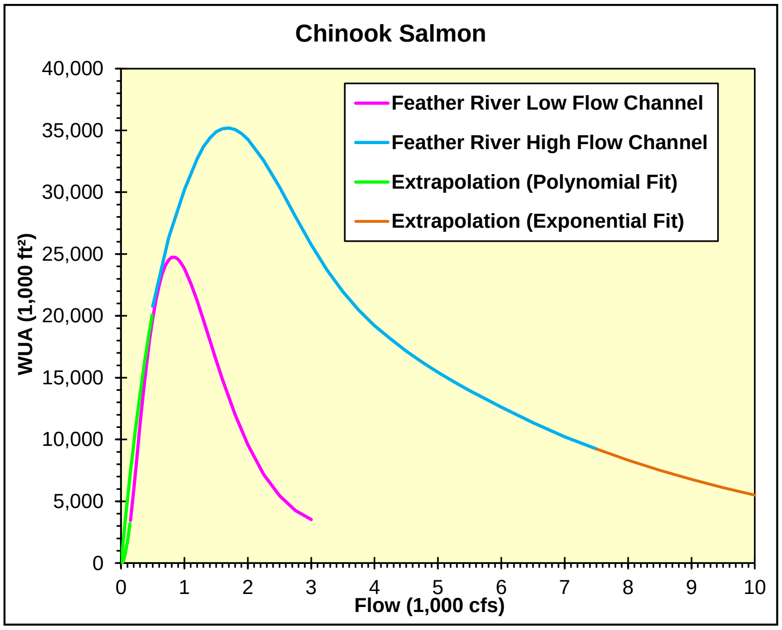


Figure 10. Final Relationship between the Composite WUA and Flow for Chinook Salmon Spawning in the LFC and HFC of the Lower Feather River.

The 15 WUA values extrapolated from the fitted polynomial were combined with the 30 values of the original LFC WUA-flow relationship into a look-up table used for the linear interpolation of WUA values for simulated monthly flows immediately downstream of the Fish Barrier Dam with the Folsom WCM alternatives and the bases of comparison over the entire simulation period (**Table 9**). Similarly, the 50 WUA values extrapolated from the fitted polynomial and the 70 WUA values extrapolated from the fitted exponential function were combined with the 30 values of the original HFC WUA-flow relationship into a look-up table used for the linear interpolation of WUA values for simulated monthly flows immediately downstream of the Thermalito Afterbay with the Folsom WCM alternatives and the bases of comparison over the entire simulation period (**Table 10**).

Table 9. Extrapolated Spawning WUA-Flow Relationships for Chinook Salmon in the Lower Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet.

Flow (cfs)	WUA (1,000 ft^2)	Flow (cfs)	WUA (1,000 ft^2)	Flow (cfs)	WUA (1,000 ft^2)
0	0	150	3,460.980	900	24,567.120
10	5.799	200	5,903.400	950	24,248.470
20	54.098	250	8,565.240	1,000	23,821.070
30	142.743	300	11,197.250	1,100	22,655.140
40	269.619	350	13,691.620	1,200	21,237.340
50	432.654	400	15,979.160	1,300	19,662.700
60	629.821	450	18,011.420	1,400	18,012.660
70	859.132	500	19,778.950	1,500	16,416.190
80	1,118.644	550	21,271.740	1,600	14,861.290
90	1,406.456	600	22,472.430	1,800	12,004.900
100	1,720.710	650	23,416.740	2,000	9,588.350
110	2,059.588	700	24,090.230	2,250	7,178.580
120	2,421.317	750	24,525.810	2,500	5,454.150
130	2,804.166	800	24,736.140	2,750	4,264.050
140	3,206.446	850	24,741.090	3,000	3,523.410

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

Table 10. Extrapolated Spawning WUA-Flow Relationships for Chinook Salmon in the Lower Feather River between the Thermalito Afterbay Outlet and the Confluence with Honcut Creek.

Flow (cfs)	WUA (1,000 ft²)	Flow (cfs)	WUA (1,000 ft²)	Flow (cfs)	WUA (1,000 ft²)	Flow (cfs)	WUA (1,000 ft²)
0	0	380	16,555.081	5,750	13,282.640	24,500	275.529
10	537.682	390	16,894.352	6,000	12,622.640	25,000	248.488
20	1,069.277	400	17,229.246	6,500	11,366.810	25,500	224.101
30	1,594.835	410	17,559.803	7,000	10,224.170	26,000	202.107
40	2,114.406	420	17,886.062	7,500	9,235.643	26,500	182.272
50	2,628.041	430	18,208.062	8,000	8,329.240	27,000	164.384
60	3,135.787	440	18,525.842	8,500	7,511.793	27,500	148.251
70	3,637.694	450	18,839.440	9,000	6,774.572	28,000	133.701
80	4,133.811	460	19,148.896	9,500	6,109.703	28,500	120.579
90	4,624.185	470	19,454.246	10,000	5,510.085	29,000	108.746
100	5,108.866	480	19,755.529	10,500	4,969.315	29,500	98.073
110	5,587.901	490	20,052.782	11,000	4,481.617	30,000	88.448
120	6,061.338	500	20,780.100	11,500	4,041.783	30,500	79.768
130	6,529.223	750	26,322.670	12,000	3,645.115	31,000	71.939
140	6,991.605	1,000	30,204.290	12,500	3,287.377	31,500	64.879
150	7,448.529	1,200	32,691.770	13,000	2,964.748	32,000	58.511
160	7,900.042	1,300	33,679.540	13,500	2,673.782	32,500	52.769
170	8,346.192	1,400	34,378.390	14,000	2,411.372	33,000	47.590
180	8,787.022	1,500	34,878.890	14,500	2,174.716	33,500	42.920
190	9,222.580	1,600	35,137.160	15,000	1,961.285	34,000	38.707
200	9,652.910	1,700	35,198.090	15,500	1,768.801	34,500	34.909
210	10,078.058	1,800	35,058.990	16,000	1,595.207	35,000	31.483
220	10,498.068	1,900	34,748.930	16,500	1,438.651	35,500	28.393
230	10,912.986	2,000	34,278.830	17,000	1,297.459	36,000	25.606
240	11,322.855	2,250	32,571.050	17,500	1,170.124	36,500	23.093
250	11,727.719	2,500	30,408.820	18,000	1,055.286	37,000	20.827
260	12,127.623	2,750	28,051.660	18,500	951.718	37,500	18.783
270	12,522.610	3,000	25,750.770	19,000	858.315	38,000	16.939
280	12,912.722	3,250	23,704.410	19,500	774.078	38,500	15.277
290	13,298.003	3,500	21,947.580	20,000	698.109	39,000	13.778
300	13,678.496	3,750	20,471.850	20,500	629.595	39,500	12.426
310	14,054.242	4,000	19,214.760	21,000	567.805	40,000	11.206
320	14,425.285	4,250	18,140.940	21,500	512.080	40,500	10.106
330	14,791.665	4,500	17,155.790	22,000	461.823	41,000	9.114
340	15,153.425	4,750	16,256.150	22,500	416.499	41,500	8.220
350	15,510.606	5,000	15,441.510	23,000	375.623	42,000	7.413
360	15,863.248	5,250	14,676.420	23,500	338.759		
370	16,211.393	5,500	13,960.600	24,000	305.512		

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

🟧 WUA values obtained through extrapolation using an exponential function (see text for details).

1.1.3.2 Steelhead

The spawning WUA-flow relationships developed for steelhead (**Figure 11**) were based on HSI curves obtained from depth, velocity, and substrate data collected on 76 steelhead redds in the late winter of 2002 (DWR 2003).

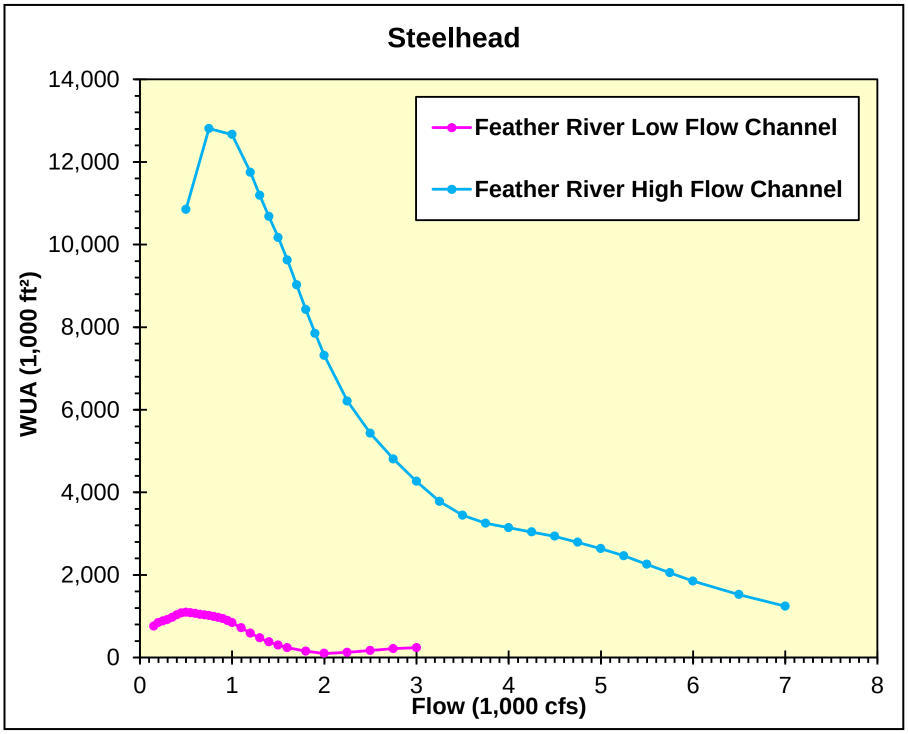


Figure 11. Relationship between Steelhead Spawning Habitat Availability (Expressed as WUA) and Flow for the Two Study Reaches in the Lower Feather River Extending from the Fish Barrier Dam to the Confluence with Honcut Creek.

The spawning WUA-flow relationship developed for the LFC (indicated as connected pink circles in Figure 11) has a maximum WUA value of 1,092,780 ft², corresponding to a flow Q = 500 cfs. The WUA-flow relationship has 30 data points corresponding to flows ranging from 150 cfs through 3,000 cfs at increasing steps of 50 cfs, 100 cfs, 200 cfs, and 250 cfs. These data points were used for the direct linear interpolation of WUA values at simulated monthly flows $Q_{m,Y}$ immediately downstream of the Fish Barrier Dam with the Folsom WCM alternatives and the bases of comparison over the entire simulation period.

The WUA-flow relationship developed for the HFC (indicated as connected blue circles in Figure 11) has a maximum WUA value of 12,808,710 ft², corresponding to a flow Q = 750 cfs. The HFC WUA-flow relationship also has 30 data points corresponding to flows ranging from 500 cfs through 7,000 cfs at increasing steps of 100 cfs, 200 cfs, 250 cfs, and 500 cfs. These data points were used for the direct linear interpolation of WUA values at simulated monthly flows $Q_{m,Y}$ immediately downstream of the Thermalito After Bay with the Folsom WCM alternatives and the bases of comparison over the entire simulation period.

To interpolate WUA values at simulated monthly flows lower than 150 cfs in the LFC and lower than 500 cfs in the HFC, two polynomial functions were fitted to some of the WUA values of the WUA-flow relationships illustrated in Figure 11. To interpolate WUA values at simulated monthly flows lower than 150 cfs in the LFC, the polynomial function was fitted to the eight lowest flows in the LFC WUA-flow relationship (the flows ranging from Q = 150 cfs to Q = 500 cfs). The equation of the fitted polynomial was $WUA = 9.915 \times Q - 0.044882 \times Q^2 + 9.61 \times 10^{-5} \times Q^3 - 7.44 \times 10^{-8} \times Q^4$, which had a coefficient of determination R² = 0.9999744. The polynomial equation was used to generate 15 extrapolated WUA values for flows ranging from *Q* = 0 cfs to *Q* = 140 cfs in increasing steps of 10 cfs, which were used to interpolate target monthly flows lower than 150 cfs. These extrapolated WUA values are plotted as a green line in **Figure 12**.

To interpolate WUA values at simulated monthly flows lower than 500 cfs in the HFC, the polynomial function was fitted to the 14 lowest flows in the HFC WUA-flow relationship (the flows ranging from *Q* = 500 cfs through *Q* = 2,500 cfs). The equation of the fitted polynomial was $WUA = 36.317 \times Q - 0.033980 \times Q^2 + 1.16 \times 10^{-5} \times Q^3 - 1.40 \times 10^{-9} \times Q^4$, which had a coefficient of determination R² = 0.9998986. The polynomial equation was used to generate 50 extrapolated WUA values for flows ranging from *Q* = 0 cfs to *Q* = 490 cfs in increasing steps of 10 cfs, which were used to interpolate WUA values at target monthly flows lower than 500 cfs. These extrapolated WUA values also are plotted as a green line in Figure 12.

To interpolate WUA values at simulated monthly flows higher than 7,000 cfs in the HFC, an exponential function was fitted to the WUA values for the six highest flows in the HFC WUA-flow relationship (the flows ranging from *Q* = 5,250 cfs to *Q* = 7,000 cfs). The fitted exponential function was $\ln(WUA) = 9.879 - 0.000393 \times Q$, which had a coefficient of determination R² = 0.9996391. The regression equation was then used to generate 70 extrapolated WUA values for *Q* ranging from 7,500 cfs through 42,000 cfs in increasing steps of 500 cfs, which were used to interpolate target monthly flows greater than 31,000 cfs (orange line in Figure 12).

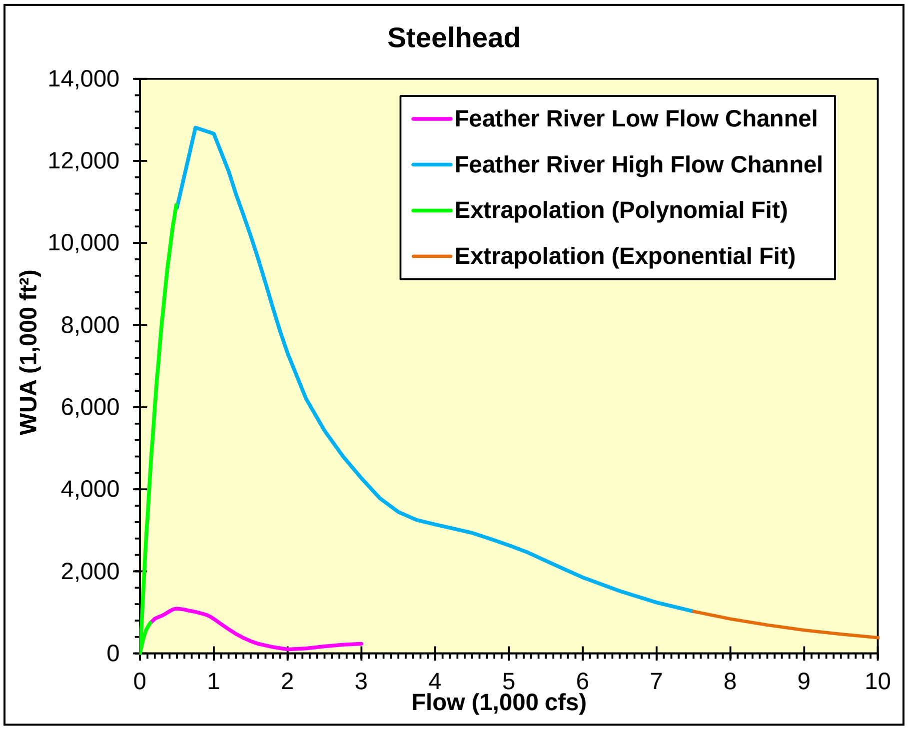


Figure 12. Final Relationship between the Composite WUA and Flow for Steelhead Spawning in the LFC and HFC of the Lower Feather River.

The 15 WUA values extrapolated from the fitted polynomial were combined with the 30 values of the original LFC WUA-flow relationship into a look-up table used for the linear interpolation of steelhead WUA values for simulated monthly flows immediately downstream of the Fish Barrier Dam with the Folsom WCM alternatives and the bases of comparison over the entire simulation period (**Table 11**). Similarly, the 50 WUA values extrapolated from the fitted polynomial and the 70 WUA values extrapolated from the fitted exponential function were combined with the 30 values of the original HFC WUA-flow relationship into a look-up table used for the linear interpolation of steelhead WUA values for simulated monthly flows immediately downstream of the Thermalito Afterbay with the Folsom WCM alternatives and the bases of comparison over the entire simulation period (**Table 12**).

Table 11. Extrapolated Spawning WUA-Flow Relationship for Steelhead in the Lower Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet.

Flow (cfs)	WUA (1,000 ft²)	Flow (cfs)	WUA (1,000 ft²)	Flow (cfs)	WUA (1,000 ft²)
0	0	150	757.810	900	939.150
10	94.756	200	846.400	950	897.040
20	181.102	250	884.980	1,000	841.560
30	259.587	300	919.660	1,100	718.450
40	330.742	350	971.890	1,200	591.180
50	395.082	400	1,031.790	1,300	474.000
60	453.103	450	1,075.030	1,400	378.050
70	505.282	500	1,092.780	1,500	300.270
80	552.080	550	1,084.020	1,600	238.510
90	593.939	600	1,067.460	1,800	154.680
100	631.285	650	1,044.300	2,000	100.720
110	664.522	700	1,031.830	2,250	124.360
120	694.041	750	1,013.030	2,500	171.570
130	720.213	800	989.930	2,750	215.650
140	743.389	850	966.920	3,000	237.410

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

Table 12. Extrapolated Spawning WUA-Flow Relationships for Steelhead in the Lower Feather River between the Thermalito Afterbay Outlet and the Confluence with Honcut Creek.

Flow (cfs)	WUA (1,000 ft²)	Flow (cfs)	WUA (1,000 ft²)	Flow (cfs)	WUA (1,000 ft²)	Flow (cfs)	WUA (1,000 ft²)
0	0	380	9,502.383	5,750	2,051.450	24,500	1.292
10	359.785	390	9,652.399	6,000	1,851.590	25,000	1.062
20	712.844	400	9,798.083	6,500	1,523.520	25,500	0.873
30	1,059.246	410	9,939.492	7,000	1,243.430	26,000	0.717
40	1,399.059	420	10,076.682	7,500	1,026.058	26,500	0.589
50	1,732.353	430	10,209.709	8,000	843.107	27,000	0.484
60	2,059.195	440	10,338.628	8,500	692.778	27,500	0.398
70	2,379.653	450	10,463.494	9,000	569.253	28,000	0.327
80	2,693.795	460	10,584.362	9,500	467.752	28,500	0.269
90	3,001.689	470	10,701.287	10,000	384.350	29,000	0.221
100	3,303.400	480	10,814.323	10,500	315.819	29,500	0.181
110	3,598.996	490	10,923.523	11,000	259.507	30,000	0.149
120	3,888.543	500	10,852.180	11,500	213.236	30,500	0.122
130	4,172.107	750	12,808.710	12,000	175.215	31,000	0.101
140	4,449.752	1,000	12,663.550	12,500	143.973	31,500	0.083
150	4,721.545	1,200	11,745.270	13,000	118.302	32,000	0.068
160	4,987.550	1,300	11,191.230	13,500	97.209	32,500	0.056
170	5,247.832	1,400	10,678.780	14,000	79.876	33,000	0.046
180	5,502.454	1,500	10,170.320	14,500	65.634	33,500	0.038
190	5,751.482	1,600	9,623.500	15,000	53.931	34,000	0.031
200	5,994.977	1,700	9,023.130	15,500	44.315	34,500	0.025
210	6,233.004	1,800	8,424.520	16,000	36.413	35,000	0.021
220	6,465.626	1,900	7,847.810	16,500	29.921	35,500	0.017
230	6,692.904	2,000	7,313.430	17,000	24.586	36,000	0.014
240	6,914.901	2,250	6,209.280	17,500	20.202	36,500	0.012
250	7,131.680	2,500	5,428.120	18,000	16.600	37,000	0.010
260	7,343.300	2,750	4,806.330	18,500	13.640	37,500	0.008
270	7,549.824	3,000	4,264.650	19,000	11.208	38,000	0.006
280	7,751.313	3,250	3,780.190	19,500	9.210	38,500	0.005
290	7,947.826	3,500	3,445.820	20,000	7.567	39,000	0.004
300	8,139.424	3,750	3,251.770	20,500	6.218	39,500	0.004
310	8,326.168	4,000	3,142.870	21,000	5.109	40,000	0.003
320	8,508.115	4,250	3,037.770	21,500	4.198	40,500	0.002
330	8,685.327	4,500	2,936.170	22,000	3.450	41,000	0.002
340	8,857.860	4,750	2,788.390	22,500	2.835	41,500	0.002
350	9,025.775	5,000	2,636.030	23,000	2.329	42,000	0.001
360	9,189.128	5,250	2,464.440	23,500	1.914		
370	9,347.978	5,500	2,256.520	24,000	1.573		

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

🟧 WUA values obtained through extrapolation using an exponential function (see text for details).

1.1.4 Temporal Weighting Coefficients

Because CWUAY in formulae 1, 2, 3, and 4 is a scaled composite WUAs for species/runs spawning over various months of their spawning season, and because the species/run-specific spawning intensity does not remain constant throughout the spawning season, the temporal weighting coefficients wm were incorporated into the formulae to account for the expected relative spawning intensity in each month of the assumed species/run-specific spawning period. Each wm is a proportion with a value between 0 and 1, so that, for a given species/run, the sum over the assumed spawning period of the species/run is equal to 1.

1.1.4.1 Upper Sacramento River

The spawning periods and associated temporal weighting coefficients applied to steelhead and the three Chinook salmon runs in the upper Sacramento River were derived from the information on spawning timing and intensity presented in Table 2.7 of the *Design and Guidelines to the Sacramento River Ecological Flows Tool (SacEFT)* (ESSA Technologies, Ltd. 2010), which was used in the assessment of Sacramento River salmonid spawning WUA in the 2013 Draft EIR/EIS of the Bay Delta Conservation Plan (BDCP) (ICF International 2013). In Table 2.7 of ESSA Technologies, Ltd. (2010), the year is divided in half-month intervals, with the spawning periods for steelhead and Chinook runs highlighted in two colors. Time intervals marked with a dark color denote the period between the 25th and 75th percentiles, when half the spawning occurs. The information in Table 2.7 of ESSA Technologies, Ltd. (2010) was reportedly based on documentation for SALMOD (Bartholow and Heasley 2006), which was reportedly based on Vogel and Marine (1991).

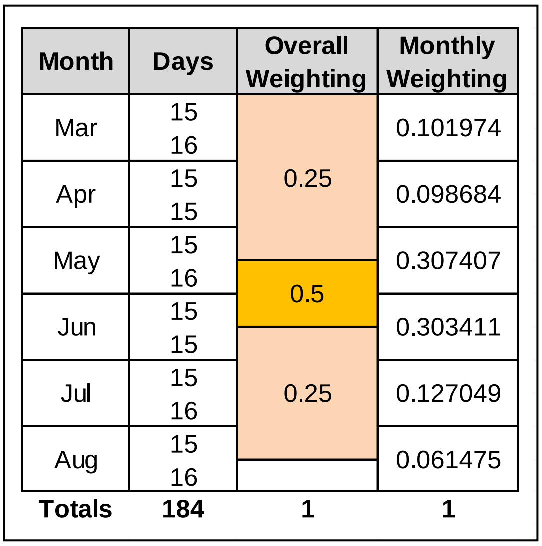
For the purpose of this analysis, the monthly weighting coefficients (w_m) were calculated by apportioning the number of days in the spawning month to the number of days in the periods with the spawning proportions of 0.25, 0.5, and 0.25 identified in ESSA Technologies, Ltd. (2010).

For winter-run Chinook salmon (**Table 13**), the spawning period extends from March 1 through August 15, and, according to ESSA Technologies, Ltd. (2010), half of the spawning occurs from May 16 through June 15, while 25 percent of the spawning occurs from March 1 through May 15, and 25 percent occurs from June 16 through August 15. Consistent with these proportions, the monthly weighting coefficient for March was calculated as the product of the spawning proportion assigned to the period March 1 through May 15 (0.25) and the ratio between the 31 days of March and the 76 days in the period of March 1 through May 15. Similarly, the monthly weighting coefficient for April was calculated as the product of the spawning proportion assigned to the period of March 1 through May 15 (0.25) and the ratio between the 30 days of April and the 76 days in the period March 1 through May 15.

The calculations for the May and June weighting coefficients are slightly different because May and June are split between periods with spawning proportions of 0.25 and 0.5. For May, the monthly weighting coefficient was calculated as the product of 0.25 and the ratio between the 15 days of May and the 76 days in the period of March 1 through May 15, plus the product of 0.5 and the ratio between the 16 days of May in the May 16 – June 15 period and the 31 days in the period. For June, the monthly weighting coefficient was calculated as the product of 0.5 and the ratio between the 15 days of June and the 31 days in the period May 16 through June 15, plus the product of 0.25 and the ratio between the 15 days of June in the June 16 – August 15 period and the 61 days in the period.

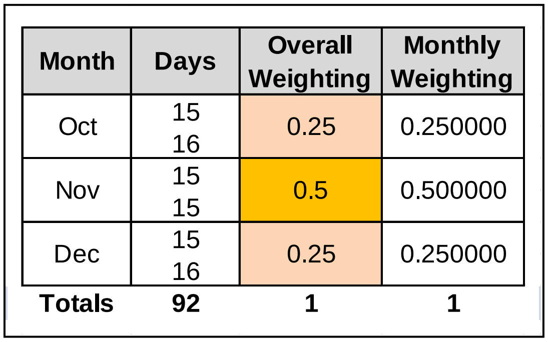
Similar calculations as described for winter-run Chinook salmon, above, were performed for fall-run Chinook salmon, late fall-run Chinook salmon, and steelhead. The resulting weighting coefficients are displayed in **Table 14** (fall-run Chinook salmon), **Table 15** (late fall-run Chinook salmon), and **Table 16** (steelhead).

Table 13. Monthly Weighting Coefficients for Winter-run Chinook Salmon Spawning in the Rpper Sacramento River.



Month	Days	Overall Weighting	Monthly Weighting
Mar	15 16	0.25	0.101974
Apr	15 15		0.098684
May	15 16	0.5	0.307407
Jun	15 15	0.25	0.303411
Jul	15 16		0.127049
Aug	15 16		0.061475
Totals	**184**	**1**	**1**

Table 14. Monthly Weighting Coefficients for Fall-run Chinook Salmon Spawning in the Upper Sacramento River.



Month	Days	Overall Weighting	Monthly Weighting
Oct	15 16	0.25	0.250000
Nov	15 15	0.5	0.500000
Dec	15 16	0.25	0.250000
Totals	**92**	**1**	**1**

Table 15. Monthly Weighting Coefficients for Late Fall-run Chinook Salmon Spawning in the Upper Sacramento River.

Month	Days	Overall Weighting	Monthly Weighting
Jan	15	0.25	0.508065
	16	0.5	
Feb	15		0.297020
	13	0.25	
Mar	15		0.131356
	16		
Apr	15		0.063559
	15		
Totals	**120**	**1**	**1**

Table 16. Monthly Weighting Coefficients for Steelhead Spawning in the Upper Sacramento River.

Month	Days	Overall Weighting	Monthly Weighting
Nov	15		0.081522
	15	0.25	
Dec	15		0.168478
	16		
Jan	15	0.5	0.172222
	16		
Feb	15		0.155556
	13		
Mar	15		0.172222
	16		
Apr	15	0.25	0.166667
	15		
May	15		0.083333
	16		
Totals	**212**	**1**	**1**

1.1.4.2 Feather River

Information on the relative intensity of spawning during the spawning periods of Feather River salmonids was not available at the time of this analysis. Therefore, the monthly weighting coefficients (w_m) used in this analysis of flow-dependent habitat availability were calculated by simply apportioning the number of days in the spawning month to the total number of days in the assumed spawning periods of Feather River salmonid species.

The monthly weighting coefficients for fall-run Chinook salmon (**Table 17**) were calculated by dividing the number of days of each spawning month by the 92 days of the October-through-December spawning period. Similar calculations were used to calculate monthly weighting coefficients for spring-run Chinook salmon, based on a spawning period of September and October (a total of 61 days), and for steelhead, based on a spawning period of January 1 through April 30 (a total of 120 days) (Table 17).

Table 17. Monthly Weighting Coefficients for Spring-run and Fall-run Chinook Salmon and Steelhead Spawning in the Lower Feather River.

Species and run		Chinook Salmon Spawning				Steelhead Spawning	
		Spring-run		Fall-run			
Month	Days	Period	Monthly Weighting	Period	Monthly Weighting	Period	Monthly Weighting
Sep	30	🟧	0.491803		0		0
Oct	31	🟧	0.508197	🟧	0.336957		0
Nov	30		0	🟧	0.326087		0
Dec	31		0	🟧	0.336957		0
Jan	31		0		0	🟧	0.258333
Feb	28		0		0	🟧	0.233333
Mar	31		0		0	🟧	0.258333
Apr	30		0		0	🟧	0.250000
May	31		0		0		0
Jun	30		0		0		0
Jul	31		0		0		0
Aug	31		0		0		0
Totals	**365**		**1**		**1**		**1**

1.1.5 Spatial Weighting Coefficient

Annual Chinook salmon carcass survey data are available for the lower Feather River from 2000 through 2014 and include whether each carcass was observed in the LFC or the HFC (DWR, no date). USACE's examination of the Chinook salmon carcass data suggests that the majority of Chinook salmon spawning in the lower Feather River occurs in the upstream LFC. Chinook salmon carcasses cannot be identified as spring-run or fall-run. However, as an indicator of phenotypic spring-run Chinook salmon, USACE complied all Chinook salmon carcasses observed from the beginning of the annual carcass survey period through the end of the expected phenotypic spring-run Chinook salmon spawning period (October 15) to estimate the proportion of spring-run Chinook salmon spawning in the LFC and HFC over the period of record (2000 through 2014). As shown in **Table 18**, the vast majority of expected phenotypic spring-run Chinook salmon (an annual average of about 95 percent) spawned in the LFC.

As an indicator of phenotypic fall-run Chinook salmon, USACE complied all Chinook salmon carcasses observed from the beginning of the expected fall-run Chinook salmon spawning period (October 1) through the end of the annual carcass surveys to estimate the proportion of fall-run Chinook salmon spawning in the LFC and HFC over the period of record. Most of the phenotypic fall-run Chinook salmon (an annual average of about 85 percent) spawned in the LFC (**Table 19**).

Because of the vast difference in spatial utilization of both spring-run and fall-run Chinook salmon in the lower Feather River, the scaled composite annual spawning WUA index ($CWUA_Y$) for spring-run and fall-run Chinook salmon (formula 4) incorporate the spatial weighting coefficients w_l and w_h for the Feather River LFC and HFC to account for the marked different in utilization between the LFC and HFC. The coefficients w_l (for the LFC) and w_h (for the HFC) integrate both the relative importance of the reach in terms of maximum achievable WUA and the relative use of the reach by the species as the average proportion of carcasses found in the reach during the 2000–2014 carcass surveys.

Table 18. Number and Proportions of Chinook Salmon Carcasses Collected in the Feather River LFC and HFC from the Beginning of the Annual Carcass Survey through October 15, as an Indicator of Phenotypic Spring-run Chinook Salmon Spawning.

Chinook salmon carcasses by reach collected through October 15				
Reach	**LFC**		**HFC**	
Year	**No. of fish**	**Proportion**	**No. of fish**	**Proportion**
2000	2,252	0.9128	215	0.0872
2001	1,776	0.9197	155	0.0803
2002	2,396	0.9370	161	0.0630
2003	2,393	0.9165	218	0.0835
2004	1,589	0.9190	140	0.0810
2005	1,424	0.9551	67	0.0449
2006	1,938	0.9094	193	0.0906
2007	1,177	0.9800	24	0.0200
2008	312	0.9873	4	0.0127
2009	161	0.9938	1	0.0062
2010	644	0.9802	13	0.0198
2011	1,983	0.9759	49	0.0241
2012	1,794	0.9819	33	0.0181
2013	3,926	0.9023	425	0.0977
2014	2,063	0.9318	151	0.0682
Averages	u_l	**0.9469**	u_h	**0.0531**

Table 19. Number and Proportions of Chinook Salmon Carcasses Collected in the Feather River LFC and HFC from October 1 through the End of the Annual Carcass Surveys, as an Indicator of Phenotypic Fall-run Chinook Salmon Spawning.

Chinook salmon carcasses by reach collected from October 1				
Reach	**LFC**		**HFC**	
Year	**No. of fish**	**Proportion**	**No. of fish**	**Proportion**
2000	4,695	0.8512	821	0.1488
2001	3,820	0.8104	894	0.1896
2002	3,529	0.7883	948	0.2117
2003	3,112	0.6811	1,457	0.3189
2004	2,331	0.7113	946	0.2887
2005	2,821	0.8232	606	0.1768
2006	2,665	0.8533	458	0.1467
2007	1,191	0.9233	99	0.0767
2008	534	0.9303	40	0.0697
2009	261	0.9223	22	0.0777
2010	2,276	0.9366	154	0.0634
2011	6,085	0.9152	564	0.0848
2012	6,707	0.9391	435	0.0609
2013	7,083	0.8621	1,133	0.1379
2014	3,804	0.8349	752	0.1651
Averages	u_l	**0.8522**	u_h	**0.1478**

The spatial coefficient for the LFC (w_l) was computed as:

$$w_l = \frac{\dfrac{\max\left(WUA_l\left(Q\right)\right)}{\max\left(WUA_l\left(Q\right)\right)+\max\left(WUA_h\left(Q\right)\right)}\times u_l}{\dfrac{\max\left(WUA_l\left(Q\right)\right)}{\max\left(WUA_l\left(Q\right)\right)+\max\left(WUA_h\left(Q\right)\right)}\times u_l+\dfrac{\max\left(WUA_h\left(Q\right)\right)}{\max\left(WUA_l\left(Q\right)\right)+\max\left(WUA_h\left(Q\right)\right)}\times u_h}.$$

The coefficients u_l and u_h are the average proportions of carcasses found in each reach during the 2000–2014 carcass surveys displayed in Table 18 for spring-run Chinook salmon and in Table 19 for fall-run Chinook salmon. Similarly, the spatial coefficient for the HFC (w_h) was computed as:

$$w_h = \frac{\dfrac{\max\left(WUA_h\left(Q\right)\right)}{\max\left(WUA_l\left(Q\right)\right)+\max\left(WUA_h\left(Q\right)\right)} \times u_h}{\dfrac{\max\left(WUA_l\left(Q\right)\right)}{\max\left(WUA_l\left(Q\right)\right)+\max\left(WUA_h\left(Q\right)\right)} \times u_l + \dfrac{\max\left(WUA_h\left(Q\right)\right)}{\max\left(WUA_l\left(Q\right)\right)+\max\left(WUA_h\left(Q\right)\right)} \times u_h}.$$

Replacing the specific values of maximum WUA, u_l and u_h, the spatial coefficient for spring-run Chinook salmon spawning in the LFC (w_l) becomes:

$$w_l = \frac{\dfrac{24,741}{24,741+35,198} \times 0.9469}{\dfrac{24,741}{24,741+35,198} \times 0.9469 + \dfrac{35,198}{24,741+35,198} \times 0.0531} = \frac{0.4128 \times 0.9469}{0.4128 \times 0.9469 + 0.5872 \times 0.0531} = 0.9261, \text{ while}$$

the spatial coefficient in the HFC becomes: $w_h = \dfrac{0.5872 \times 0.0531}{0.4128 \times 0.9469 + 0.5872 \times 0.0531} = 0.0739$.

Similarly, the spatial coefficient for fall-run Chinook salmon spawning in the LFC (w_l) becomes:

$$w_l = \frac{\dfrac{24,741}{24,741+35,198} \times 0.8522}{\dfrac{24,741}{24,741+35,198} \times 0.8522 + \dfrac{35,198}{24,741+35,198} \times 0.1478} = \frac{0.4128 \times 0.8522}{0.4128 \times 0.8522 + 0.5872 \times 0.1478} = 0.8021, \text{ while}$$

the spatial coefficient in the HFC becomes: $w_h = \dfrac{0.5872 \times 0.1478}{0.4128 \times 0.8522 + 0.5872 \times 0.1478} = 0.1979$.

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Appendix 7E

1.1 Analysis of Spawning Weighted Usable Area for Lower American River Salmonids

The term *flow-dependent habitat availability* refers to the quantity and quality of habitat available to individual species and lifestages for a particular instream flow. Typically, the relationship between instream flow and the quantity and quality of instream habitat is expressed in terms of weighted usable area (WUA) produced at a particular flow level.

For the Chinook salmon and steelhead adult spawning lifestage, the term *flow-dependent habitat availability* refers to the amount of appropriate spawning habitat, including the suitable 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 appropriate spawning habitat (SWRI 2002). In general, the amount of habitat suitable for spawning increases as flows increase from very low flows up to a certain flow, and then the amount of suitable spawning habitat generally decreases as flows increase because of excessive velocities, depths, etc. In addition, excessive stream flows can cause scouring of the substrate, resulting in mortality to developing eggs and embryos (Spence et al. 1996).

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 WUA and 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.

1.1.1 Scaled Composite WUA Annual Index

In the lower American River, available spawning habitat for fall-run Chinook salmon and steelhead is expressed by scaled composite WUA indices that correspond to the spawning habitat available to the species under the daily flows occurring during their spawning seasons. The scaled composite WUA annual index ($CWUA_Y$) is calculated as the sum of the WUAs that correspond to the simulated average daily flows during the species' spawning season at five sampled reaches within the species' spawning area, multiplied by a temporal weighting coefficient that represents the average relative spawning intensity in the particular day of the spawning season, divided by the maximum WUA for the sum of the five spawning reaches, over the flow range for which the WUA-flow relationship was developed.

For both fall-run Chinook salmon and steelhead that spawns at five distinct reaches (h) within the lower American River during a period of K consecutive days of a particular year Y, the scaled composite WUA annual index ($CWUA_Y$) is expressed by the following formula:

$$CWUA_Y = \frac{\sum_{d=1}^{K} w_d \times \left(\sum_{h=1}^{5} WUA_h \left(Q_{d,Y} \right) \right)}{\max \left(\sum_{h=1}^{5} WUA_h \left(Q \right) \right)} \qquad (1)$$

where $WUA_h(Q_{d,Y})$ is the WUA of reach h at the daily flow $Q_{d,Y}$ obtained from the WUA-flow relationships developed by the most recent Instream Flow Incremental Methodology (IFIM) studies (USFWS 2003) performed at the five sampled spawning reaches. The denominator of the equation that serves to scale the expression is the maximum achievable WUA for all five spawning reaches combined over the flow range for which the WUA-flow relationships were developed. Finally, w_d are the temporal weighting coefficients for fall-run Chinook salmon or steelhead for each of the days in the K-day spawning periods of fall-run Chinook salmon or steelhead.

Table 1 summarizes the calculation of annual spawning habitat availability in the lower American River by species, specifying the days (d) and river reaches (h) over which the summations are performed.

The simulated average daily flows below Nimbus Dam and equation 1 was used by the U.S. Army Corps of Engineers (USACE) to calculate the expected scaled composite WUA annual indices for fall-run Chinook salmon and steelhead spawning in the lower American River for each of the 73 years simulated with the Folsom Water Control Manual (WCM) Project alternatives and the bases of comparison. For comparative purposes, the resulting annual indices were averaged and compared for the Folsom WCM alternatives relative to the bases of comparison over the entire simulation period and by water year type. Additionally, the resulting annual indices of spawning WUA were used to develop exceedance distributions for comparison of the Folsom WCM alternatives relative to the bases of comparison over the entire simulation period.

Table 1. Summary of Calculations of Annual Spawning Habitat Availability Indexes in the Lower American River by Species.

Species	WUA Equation	Days (*d*)	Reaches (*h*)
Fall-run Chinook salmon	1	98 (Oct 13 – Jan 18)	5 (Upstream RM 21.8; from RM 21.2 to RM 20.7; from RM 20.2 to RM 19.6; from RM 19.1 to RM 18.9; and downstream RM 17.3)
Steelhead	1	114 (Dec 14 – Apr 5)	5 (Upstream RM 21.8; from RM 21.2 to RM 20.7; from RM 20.2 to RM 19.6; from RM 19.1 to RM 18.9; and downstream RM 17.3)

RM = River Mile

The following sections describe the data and calculations used by USACE to develop the main components of CWUAY in equation 1:

- WUA-flow relationships per species/run ($WUA_k(Q)$)
- Temporal weighting coefficients (w_m)

1.1.2 WUA-Flow Relationships

To describe the flow-dependent spawning habitat available to fall-run Chinook salmon and steelhead at different lower American River flow levels, this analysis uses the WUA-flow relationships that were developed by the most recent IFIM study that used two-dimensional (2-D) modeling (USFWS 2003). In the 2003 USFWS 2-D study, the lower American River was divided into five reaches (**Table 2**).

Table 2. Names and River Miles of the Limits of Lower American River Reaches with WUA-Flow Relationships Developed by USFWS (2003).

Reach (*k*)	Reach Name	Downstream Limit (RM)	Upstream Limit (RM)	Model Node
1	Sailor Bar	21.8	22.1	Nimbus
2	Above Sunrise	20.7	21.2	Nimbus
3	Sunrise	19.6	20.2	Nimbus
4	El Manto	18.9	19.1	Nimbus
5	Rossmoor	16.6	17.3	Nimbus

For each species, the WUA values for each of the five study reaches *h* at a particular daily flow $Q_{d,Y}$ were obtained from the WUA-flow relationships developed by the 2-D IFIM study, and summed to calculate a composite value ($\sum_{h=1}^{5} WUA_h\left(Q_{d,Y}\right)$ in equation 1). The daily flow $Q_{d,Y}$ was the daily flow modeled with the Folsom WCM alternatives and the bases of comparison for the particular day *d* and year below Nimbus Dam, the uppermost boundary of the five study reaches.

The WUA-flow relationships developed by the most recent IFIM studies present WUA values within particular flow ranges at particular variable steps (e.g., in the lower American River, the WUA-flow relationships were developed for a flow range of 1,000 cubic feet per second [cfs] to 11,000 cfs, with flow steps of 200 cfs, 400 cfs, and 600 cfs). Because simulated daily flows often do not correspond to one of the specified flows in the WUA-flow relationship, the composite WUA value for a given day was determined by linear interpolation between the available WUA values for the flows immediately below and above the target flow $Q_{d,Y}$. In those cases when the target flow $Q_{d,Y}$ was lower than the lowest flow value in the WUA-flow relationship (1,000 cfs) or higher than the highest flow value in the WUA-flow relationship (11,000 cfs), two series of extrapolated WUA values were generated from fitting a polynomial and a power function to the closest WUA and flow values in the available WUA-flow relationships, as further described below.

A polynomial function was fitted to the WUA values for the seven lower flows in the available WUA-flow relationship (Q = 1,000 cfs, 1,200 cfs, 1,400 cfs, 1,600 cfs, 1,800 cfs, 2,000 cfs, and 2,200 cfs) to generate seven extrapolated WUA values for Q = 0 cfs, 50 cfs, 100 cfs, 200 cfs, 400 cfs, 600 cfs, and 800 cfs. A power function was fitted to the WUA values for the 10 higher flows in the available WUA-flow relationships (Q ranging from 7,000 cfs through 11,000 cfs) to generate 27 extrapolated WUA values for Q ranging from 12,000 cfs through 38,000 in increasing steps of 1,000 cfs. Details of the extrapolation procedure and available WUA-flow relationships for fall-run Chinook salmon and steelhead spawning in the lower American River are provided in the following sections.

1.1.2.1 Fall-run Chinook Salmon

The WUA-flow relationships developed for spawning fall-run Chinook salmon (**Figure 1**) through 2-D modeling were based on Habitat Suitability Curves (HSC) obtained from depth, velocity, and substrate data collected during surveys for shallow and deep fall-run Chinook salmon redds conducted on November 6 and 7, 1996, and on December 11 through 17, 1998. A total of 218 measurements were collected in 1996 (USFWS 1996), and a total of 189 measurements were obtained in 1998 (USFWS 2003).

Figure 1 shows the WUA-flow relationships for the five studied reaches (Sailor Bar, Above Sunrise, Sunrise, El Manto, and Rossmoor) as connected colored circles. The composite WUA-flow relationship, resulting from the sum of the reach-specific relationships, is indicated as a gray line. The white circle on this line, with coordinates WUA = 881,905 square feet (ft²) and Q = 2,200 cfs, indicates the maximum WUA for all five spawning reaches combined that corresponds to the denominator $\max\left(\sum_{h=1}^{5} WUA_h\left(Q\right)\right)$ in equation 1 and is used to scale the composite WUA annual index.

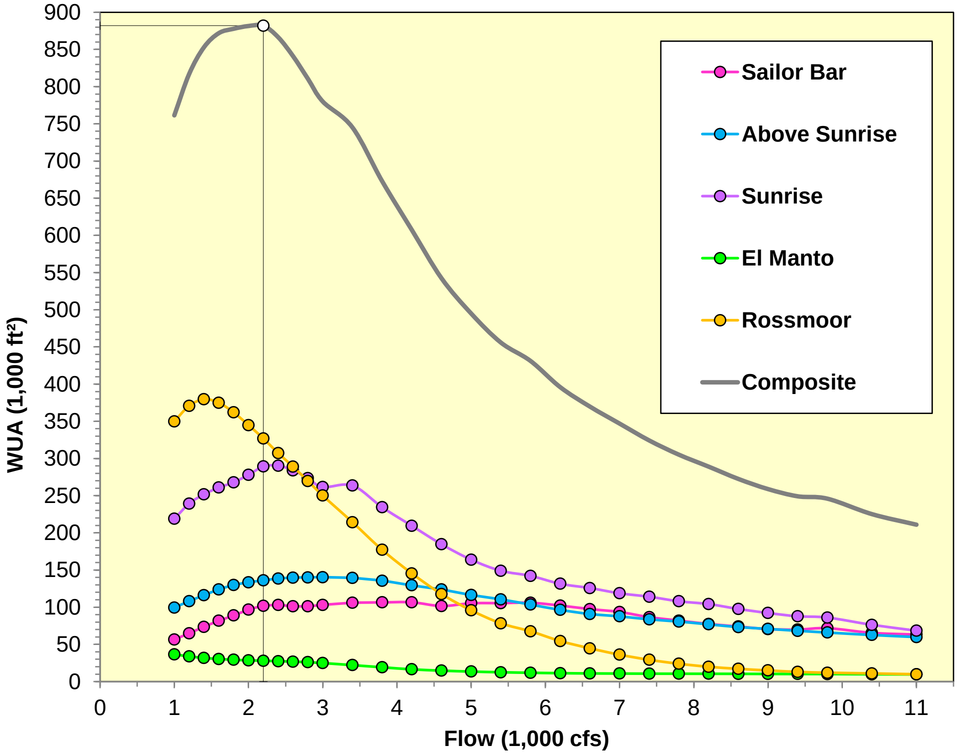

Figure 1. Relationship between Chinook Salmon Spawning Habitat Availability (Expressed as WUA) and Flow for the Five Lower American River Study Reaches and for the Composite of the Five Study Reaches.

The composite WUA curve has 30 data points corresponding to flows ranging from 1,000 cfs through 11,000 cfs that were used for the direct linear interpolation of target daily flows $Q_{d,Y}$ describing daily flow conditions below Nimbus Dam between 1,000 cfs, and 11,000 cfs with the Folsom WCM alternatives and the bases of comparison over the entire simulation period.

To interpolate target daily flows lower than 1,000 cfs, a polynomial function was first fitted to the WUA values for the seven lowest flows in the composite WUA-flow relationship (*Q* = 1,000 cfs, 1,200 cfs, 1,400 cfs, 1,600 cfs, 1,800 cfs, 2,000 cfs, and 2,200 cfs). The equation of the fitted polynomial was $WUA = 1,257.737 \times Q - 0.590034 \times Q^2 + 7.88 \times 10^{-5} \times Q^3 + 4.67 \times 10^{-9} \times Q^4$, and had a coefficient of determination R² = 0.9999. The polynomial equation was used to generate seven extrapolated WUA values for *Q* = 0 cfs, 50 cfs, 100 cfs, 200 cfs, 400 cfs, 600 cfs, and 800 cfs.

To interpolate target daily flows higher than 11,000 cfs, a power function was fitted to the WUA values for the 10 higher flows in the composite WUA-flow relationship (*Q* ranging from 7,000 cfs through 11,000 cfs). The equation of the fitted power function was $\ln(WUA) = 22.230782 - 1.071176 \times \ln(Q)$, and had a coefficient of determination R² = 0.9949. The regression equation was used to generate 27 extrapolated WUA values for *Q* ranging from 12,000 cfs through 38,000 in increasing steps of 1,000 cfs.

The seven WUA values extrapolated from the fitted polynomial and the 27 WUA values extrapolated from the fitted power function were combined with the 30 values of the original composite WUA-flow relationship into a look-up table used for the linear interpolation of WUA values for all simulated average daily flows below Nimbus Dam with the Folsom WCM alternatives and the bases of comparison over the entire simulation period (**Table 3**). The composite WUA values in **Table 3** are plotted in **Figure 2**.

Table 3. Composite WUA Values for Fall-run Chinook Salmon Spawning in the Lower American River Used as Look-up Table for Linear Interpolation of Spawning WUA Values for Simulated Average Daily Flows below Nimbus Dam.

Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)	Flow (cfs)	WUA (ft²)
0	0	2,800	810,552	9,000	258,849	23,000	96,057
50	61,922	3,000	779,982	9,400	249,130	24,000	91,776
100	120,953	3,400	745,172	9,800	245,933	25,000	87,850
200	230,584	3,800	672,903	10,400	225,180	26,000	84,235
400	417,855	4,200	607,384	11,000	210,972	27,000	80,898
600	565,864	4,600	542,402	12,000	192,835	28,000	77,807
800	678,846	5,000	494,912	13,000	176,990	29,000	74,937
1,000	761,361	5,400	455,893	14,000	163,484	30,000	72,264
1,200	817,031	5,800	431,125	15,000	151,837	31,000	69,770
1,400	853,047	6,200	395,906	16,000	141,695	32,000	67,437
1,600	871,959	6,600	369,760	17,000	132,786	33,000	65,250
1,800	877,804	7,000	346,898	18,000	124,900	34,000	63,197
2,000	881,528	7,400	324,186	19,000	117,872	35,000	61,265
2,200	881,905	7,800	305,059	20,000	111,570	36,000	59,444
2,400	866,405	8,200	289,010	21,000	105,889	37,000	57,724
2,600	840,949	8,600	272,509	22,000	100,741	38,000	56,099

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

🟧 WUA values obtained through extrapolation using a power function (see text for details).

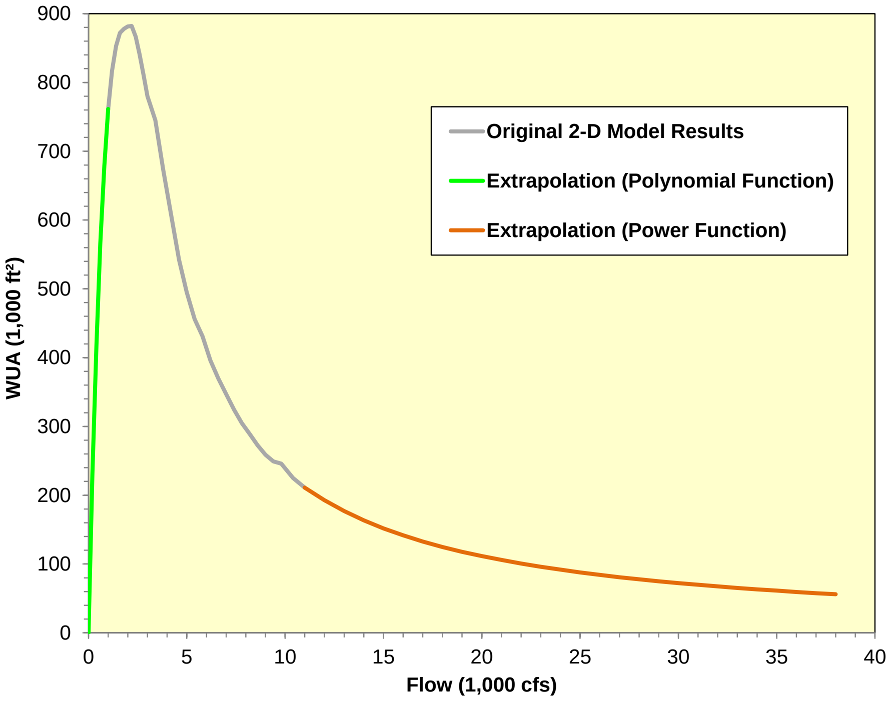

Figure 2. Final Relationship between the Composite Chinook Salmon Spawning WUA and Flow in the Lower American River.

1.1.2.2 Steelhead

Figure 3 displays the WUA-flow relationships developed for lower American River steelhead. As with Figure 1, the WUA-flow relationships for the five studied reaches (Sailor Bar, Above Sunrise, Sunrise, El Manto, and Rossmoor) are shown as connected colored circles. The composite WUA-flow relationship, resulting from the sum of the reach specific relationships, is indicated as a gray line. The white circle on this line, with coordinates WUA = 285,665 ft² and Q = 2,200 cfs, indicates the maximum WUA for all five steelhead spawning reaches combined.

The WUA-flow relationships developed for lower American River steelhead spawning were based on:

- A depth HSC developed from 192 observations of lower American River steelhead redds made by the U.S. Bureau of Reclamation (Reclamation) during 2003 and 2004 (Hannon and Deason 2004) (Figure 4);
- A substrate HSC developed from 190 observations of lower American River steelhead redds made by Reclamation during 2003 and 2004 (Figure 5);
- A velocity HSC developed from 27 observations of lower American River steelhead redds made by the California Department of Fish and Wildlife (CDFW) in 1992 (USFWS 1996); and
- Hydraulic and structural data collected by the U.S. Fish and Wildlife Service (USFWS) and described in USFWS (2003).

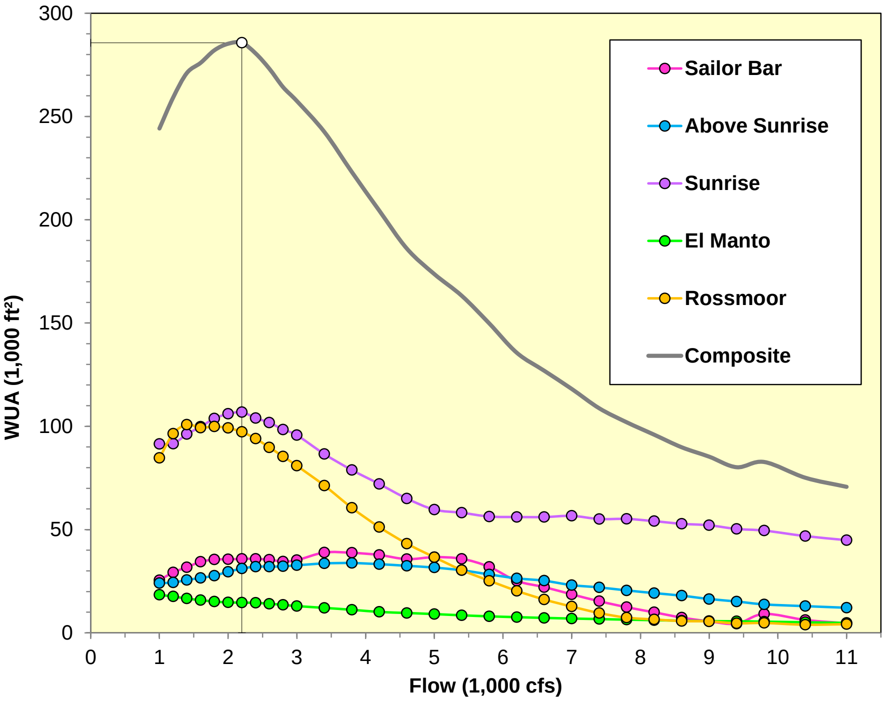

Figure 3. Relationship between Steelhead Spawning WUA and Flow for the Five lower American River Study Reaches and for the Composite WUA of the Five Study Reaches.

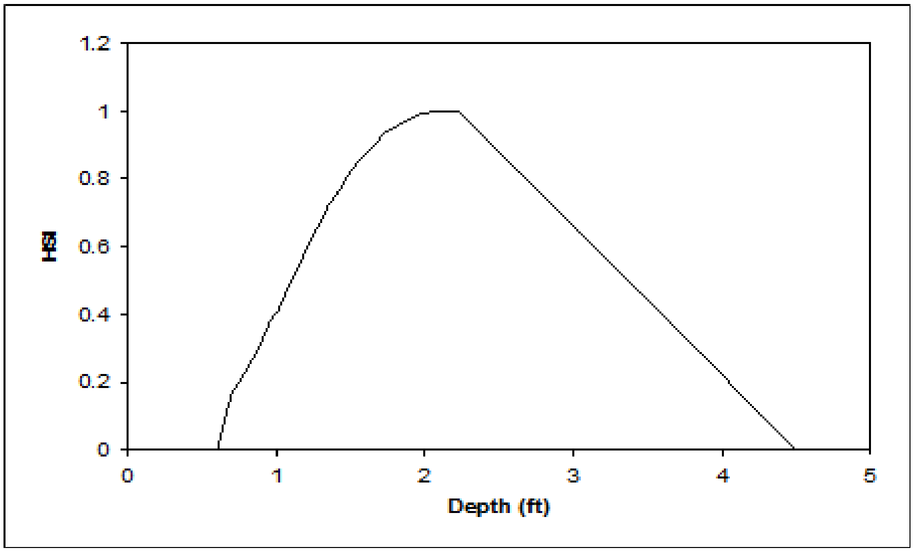

Figure 4. Habitat Suitability Curve based on Lower American River Steelhead Redd Depth Data Collected by Reclamation in 2003 and 2004.

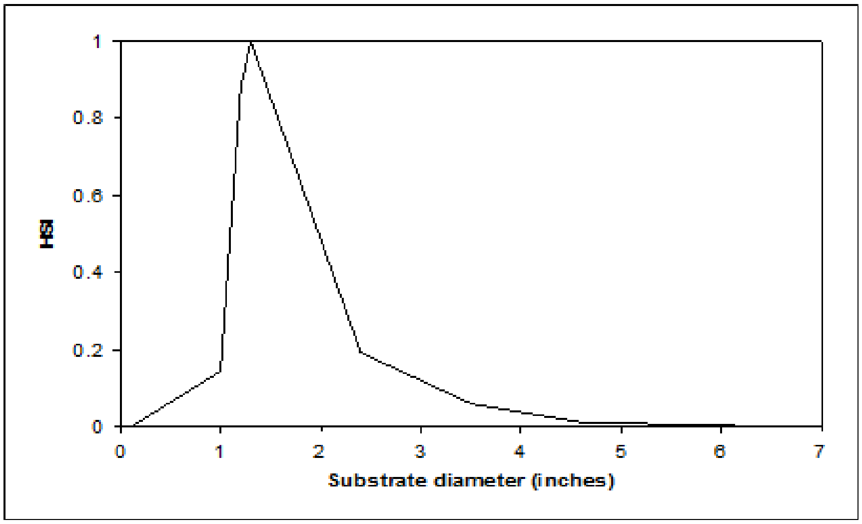

Figure 5. Habitat Suitability Curve Based on Lower American River Steelhead Substrate Diameter Collected by Reclamation in 2003 and 2004.

As with the composite spawning WUA-flow relationship for Chinook salmon, the steelhead composite spawning WUA relationship also has 30 data points corresponding to flows ranging from 1,000 cfs through 11,000 cfs that were used for the direct linear interpolation of target daily flows $Q_{d,Y}$ describing simulated average daily flow below Nimbus Dam between 1,000 cfs and 11,000 cfs with the Folsom WCM alternatives and the bases of comparison. The steelhead composite WUA curve also required extrapolations to account for flows outside the 1,000–11,000 cfs range.

To interpolate WUA values at target daily flows lower than 1,000 cfs, a polynomial function was fitted to the WUA values for the seven lowest flows in the composite WUA-flow relationship (Q = 1,000 cfs, 1,200 cfs, 1,400 cfs, 1,600 cfs, 1,800 cfs, 2,000 cfs, and 2,200 cfs). The equation of the fitted polynomial was $WUA = 476.638 \times Q - 0.327497 \times Q^2 + 0.000110 \times Q^3 - 1.49 \times 10^{-8} \times Q^4$, and had a coefficient of determination $R^2 = 0.9999$. The polynomial equation was used to generate seven extrapolated WUA values for Q = 0 cfs, 50 cfs, 100 cfs, 200 cfs, 400 cfs, 600 cfs, and 800 cfs.

To interpolate WUA values at target daily flows higher than 11,000 cfs, a power function was fitted to the WUA values for the 10 higher flows in the composite WUA-flow relationship (Q ranging from 7,000 cfs through 11,000 cfs). The equation of the fitted power function was $\ln(WUA) = 21.407234 - 1.101644 \times \ln(Q)$, and had a coefficient of determination $R^2 = 0.97999$. The regression equation was used to generate 27 extrapolated WUA values for Q ranging from 12,000 cfs through 38,000 cfs in increasing steps of 1,000 cfs. The seven WUA values extrapolated from the fitted polynomial and the 27 WUA values extrapolated from the fitted power function were combined with the 30 values of the original composite WUA-flow relationship into a look-up table used for the linear interpolation of WUA values for all simulated average daily flows below Nimbus Dam with the Folsom WCM alternatives and the bases of comparison over the entire simulation period (**Table 4**). The composite steelhead spawning WUA values in Table 4 are plotted in **Figure 6**.

Table 4. Composite WUA Values for Steelhead Spawning in the Lower American River Used as Look-up Table for Linear Interpolation of Spawning WUA Values for Simulated Average Daily Flows below Nimbus Dam.

Flow (cfs)	WUA (ft²)
0	0
50	23,027
100	44,497
200	83,084
400	144,912
600	189,906
800	221,915
1,000	244,184
1,200	259,200
1,400	271,081
1,600	275,989
1,800	282,068
2,000	285,223
2,200	285,665
2,400	280,536
2,600	273,113
2,800	264,182
3,000	257,478
3,400	242,542
3,800	223,125
4,200	204,398
4,600	186,065
5,000	173,712
5,400	163,188
5,800	149,814
6,200	135,625
6,600	126,901
7,000	118,107
7,400	108,736
7,800	101,952
8,200	95,945
8,600	89,863
9,000	85,313
9,400	80,198
9,800	82,740
10,400	75,103
11,000	70,711
12,000	63,568
13,000	58,203
14,000	53,640
15,000	49,714
16,000	46,302
17,000	43,311
18,000	40,668
19,000	38,316
20,000	36,211
21,000	34,316
22,000	32,602
23,000	31,044
24,000	29,622
25,000	28,319
26,000	27,122
27,000	26,017
28,000	24,995
29,000	24,048
30,000	23,166
31,000	22,344
32,000	21,576
33,000	20,857
34,000	20,182
35,000	19,548
36,000	18,951
37,000	18,387
38,000	17,855

🟨 WUA values obtained through extrapolation using a polynomial function (see text for details).

🟧 WUA values obtained through extrapolation using a power function (see text for details).

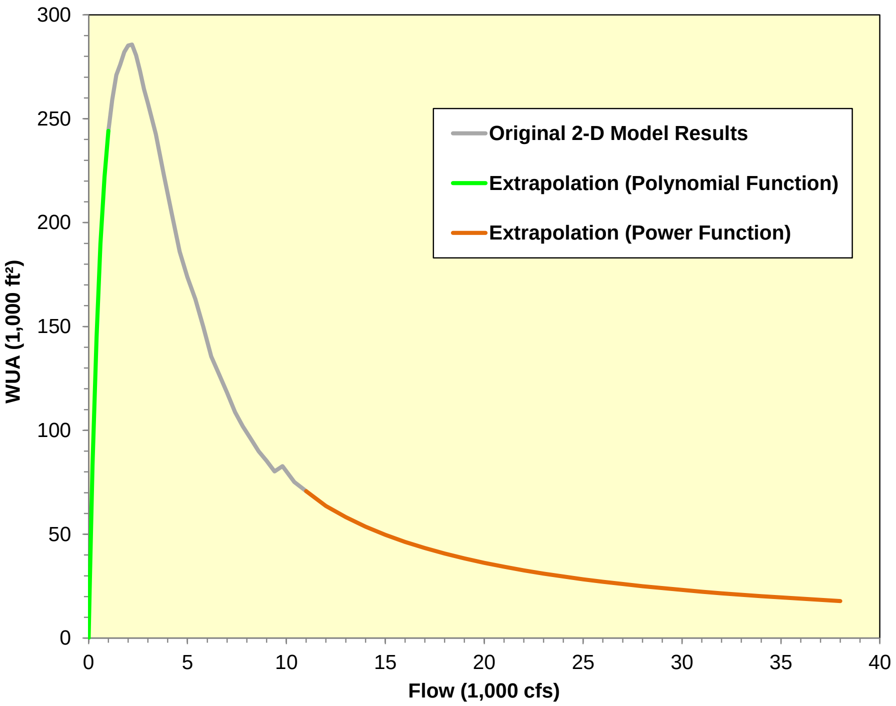

Figure 6. Final Relationship between the Composite Steelhead Spawning WUA and Flow in the Lower American River.

1.1.3 Temporal Weighting Coefficients

Because $CWUA_Y$ in equation 1 is a scaled composite WUA for a species spawning over various months of its spawning season, and because the species' spawning intensity does not remain constant throughout the spawning season, the temporal weighting coefficients w_d were incorporated into equation 1 to account for the expected relative spawning intensity on a particular day. Each w_d is a proportion with a value between 0 and 1, so that, for a given species, the sum of the daily proportions over the assumed spawning period is equal to 1.

In general, to calculate the temporal weighting coefficients, spawning timing is described as an asymmetric logistic function of time. The asymmetric logistic function, also known as Richards sigmoidal curve (Ratkowsky 1983), has the following expression:

$$Y_D = \left(\frac{1}{1 + \exp\left(\alpha + \beta \times D\right)} \right)^{1/\delta} \tag{2}$$

where Y_D is the expected cumulative proportion of spawning through day D, and α, β, and δ are parameters that determine the shape of the cumulative curve. The variable D is a continuous variable that indicates the day number at which new spawning occurs during a particular spawning season, counting from a particular starting date. In order to estimate the values of α, β, and δ, the daily cumulative proportions of newly built redds, reported in available annual redd survey reports, were normally used as a proxy for Y_D and were fitted to the asymmetric logistic model through a nonlinear least-squares procedure. In the case of fall-run Chinook salmon spawning in the lower American River, the data describing Y_D arose from combining information in available carcass and redd survey annual reports (see **Section 1.1.3.1** for details).

Once equation 2 was fitted to the data available for a particular species, the fitted curve was rescaled to the commonly accepted spawning period of the species, and the daily temporal weighting coefficients w_d were calculated by subtraction. For example, if $\hat{Y}_D$ is the value of the fitted asymmetric logistic curve at a given day D for a species that spawns in the lower American River from January 1 through April 15, the temporal weighting coefficient for February 15 ($w_{Feb.15}$) is calculated as:

$$w_{Feb.15} = \left(\hat{Y}_{2/16/Year} - \hat{Y}_{2/15/Year}\right) \Big/ \left(\hat{Y}_{4/15/Year} - \hat{Y}_{1/01/Year}\right).$$

1.1.3.1 Fall-run Chinook Salmon

The temporal weighting coefficients and spawning period used for fall-run Chinook salmon spawning in the lower American River were derived from data collected by both redd surveys and carcass surveys. Redd surveys that provide the cumulative distribution of newly built redds over time, which is a better descriptor of spawning timing, were performed only during the 1991/92 through the 1995/96 fall-run Chinook salmon spawning seasons (Snider and McEwan 1992; Snider, Urquhart, McEwan, and Munos 1993; Snider and Vyverberg 1995, 1996; Snider et al. 1996). On the other hand, fall-run Chinook salmon carcass surveys have been performed annually since the late 1960s, and data or reports are available for all surveys performed from October 1992 through October 2012 (e.g., Snider and Bandner 1996; Snider and Reavis 1996; Snider, Keenan, and Munos 1993; Snider et al. 1995; Healey 2002, 2003, 2004, 2005, 2006; Healey and Fresz 2007; Healey and Redding 2008; Vincik and Kirsch 2009; Vincik and Mamola 2010; Maher et al. 2012; Phillips and Helstab 2013; Phillips and Maher 2013).

The temporal distributions of fresh carcasses described in these reports can be used to estimate an overall cumulative distribution of fresh carcasses over time that describe when fresh carcasses appear in the surveys, which is subsequent to the actual time of spawning. When appropriately lagged by the time elapsing between spawning and appearance of fresh carcasses in the surveys, the carcass surveys also describe spawning timing. The time elapsing between spawning and redd-construction and post-spawning mortality, or life expectancy after spawning, has been reported to normally be between 2 and 4 weeks (Briggs 1953).

To take advantage of the potential information in the available redd and carcass surveys on fall-run Chinook salmon spawning timing in the lower American River, USACE developed a five-step procedure to estimate the sigmoidal curve describing fall-run Chinook salmon spawning timing in the lower American River that was used to calculate the temporal weighting coefficients for the composite WUA equation 1. The five-step procedure consists of the following steps:

1. Fit an asymmetric logistic function to the daily cumulative proportions of newly built redds obtained from the four annual photogrammetric redd surveys performed during the 1992/93 through the 1995/96 fall-run Chinook salmon spawning seasons.
2. Fit an asymmetric logistic function to the daily cumulative proportions of fresh carcasses obtained from the four carcass surveys performed during the 1992/93 through the 1995/96 fall-run Chinook salmon spawning seasons.
3. Calculate the lag times between the fitted redd and fresh carcass cumulative distributions (i.e., the number of days separating similar cumulative proportions under the asymmetric logistic functions fitted in steps 1 and 2).
4. Fit an asymmetric logistic function to the daily cumulative proportions of fresh carcasses obtained from the available carcass surveys performed during the 1992/93 through the 2012/13 fall-run Chinook salmon spawning seasons.
5. Apply the lag times calculated in step 3 to the curve fitted in step 4 by subtracting the corresponding lag times from the days for particular cumulative proportions of fresh carcasses expected under the curve obtained in step 4. The resulting lagged asymmetric logistic function was used to describe fall-run Chinook salmon spawning timing in the lower American River based on carcass surveys from 1992/93 through the 2012/13 fall-run Chinook salmon spawning seasons and to calculate the temporal weighting coefficients for the species.

During the four photogrammetric redd surveys performed from late September or October through early January during the 1992/93 through the 1995/96 fall-run Chinook salmon spawning seasons, a total of 14,084 newly built redds were counted, ranging from a low of 1,138 redds during the 1992/93 spawning season to a high of 6,205 redds during the 1993/94 spawning season. Given the variation in total number of redds counted each season, as well as the number of weekly aerial surveys performed during each spawning season, a weighted nonlinear least-squares procedure was used to fit the common asymmetric logistic function (equation 2) to the four sets of daily cumulative proportions of newly built redds.

The weights were calculated as the ratio of the annually counted redds to the overall total number of counted redds (14,084 newly-built redds). For example, the 13 daily cumulative proportions of redds built during the 1992/93 spawning season each received a weight of 0.0808 (1,138/14,084 = 0.0808), while the seven daily cumulative proportions of redds built during the 1995/96 spawning season each received a weight of 0.2823 (3,976/14,084 = 0.2823). The common asymmetric logistic function fitted to the redd data had the following expression:

$$Y_D = \left(\frac{1}{1 + \exp\left(8.6114 - 0.1430 \times D\right)} \right)^{1/0.2330} \qquad \textbf{(3)}$$

where *D* is the day number at which new redds were observed during a particular annual survey, counted from midnight of August 31 of each year. The mean-square error of this fit was 0.0513. **Figure 7** displays the four sets of daily cumulative proportions and the fitted curve of equation 3.

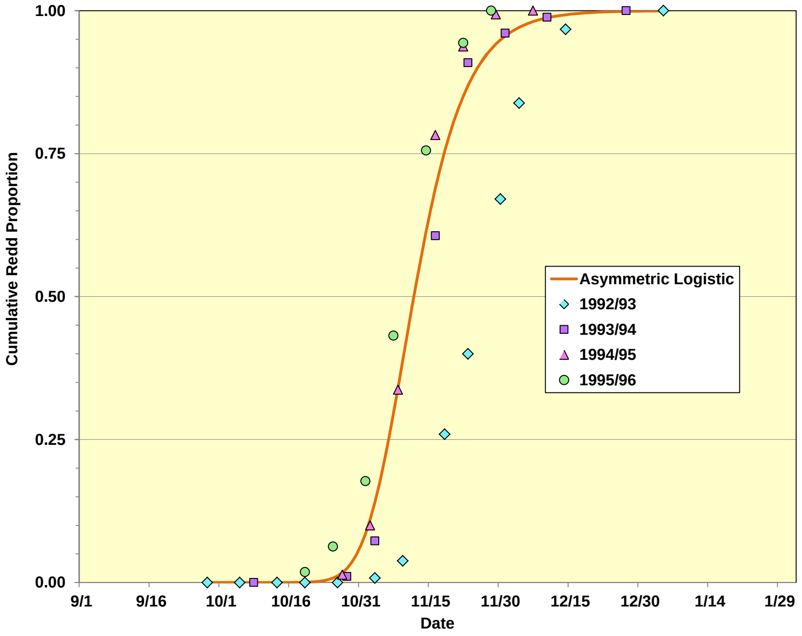

Figure 7. Fall-run Chinook Salmon Cumulative Proportions of Redds in the Lower American River, during the 1992/93 – 1995/96 Spawning Seasons, and Fitted Asymmetric Logistic Curve.

During the four carcass surveys performed from October through mid-January during the 1992/93 spawning season through the 1995/96 fall-run Chinook salmon spawning season, a total of 5,788 fresh carcasses were counted, ranging from a low of 360 fresh carcasses during the 1992/93 spawning season to a high of 1,980 fresh carcasses during the 1995/96 spawning season. A weighted nonlinear least-squares procedure was used to fit the common asymmetric logistic function (equation 2) to the four sets of daily cumulative proportions of fresh carcasses. The weights were calculated as the ratio of the annually counted fresh carcasses to the overall number of counted fresh carcasses (5,788 carcasses). For example, the 18 daily cumulative proportions of fresh carcasses of the 1992/93 spawning season each received a weight of 0.0627 (360/5,788 = 0.0622), while the 11 daily cumulative proportions of fresh carcasses of the 1995/96 spawning season each received a weight of 0.3419 (1,980/5,788 = 0.3421).

Figure 8 displays the four sets of daily cumulative proportions and the fitted asymmetric logistic curve of equation 4.

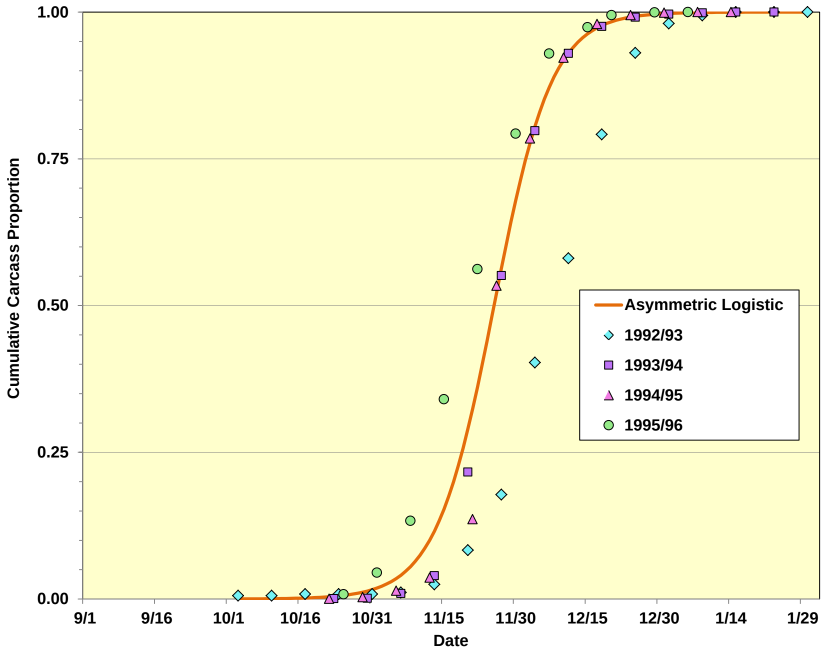

Figure 8. Fall-run Chinook Salmon Cumulative Proportions of Fresh Carcasses in the Lower American River, during the 1992/93 – 1995/96 Spawning Seasons, and Fitted Asymmetric Logistic Curve.

The common asymmetric logistic function fitted to the fresh carcass data had the following expression:

$$Y_D = \left(\frac{1}{1 + \exp\left(14.5710 - 0.1677 \times D\right)} \right)^{1/1.0518} . \qquad \textbf{(4)}$$

The mean-square error of this fit was 0.0396.

As part of the third procedural step in which the lag times between the fitted redd and fresh-carcass cumulative distributions were computed, the parameter values of equations 3 and 4 were applied to the following equation:

$$D_{Y'} = \frac{\ln\left[\left(\frac{1}{Y'}\right)^{\hat{\delta}} - 1\right] - \hat{\alpha}}{\hat{\beta}}, \qquad \textbf{(5)}$$

where *Y'* are particular expected cumulative proportions under fitted equations 3 and 4 (e.g., 0.05, 0.15, 0.25, 0.5, etc.), $D_{Y'}$ are the days at which those proportions are achieved, and $\hat{\alpha}$, $\hat{\beta}$, and $\hat{\delta}$ are the parameter values in equations 3 and 4. After calculating equation 5 with both sets of parameter estimates, there were two $D_{Y'}$ values for each particular expected cumulative proportion *Y'*, one for the fitted redd cumulative distribution (equation 3) and the other for the fitted fresh carcass cumulative distribution (equation 4). The lag times between the fitted redd and fresh carcass cumulative distributions were then calculated as the differences between the pairs of $D_{Y'}$ values (**Table 5**).

Table 5. Lag Times between Cumulative Proportions (*Y'*%) of the Redd and Fresh Carcass Cumulative Distributions Fitted to Data for the 1992/93 – 1995/96 Chinook Salmon Spawning Seasons.

Cumulative Proportion (*Y'*%)	Day under Fitted Redd Cumulative Curve ($D_{Y'}$)	Day under Fitted Carcass Cumulative Curve ($D_{Y'}$)	Lag Time (days)
1%	55.64	58.05	2.42
5%	60.15	68.36	8.21
15%	64.32	75.86	11.54
25%	66.96	79.77	12.82
50%	72.39	86.47	14.08
75%	78.88	93.09	14.22
85%	82.97	96.91	13.93
95%	91.13	104.14	13.01
99%	102.56	113.99	11.43

$D_{Y'}$ and lag times are expressed in decimal days counted from the midnight of August 31 ($D_{Y'} = 0$)

As part of the fourth procedural step, a new asymmetric logistic function was fitted to the daily cumulative proportions of fresh carcasses obtained from the available carcass surveys performed during the 1992/93 through the 2012/13 fall-run Chinook salmon spawning seasons to incorporate any additional information on spawning timing not present in the shorter data sets used in steps 1 and 2. As with previous fits, a weighted least-square procedure was used. These weights were also calculated as the ratios of the annually counted fresh carcasses of a season to the overall number of counted fresh carcasses (38,366 carcasses). Thus, for example, the weight for the 13 daily cumulative proportions of fresh carcasses of the 1992/93 spawning season became 0.0094 (360/38,366 = 0.0094).

Equation 6 and **Figure 9** display the results of this new fitted asymmetric logistic function.

$$Y_D = \left(\frac{1}{1 + \exp\left(8.3944 - 0.1100 \times D\right)} \right)^{1/0.5373} . \qquad \textbf{(6)}$$

The mean-square error of this fit was 0.0220.

Finally, as part of the fifth procedural step, the parameter values of equation 6 were applied to equation 5 to calculate new $D_{Y'}$ values (i.e., days at particular cumulative proportions of the new fitted curve), and the lag times in Table 5 were subtracted from the new $D_{Y'}$ values. The resulting lagged asymmetric logistic curve had the following expression:

$$Y_D = \left(\frac{1}{1 + \exp\left(1.2818 - 0.1010 \times D\right)} \right)^{1/0.0046} . \qquad \textbf{(7)}$$

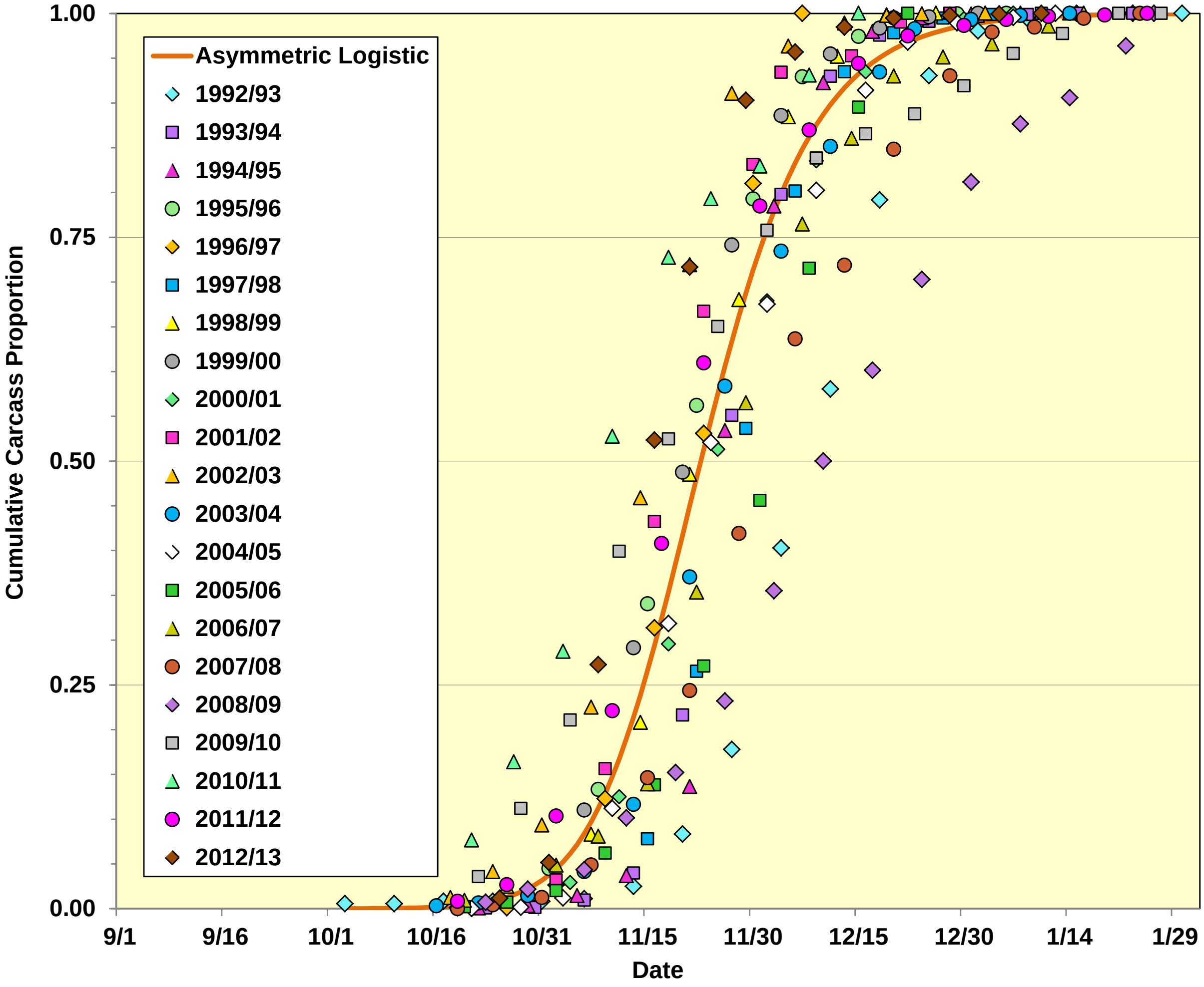

Figure 9. Fall-run Chinook Salmon Cumulative Proportions of Fresh Carcasses in the Lower American River, during the 1992/93 – 2012/13 Spawning Seasons, and Fitted Asymmetric Logistic Curve.

Figure 10 displays the four asymmetric logistic curves obtained from the five-step procedure used to describe fall-run Chinook salmon spawning timing in the lower American River.

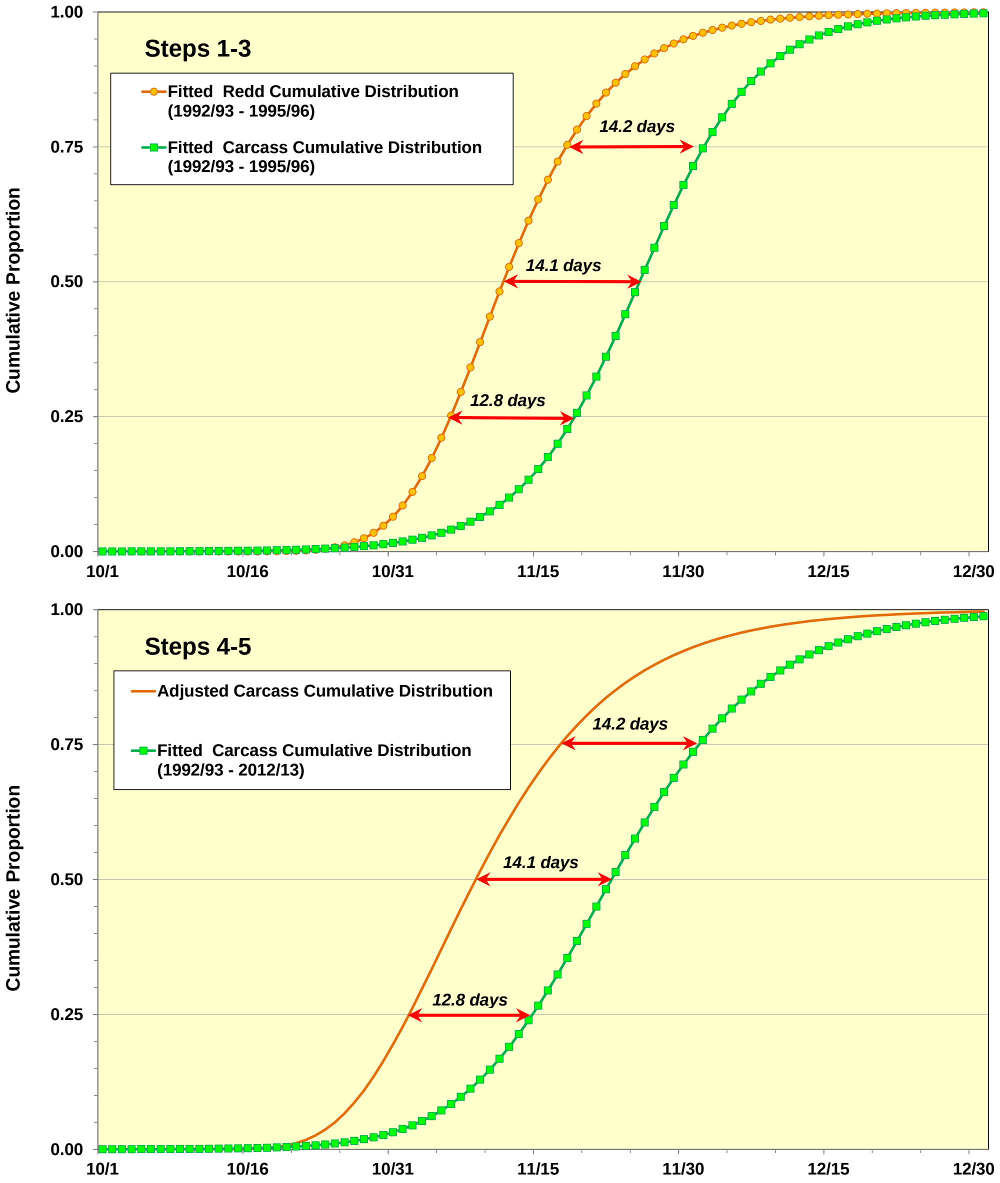

Figure 10. Asymmetric Logistic Curves Obtained from the Five-Step Procedure Used to Describe Fall-run Chinook Salmon Spawning Timing in the Lower American River during the 1992/93 – 2012/13 Spawning Seasons.

The lagged asymmetric logistic curve of equation 7 was used to calculate expected daily spawning proportions by subtraction. Finally, the daily temporal coefficients for fall-run Chinook salmon were obtained by rounding the daily proportions to four decimal places and rescaling to the sum of the rounded proportions. Figure 11 and Table 6 display the final daily weighting coefficients for fall-run Chinook salmon spawning in the lower American River, and the resulting spawning period used in the calculation of the scaled composite WUA annual index ($CWUA_Y$) for the fall-run Chinook salmon. The resulting spawning period extends from October 13 through January 18, a period of K = 98 days.

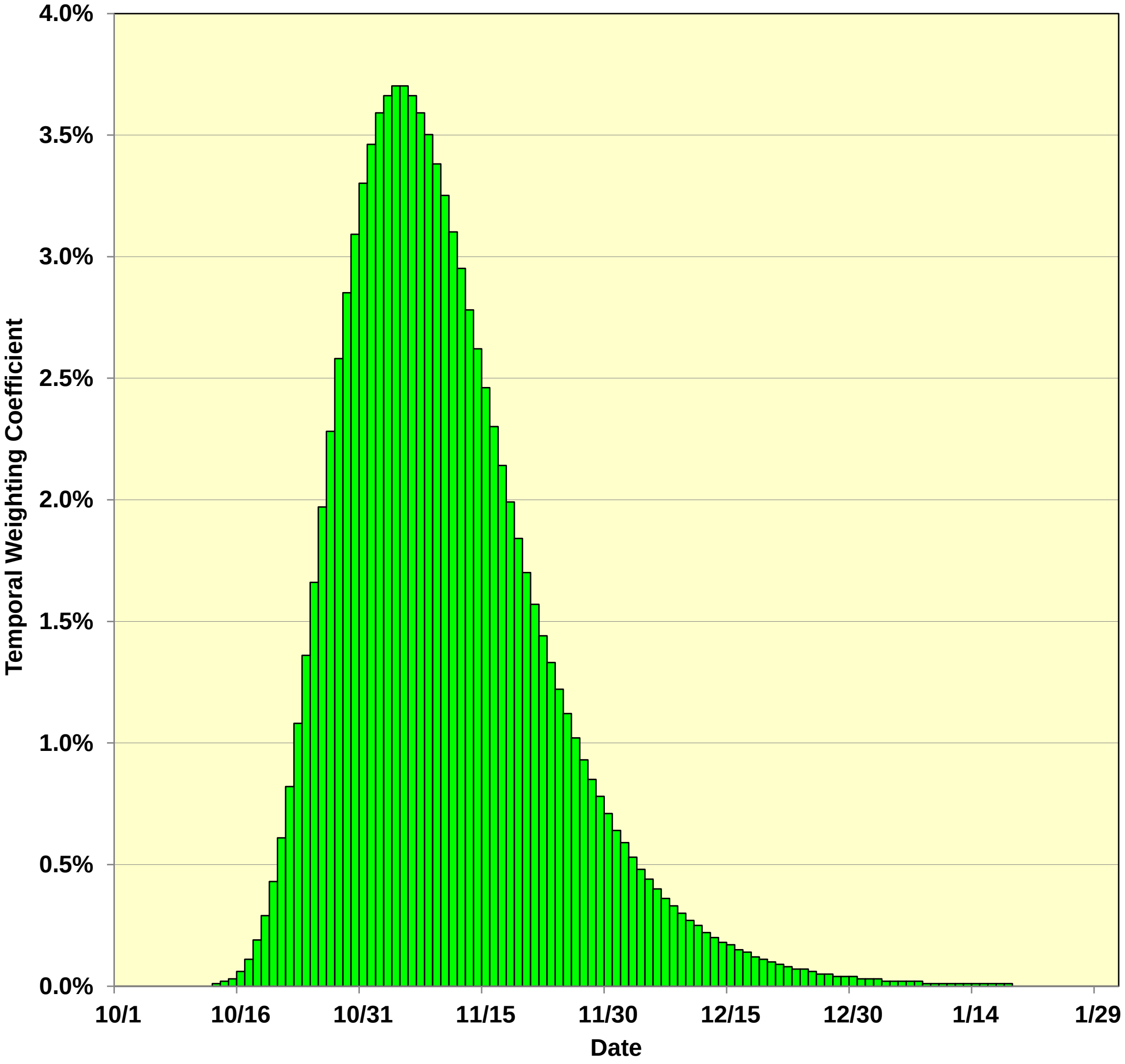

Figure 11. Daily Temporal Weighting Coefficients Used for Fall-run Chinook Salmon Spawning in the Lower American River from October 13 through January 18.

Table 6. Temporal Weighting Coefficients Used for Fall-run Chinook Salmon Spawning in the Lower American River.

Day	Lagged Carcass Fit (%)	Temporal Weighting Coefficient	Day	Lagged Carcass Fit (%)	Temporal Weighting Coefficient
10/12	0.00%	0.000000	**12/1**	0.64%	0.006403
10/13	0.01%	0.000100	**12/2**	0.59%	0.005903
10/14	0.02%	0.000200	**12/3**	0.53%	0.005303
10/15	0.03%	0.000300	**12/4**	0.48%	0.004802
10/16	0.06%	0.000600	**12/5**	0.44%	0.004402
10/17	0.11%	0.001101	**12/6**	0.40%	0.004002
10/18	0.19%	0.001901	**12/7**	0.36%	0.003602
10/19	0.29%	0.002901	**12/8**	0.33%	0.003302
10/20	0.43%	0.004302	**12/9**	0.30%	0.003002
10/21	0.61%	0.006103	**12/10**	0.27%	0.002701
10/22	0.82%	0.008204	**12/11**	0.25%	0.002501
10/23	1.08%	0.010805	**12/12**	0.22%	0.002201
10/24	1.36%	0.013607	**12/13**	0.20%	0.002001
10/25	1.66%	0.016608	**12/14**	0.18%	0.001801
10/26	1.97%	0.019710	**12/15**	0.17%	0.001701
10/27	2.28%	0.022811	**12/16**	0.15%	0.001501
10/28	2.58%	0.025813	**12/17**	0.14%	0.001401
10/29	2.85%	0.028514	**12/18**	0.12%	0.001201
10/30	3.09%	0.030915	**12/19**	0.11%	0.001101
10/31	3.30%	0.033017	**12/20**	0.10%	0.001001
11/1	3.46%	0.034617	**12/21**	0.09%	0.000900
11/2	3.59%	0.035918	**12/22**	0.08%	0.000800
11/3	3.66%	0.036618	**12/23**	0.07%	0.000700
11/4	3.70%	0.037019	**12/24**	0.07%	0.000700
11/5	3.70%	0.037019	**12/25**	0.06%	0.000600
11/6	3.66%	0.036618	**12/26**	0.05%	0.000500
11/7	3.59%	0.035918	**12/27**	0.05%	0.000500
11/8	3.50%	0.035018	**12/28**	0.04%	0.000400
11/9	3.38%	0.033817	**12/29**	0.04%	0.000400
11/10	3.25%	0.032516	**12/30**	0.04%	0.000400
11/11	3.10%	0.031016	**12/31**	0.03%	0.000300
11/12	2.95%	0.029515	**1/1**	0.03%	0.000300
11/13	2.78%	0.027814	**1/2**	0.03%	0.000300
11/14	2.62%	0.026213	**1/3**	0.02%	0.000200
11/15	2.46%	0.024612	**1/4**	0.02%	0.000200
11/16	2.30%	0.023012	**1/5**	0.02%	0.000200
11/17	2.14%	0.021411	**1/6**	0.02%	0.000200
11/18	1.99%	0.019910	**1/7**	0.02%	0.000200
11/19	1.84%	0.018409	**1/8**	0.01%	0.000100
11/20	1.70%	0.017009	**1/9**	0.01%	0.000100
11/21	1.57%	0.015708	**1/10**	0.01%	0.000100
11/22	1.44%	0.014407	**1/11**	0.01%	0.000100
11/23	1.33%	0.013307	**1/12**	0.01%	0.000100
11/24	1.22%	0.012206	**1/13**	0.01%	0.000100
11/25	1.12%	0.011206	**1/14**	0.01%	0.000100
11/26	1.02%	0.010205	**1/15**	0.01%	0.000100
11/27	0.93%	0.009305	**1/16**	0.01%	0.000100
11/28	0.85%	0.008504	**1/17**	0.01%	0.000100
11/29	0.78%	0.007804	**1/18**	0.01%	0.000100
11/30	0.71%	0.007104	**Totals**	99.95%	1

1.1.3.2 Steelhead

The temporal weighting coefficients used for steelhead spawning in the lower American River were derived from the steelhead redd surveys performed by Reclamation and CDFW from February 2002 through April 2013 (Chase 2010; Hannon 2011, 2012, 2013; Hannon and Healey 2002; Hannon et al. 2003; Hannon and Deason 2004, 2005, 2007; See and Chase 2009). Steelhead redd surveys have been conducted in the lower American River from as early as mid-December through as late as mid-June of the following year, and the available data correspond to 10 spawning seasons: 2001/02, 2002/03, 2003/04, 2004/05, 2006/07, 2008/09, 2009/10, 2010/11, 2011/12, and 2012/13. No redd surveys were conducted during the 2005/06 spawning season because of high flows and low water clarity, or during the 2007/08 season.

Redd surveys normally start in middle or late December and sample the month of January to ensure that the monitoring includes the annual initiation of the steelhead spawning season. However, the surveys conducted during the 2001/02 and 2008/09 seasons did not start until February 7, 2002, and February 11, 2009, respectively, when steelhead spawning was already in progress. To avoid any potential bias introduced by the data in these incomplete surveys, USACE did not include the steelhead cumulative proportions of newly constructed redds derived from these surveys in the fitting of the asymmetric logistic function (equation 2) that produced the temporal weighting coefficients for steelhead spawning in the lower American River.

Figure 12 displays the eight sets of daily cumulative proportions used in the fitting of the common asymmetric logistic function. To fit equation 2, the variable *D* (the days within each spawning season) was counted from midnight of November 30 of each year (*D* = 1) through midnight of July 1 of the following year, or midnight of June 30 if the following year is a leap year (*D* = 213). During the eight spawning seasons, the total number of new redds observed per season was variable (215 in 2002/03, 197 in 2003/04, 155 in 2004/05, 176 in 2006/07, 79 in 2009/10, 89 in 2010/11, 75 in 2011/12, and 317 in 2012/13). The number of weekly surveys performed during each spawning season ranged from seven weekly surveys during the 2002/03 season to 12 weekly surveys during the 2003/04 season.

Given the variation among each spawning season, a weighted nonlinear least-squares procedure was used to fit the common asymmetric logistic function (equation 2) to the eight sets of daily cumulative proportions of newly built redds. The weights were calculated as the ratio of the annually counted redds to the overall total number of counted redds over the eight sampled seasons (1,303 newly-built redds). For example, the 12 daily cumulative proportions of redds built during the 2003/04 spawning season each received a weight of 0.1512 (197/1,303 = 0.1512), while the eight daily cumulative proportions of redds built during the 2011/12 spawning season each received a weight of 0.0576 (75/1,303 = 0.0576), and the nine daily cumulative proportions of redds built during the 2012/13 spawning season each received a weight of 0.2433 (317/1,303 = 0.2433).

The resulting fitted curve had the following expression:

$$Y_D = \left(\frac{1}{1 + \exp\left(6.5517 - 0.0922 \times D\right)} \right)^{1/1.0078}, \qquad \textbf{(8)}$$

where *D* is the day number at which new steelhead redds were observed during a particular annual survey, counted from midnight of November 30 of each year. The mean-square error of this fit was 0.0250.

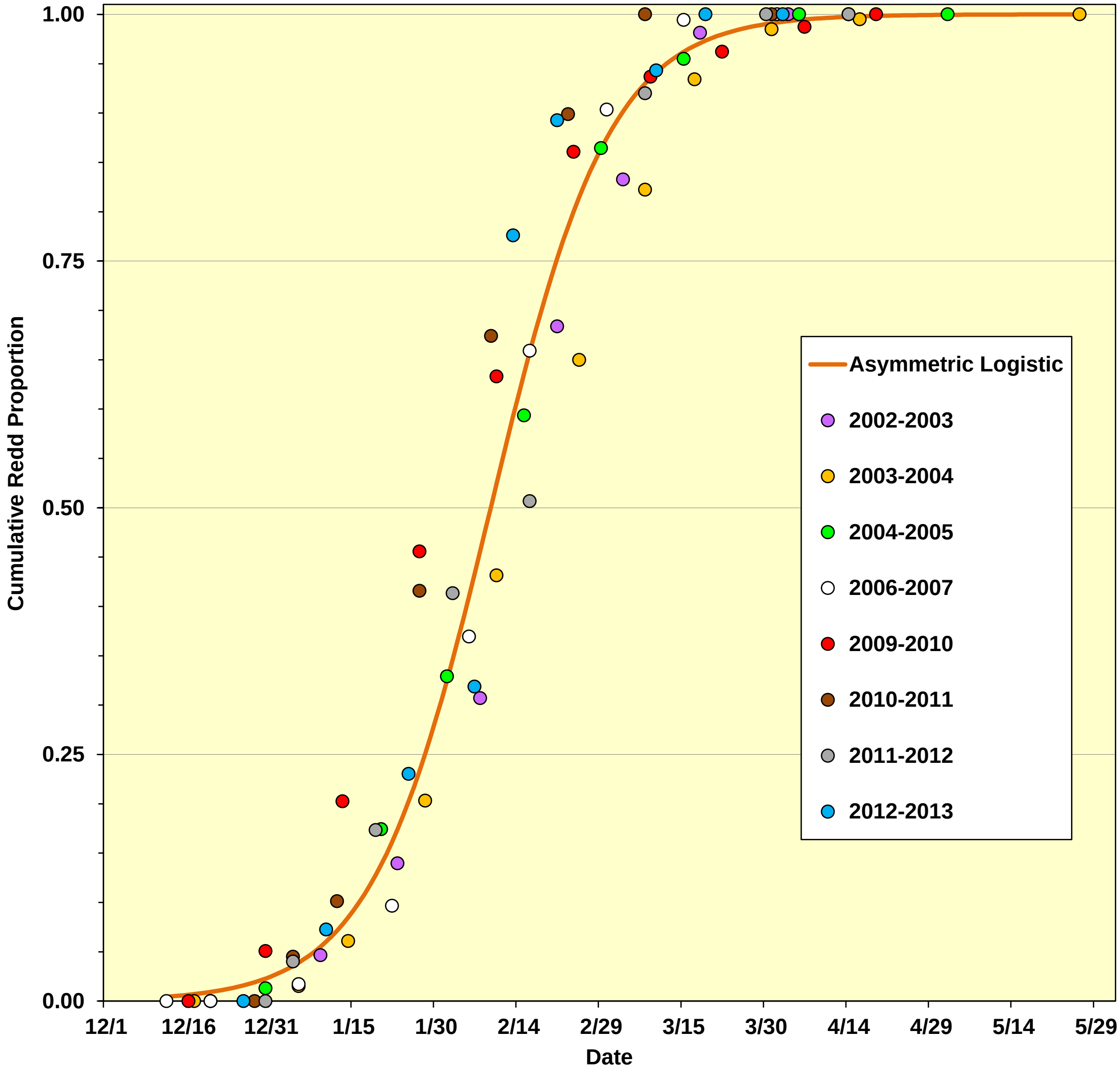

Figure 12. Steelhead Cumulative Proportions of Newly Constructed Redds in the Lower American River during the 2002/03 through 2012/13 Spawning Seasons and the Fitted Asymmetric Logistic Curve.

The cumulative distribution from equation 8 was first trimmed to daily cumulative values between 0.005 and 0.995, and the remaining daily cumulative values were used to calculate the expected daily spawning proportions by subtraction. Finally, the daily temporal coefficients for steelhead were obtained by rounding the daily proportions to four decimal places and rescaling to the sum of the rounded proportions. **Figure 13** and **Table 7** display the final daily weighting coefficients for steelhead spawning in the lower American River, and the resulting spawning period used in the calculation of the scaled composite WUA annual index ($CWUA_Y$) for steelhead. The resulting spawning period extends from December 14 through April 5, a period of K = 114 days.

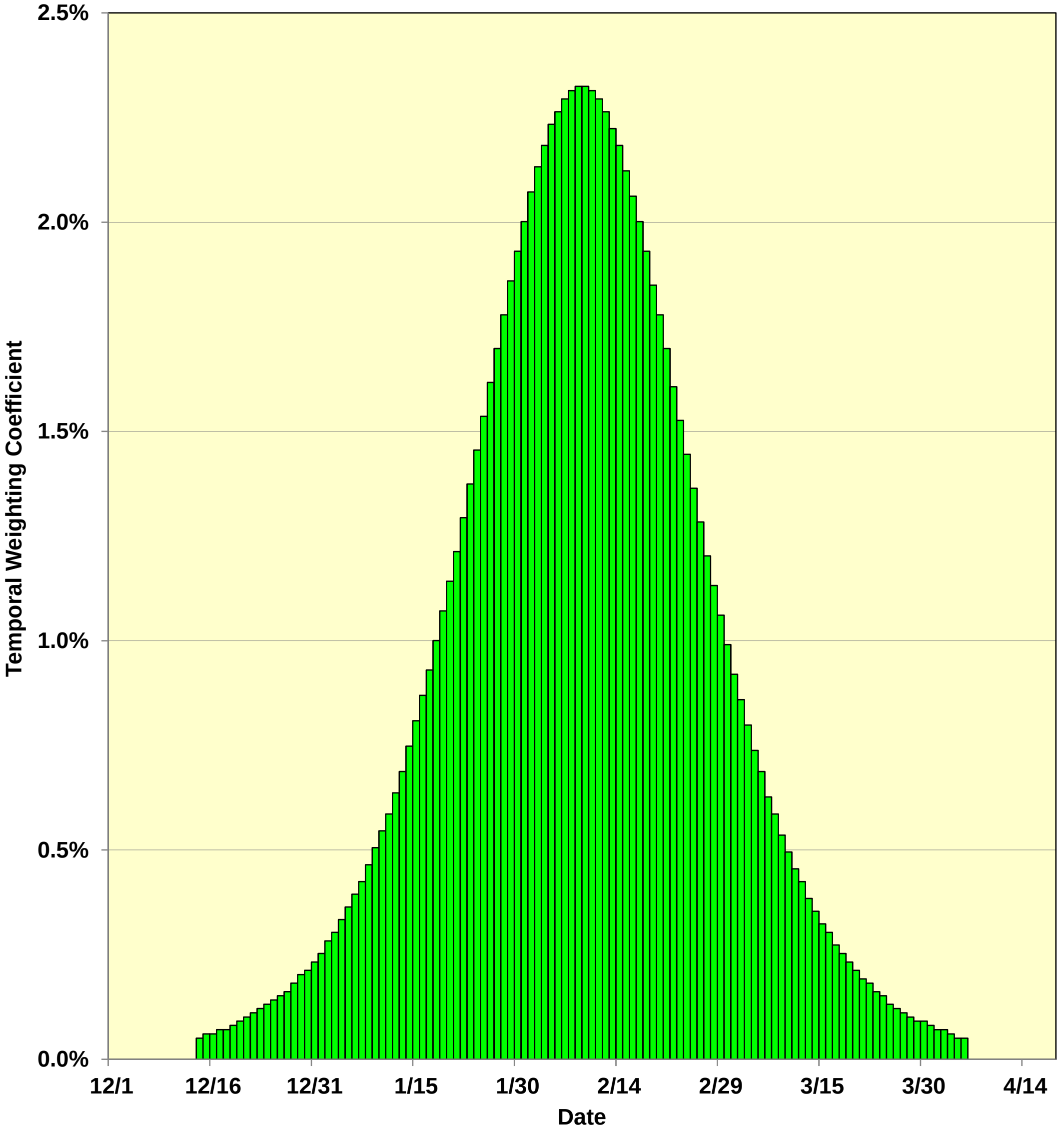

Figure 13. Daily Temporal Weighting Coefficients Used for Steelhead Spawning in the Lower American River from December 14 through April 5.

Table 7. Temporal Weighting Coefficients Used for Steelhead Spawning in the Lower American River.

Day	Estimated Redd Proportion (%)	Temporal Weighting Coefficient
12/13	0.00%	0.000000
12/14	0.05%	0.000505
12/15	0.06%	0.000606
12/16	0.06%	0.000606
12/17	0.07%	0.000707
12/18	0.07%	0.000707
12/19	0.08%	0.000809
12/20	0.09%	0.000910
12/21	0.10%	0.001011
12/22	0.11%	0.001112
12/23	0.12%	0.001213
12/24	0.13%	0.001314
12/25	0.14%	0.001415
12/26	0.15%	0.001516
12/27	0.16%	0.001617
12/28	0.18%	0.001819
12/29	0.20%	0.002021
12/30	0.21%	0.002122
12/31	0.23%	0.002325
1/1	0.25%	0.002527
1/2	0.28%	0.002830
1/3	0.30%	0.003032
1/4	0.33%	0.003335
1/5	0.36%	0.003639
1/6	0.39%	0.003942
1/7	0.42%	0.004245
1/8	0.46%	0.004649
1/9	0.50%	0.005054
1/10	0.54%	0.005458
1/11	0.58%	0.005862
1/12	0.63%	0.006367
1/13	0.68%	0.006873
1/14	0.74%	0.007479
1/15	0.80%	0.008086
1/16	0.86%	0.008692
1/17	0.92%	0.009299
1/18	0.99%	0.010006
1/19	1.06%	0.010714
1/20	1.13%	0.011421
1/21	1.20%	0.012129
1/22	1.28%	0.012937
1/23	1.36%	0.013746
1/24	1.44%	0.014554
1/25	1.52%	0.015363
1/26	1.60%	0.016171
1/27	1.68%	0.016980
1/28	1.76%	0.017789
1/29	1.84%	0.018597
1/30	1.91%	0.019305
1/31	1.98%	0.020012
2/1	2.05%	0.020720
2/2	2.11%	0.021326
2/3	2.16%	0.021831
2/4	2.21%	0.022337
2/5	2.24%	0.022640
2/6	2.27%	0.022943
2/7	2.29%	0.023145
2/8	2.30%	0.023246
2/9	2.30%	0.023246
2/10	2.29%	0.023145
2/11	2.27%	0.022943
2/12	2.24%	0.022640
2/13	2.20%	0.022236
2/14	2.16%	0.021831
2/15	2.10%	0.021225
2/16	2.04%	0.020619
2/17	1.98%	0.020012
2/18	1.91%	0.019305
2/19	1.83%	0.018496
2/20	1.76%	0.017789
2/21	1.68%	0.016980
2/22	1.59%	0.016070
2/23	1.51%	0.015262
2/24	1.43%	0.014453
2/25	1.35%	0.013645
2/26	1.27%	0.012836
2/27	1.19%	0.012027
2/28	1.12%	0.011320
2/29	1.05%	0.010612
3/1	0.98%	0.009905
3/2	0.91%	0.009197
3/3	0.85%	0.008591
3/4	0.79%	0.007985
3/5	0.73%	0.007378
3/6	0.68%	0.006873
3/7	0.62%	0.006266
3/8	0.58%	0.005862
3/9	0.53%	0.005357
3/10	0.49%	0.004952
3/11	0.45%	0.004548
3/12	0.42%	0.004245
3/13	0.38%	0.003841
3/14	0.35%	0.003537
3/15	0.32%	0.003234
3/16	0.30%	0.003032
3/17	0.27%	0.002729
3/18	0.25%	0.002527
3/19	0.23%	0.002325
3/20	0.21%	0.002122
3/21	0.19%	0.001920
3/22	0.18%	0.001819
3/23	0.16%	0.001617
3/24	0.15%	0.001516
3/25	0.13%	0.001314
3/26	0.12%	0.001213
3/27	0.11%	0.001112
3/28	0.10%	0.001011
3/29	0.09%	0.000910
3/30	0.09%	0.000910
3/31	0.08%	0.000809
4/1	0.07%	0.000707
4/2	0.07%	0.000707
4/3	0.06%	0.000606
4/4	0.05%	0.000505
4/5	0.05%	0.000505
Totals	98.94%	1

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Appendix 7F

1.1 Analysis of Potential Redd Dewatering for Lower American River Salmonids

Flow fluctuations during the fall-run Chinook salmon and steelhead embryo incubation periods are important to fisheries management because reductions in flow can decrease water surface elevations below the depth at which the redds were built. Dewatered redds can result in desiccation and the loss of eggs and developing embryos.

The biological effect of redd dewatering is determined by both the timing and duration of the desiccation and by the magnitude of the decrease in water surface elevation. For example, a decrease in flow can cause the water surface elevation to decrease only to the depth of the undisturbed bed surface without reaching the redd egg pocket that is located deeper within the redd tail spill (A in **Figure 1**). In this situation, the egg pocket can remain wetted, a situation that reduces the potential severity of the effect on eggs and developing embryos. By contrast, if the decrease in flow causes water surface elevation to drop below the depth of the egg pocket (B in Figure 1), the egg pocket can potentially desiccate, a situation that reduces the likelihood of survival of eggs and developing embryos in the redd.

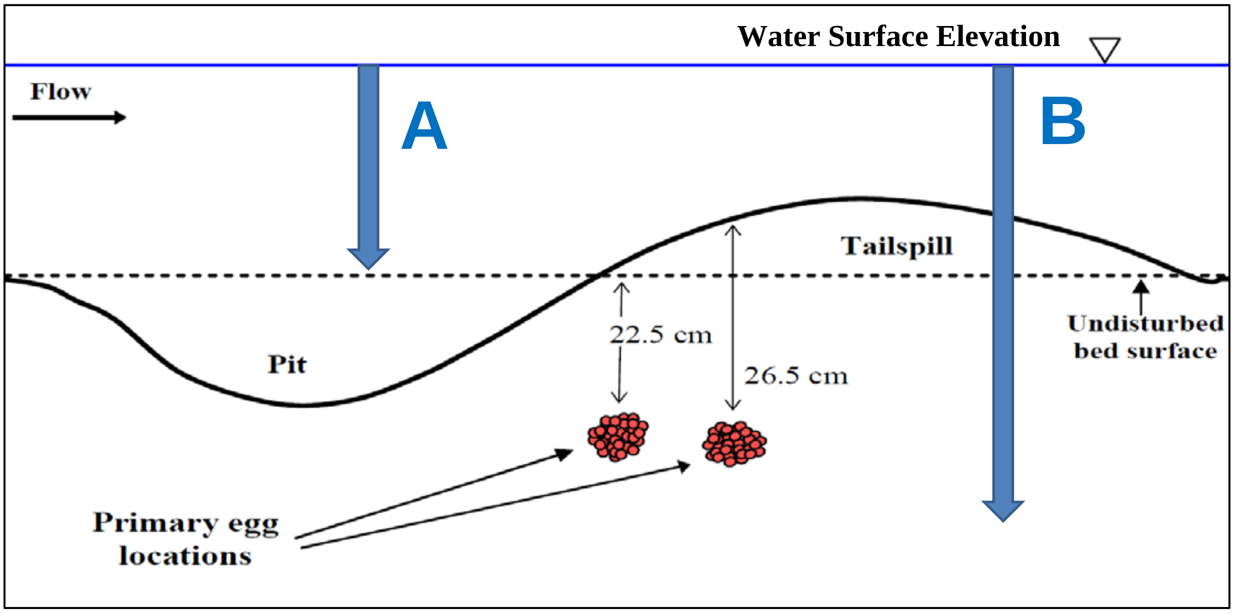


Figure 1. Diagrammatic Side View of a Chinook Salmon Redd Showing the Relative Location and Mean Depth of Egg Pockets, Modified from Evenson (2001).

Given the potentially severe effects of redd dewatering on the survival of eggs and developing embryos, other authors have attempted to directly measure redd dewatering and monitoring of the potential effect of redd dewatering in the lower American River during particular spawning seasons of fall-run Chinook salmon and steelhead, as further described below.

As part of the Chinook salmon redd surveys conducted in the lower American River during the 1991/1992 through the 1995/1996 fall-run Chinook salmon spawning seasons (Snider and McEwan 1992; Snider, Urquhart, McEwan, and Munos 1993; Snider and Vyverberg 1995, 1996; Snider et al. 1996), the authors attempted to evaluate the percentage of Chinook salmon redds dewatered by changes in flow that occurred during the survey seasons. During these surveys, the potential dewatering of redds was evaluated by comparing redd locations traced from photographs made at higher flows with photographs of the same locations taken during subsequent, lower-flow conditions. Redd locations no longer inundated were considered to be dewatered. The total number of dewatered redd locations was then expressed as a percentage of the total number of newly constructed redds counted over the entire annual survey.

Because flows either did not decrease or decreased very little during the survey periods, no dewatering of fall-run Chinook salmon redds was observed during the redd surveys corresponding to the 1993/1994, 1994/1995 and 1995/1996 spawning seasons (Snider and Vyverberg 1995, 1996; Snider et al. 1996). During the 1991/1992 fall-run Chinook salmon spawning season, 15 redds located in Sunrise riffles and 25 redds built in Sailor Bar riffles (a total of 40 redds, about 2.5 percent of the 1,626 redds observed during the redd survey period) were considered dewatered when flows dropped from 2,500 cubic feet per second (cfs) to less than 1,000 cfs (Snider and McEwan 1992). No dewatering was reported for the 1992/1993 fall-run Chinook salmon spawning season.

More recently, cbec (2014) estimated the potential for Chinook salmon redd dewatering during the 2013 Chinook salmon spawning season. cbec used Chinook salmon redd survey data provided by Cramer Fish Sciences and a suite of two-dimensional (2-D) hydraulic models developed by cbec for specific reaches of the lower American River. The redd data used in the analysis consisted of ground global positioning system (GPS) observations collected only at gravel augmentation sites and any side channels associated with those sites during surveys conducted on October 28, November 1, November 21, and November 22, 2013. Additionally, redd data included digitized redd locations from a geo-rectified high-resolution aerial photograph of the Lower Sunrise Side Channel (not a gravel augmentation site) taken November 25, 2013.

A suite of five individual 2-D hydraulic models that used the most recent topographic/bathymetric data available at the time of analysis was used to simulate water surface elevations at flow rates of 200, 250, 300, 350, 400, 450, 500, 800, 1,000, 1,250, 1,330, 1,500, and 2,000 cfs. The available 2,150 redd locations were compared with the extent of the inundated areas simulated by the models for the 200-through-2,000-cfs flows. If a particular redd location fell outside the area inundated, it was considered to be dewatered.

cbec’s analysis showed that, as flows decreased from 2,000 cfs to 1,000 cfs, very few redds were dewatered (**Figure 2**). When flow decreased to 800 cfs, roughly 2.3 percent of the sampled redds were potentially dewatered (i.e., left outside the inundated area predicted by the 2-D hydraulic models). The expected percentage of the redds dewatered as flows decrease in increments from 800 cfs to 200 cfs increased at a fairly rapid rate, particularly as flow decreases from 400 cfs to 350 cfs. When flow drops to only 200 cfs, 57.2 percent of the sampled redds might be dewatered.

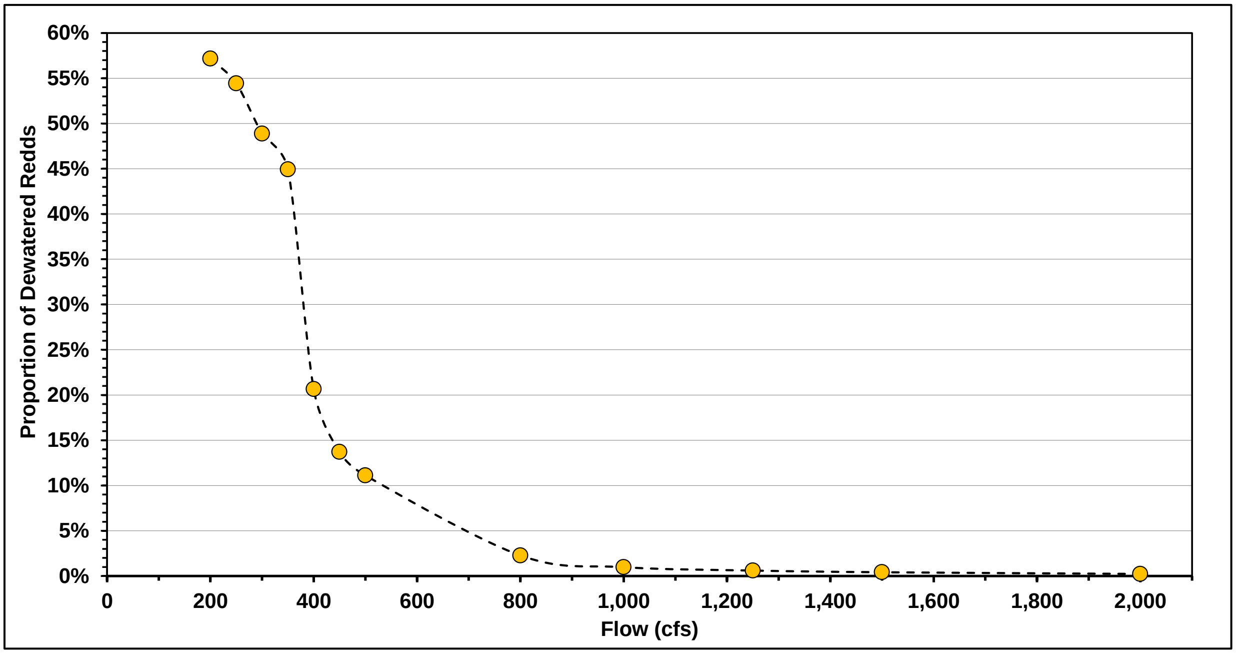


Figure 2. Estimated Percentages of Dewatered Chinook Salmon Redds as a Function of Flow. Data are based on 2,150 redd locations sampled at various gravel augmentation sites in the lower American River and at the Lower Sunrise Side Channel during 2013, and 2-D modeling of inundated areas at various flow rates (cbec 2014).

Hannon and Deason (2005) also attempted to evaluate redd dewatering during lower American River steelhead redd surveys for the 2002/2003, 2003/2004, and 2004/2005 steelhead spawning seasons. During these surveys, redd monitoring was concentrated on redds built in the Lower Sunrise Side Channel located at river mile (RM) 19. A total of 16, 13, and seven steelhead redds were built at this site during the 2002/2003, 2003/2004, and 2004/2005 steelhead spawning seasons, respectively. Fifteen of the 16 redds observed during the 2002/2003 season were built after flood-control releases raised flow up to 5,500 cfs between February 11 and 18, 2003. When flow ramped down to 2,000 cfs through the remainder of the spawning period, five redds were dewatered, representing 31.3-percent dewatering with respect to all redds built in the side channel during the entire 2002/2003 season.

Eleven of the 13 redds observed in the Lower Sunrise Side Channel site during the 2003/2004 spawning season were built between February 19 and 28, 2004, after flows increased up to 7,000 cfs. Five of these redds were later dewatered when flow decreased to 3,000 cfs, representing a 38.5-percent dewatering of all redds built in the side channel during the 2003/2004 spawning season.

Finally, the seven redds observed in the Lower Sunrise Side Channel during the 2004/2005 steelhead spawning season were built during two flood-control releases of 8,000 cfs in mid-February 2005. Four of these redds were later dewatered when flows decreased to about 2,000 cfs through mid-March, representing a 57.1-percent dewatering of all redds built in the side channel during the entire 2004/2005 season.

However, the estimates of Chinook salmon and steelhead redd dewatering discussed above cannot be directly integrated in the U.S. Army Corps of Engineers' (USACE) assessment of the potential for redd dewatering in the lower American River with the Folsom Water Control Manual (WCM) Project alternatives because of the sporadic nature of the estimates, among other reasons. These estimates represent different annual flow and environmental conditions, different spatial and temporal distributions of the annual spawning activity of Chinook salmon and steelhead, and often different estimation and sampling techniques.

Evaluating the potential redd dewatering effects of flow fluctuations on spawning salmonids typically 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 is 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.

For this analysis, USACE analyzed the potential for fall-run Chinook salmon and steelhead redd dewatering due to daily flow fluctuations in the lower American River with the Folsom WCM alternatives and the bases of comparison through an annual weighted redd dewatering index. In this index, the potential for redd dewatering because of changes in daily flows and corresponding changes in river stage 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, on the duration of embryo incubation based on simulated water temperatures, and on 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 a spawning season).

The annual weighted redd dewatering index (WRD_Y) 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 surface elevation occurring from the date of redd construction through the corresponding date of expected fry emergence. In WRD_Y, the changes in water surface elevation or river stage are evaluated against the overall distributions of Chinook salmon and steelhead redd depths in the lower American River measured at the level of the undisturbed bed surface of the redd (A in Figure 1).

Details on the calculation of the annual dewatering index as well as on the various distributions used in the calculations are provided in the following sections.

1.1.1 Annual Weighted Redd Dewatering Index

The annual weighted redd dewatering index (WRD_Y) provides an annual estimate of the expected maximum proportion 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 surface elevation occurring from the date of redd construction through the corresponding date of fry emergence. The equation describing the annual weighted redd dewatering index is:

$$WRD_Y = \sum_{d=1}^{k} w_d \times \left\{ \sum_{h=1}^{18} w_h \times \left[\Pr\left(Redd\ Depth \le \underset{i=d+1 \rightarrow ED_{d,h,Y}}{\mathrm{Max}} \left(Stage_{d,h,Y} - Stage_{i,h,Y} \right) \right) \right] \right\}. \qquad \textbf{(1)}$$

The primary components of equation 1 are described below.

- The factor w_d is a temporal weighting coefficient that indicates the proportion of redds built on a particular day (d) relative to all the redds expected to be built during the k days of the fall-run Chinook salmon or steelhead spawning periods over the species' entire spawning grounds. The sum of the daily temporal weighting coefficients over the entire spawning season equals 1 ($\sum_{d=1}^{k} w_d = 1$). See **Section F-2** for further details on the temporal weighting coefficients for fall-run Chinook salmon and steelhead spawning in the lower American River.
- The factor w_h is a spatial weighting coefficient that indicates the proportion of redds built on a particular area (h) relative to all the redds expected to be built on any given day of the spawning season over the 18 areas in which the lower American River spawning grounds of fall-run Chinook salmon and steelhead are divided. For any given day of the species' spawning season, the sum of the spatial weighting coefficients over the entire spawning ground equals 1 ($\sum_{h=1}^{18} w_h = 1$). See **Section F-3** for further details on the calculation of the spatial weighting coefficients for fall-run Chinook salmon and steelhead spawning in the lower American River.
- The variable $ED_{d,h,Y}$ indicates the duration (in number of days) of the embryo incubation for redds built on day d of year Y in spawning area h. The values of the variables are derived from the time series of simulated daily water temperatures for each of the simulated years with the Folsom WCM alternatives and bases of comparison. See **Section F-4** for details on the calculation of $ED_{d,h,Y}$ for fall-run Chinook salmon and steelhead spawning in the lower American River.
- The variable $Stage_{d,h,Y}$ indicates the mean daily river stage in spawning area h on redd construction day d of year Y. The variable $Stage_{i,h,Y}$ indicates the mean daily river stage in the same spawning area, on any day i subsequent to the date of redd construction, until the last day of the calculated embryo incubation period for the redds built on day d ($ED_{d,h,Y}$). For each redd cohort (i.e., the group of redds built on the same day d and in the same spawning area h), the positive river-stage differences between $Stage_{d,h,Y}$ and $Stage_{i,h,Y}$ are evaluated for each day within the period d+1 through $ED_{d,h,Y}$ to determine the maximum river-stage difference:

$\underset{i=d+1\rightarrow ED_{d,h,Y}}{\text{Max}}\left(Stage_{d,h,Y}-Stage_{i,h,Y}\right)$. This value is equivalent to the maximum drop in water surface elevation experienced by redds built on day *d* in spawning area *h* during year *Y*.

- The expression $\Pr\left(Redd\ Depth \leq \underset{i=d+1\rightarrow ED_{d,h,Y}}{\text{Max}}\left(Stage_{d,h,Y}-Stage_{i,h,Y}\right)\right)$ indicates the expected probability of redds being constructed at depths less or equal to the maximum river stage difference experienced by redds built in spawning zone *h* on day *d* throughout their embryo incubation periods. These probabilities were obtained from cumulative distributions of redd depths, measured at the level of the undisturbed bed surface of the redd, that were developed for fall-run Chinook salmon and steelhead spawning in the lower American River (see details in Section F-5).

Once USACE calculated the annual index (WRD_Y) for fall-run Chinook salmon and steelhead spawning in the lower American River using average daily flows (and associated river stages) and average daily water temperatures modeled with the Folsom WCM alternatives and the bases of comparison during each of the years simulated, the resulting annual indices were averaged over the entire simulation period and by water year type for comparison with the Folsom WCM alternatives relative to the bases of comparison.

1.1.2 Temporal Weighting Coefficients

The annual weighted redd dewatering index uses temporal weighting coefficients to indicate the proportion of redds expected to be built on each day of the assumed spawning periods, based on the expected spawning temporal distributions for fall-run Chinook salmon and steelhead.

In general, to calculate the temporal weighting coefficients, spawning timing is described as an asymmetric logistic function of time. The asymmetric logistic function, also known as Richards sigmoidal curve (Ratkowsky 1983), has the following expression:

$$Y_D=\left(\frac{1}{1+\exp\left(\alpha+\beta\times D\right)}\right)^{1/\delta} \qquad \textbf{(2)}$$

where Y_D is the expected cumulative proportion of spawning through day *D*, and α, β, and δ are parameters that determine the shape of the cumulative curve. The variable *D* is a continuous variable that indicates the day number at which new spawning occurs during a particular spawning season, counting from a particular starting date. In order to estimate the values of α, β, and δ, the daily cumulative proportions of newly built redds, reported in available annual redd survey reports, were normally used as a proxy for Y_D and fitted to the asymmetric logistic model through a nonlinear least-squares procedure.

In the case of fall-run Chinook salmon spawning in the lower American River, the data describing Y_D arose from combining information in available carcass and redd survey annual reports. Once equation 2 was fitted to the fall-run Chinook salmon or steelhead data, the fitted curve was rescaled to the assumed spawning period of the species, and the daily temporal weighting coefficients w_d were calculated by subtraction (see **Appendix X [LAR Spawning WUA Appendix]** for details on this procedure).

1.1.2.1 Fall-run Chinook Salmon

USACE derived the temporal weighting coefficients used for fall-run Chinook salmon spawning in the lower American River from data collected by both redd surveys and carcass surveys. Redd surveys that provide the cumulative distribution of newly built redds over time, which is a better descriptor of spawning timing, were performed only during the 1991/1992 through the 1995/1996 fall-run Chinook salmon spawning seasons (Snider and McEwan 1992; Snider, Urquhart, McEwan, and Munos 1993; Snider and Vyverberg 1995, 1996; Snider et al. 1996). On the other hand, fall-run Chinook salmon carcass surveys have been performed annually since the late 1960s, and data or reports are available for all surveys performed from October 1992 through October 2012 (Snider and Bandner 1996; Snider and Reavis 1996; Snider, Keenan, and Munos 1993; Snider et al. 1995; Healey 2002, 2003, 2004, 2005, 2006; Healey and Fresz 2007; Healey and Redding 2008; Vincik and Kirsch 2009; Vincik and Mamola 2010; Maher et al. 2012; Phillips and Helstab 2013; Phillips and Maher 2013).

USACE used the temporal distributions of fresh carcasses described in these reports to estimate an overall cumulative distribution of fresh carcasses over time that describes when fresh carcasses appear in the surveys, which is subsequent to the actual time of spawning and redd construction. The time elapsing between (1) spawning and red construction and (2) post-spawning mortality has been reported to typically be between 2 and 4 weeks (Briggs 1953). To take advantage of the information on fall-run Chinook salmon spawning timing in the lower American River in the available redd and carcass surveys, USACE developed a five-step procedure to estimate the sigmoidal curve describing fall-run Chinook salmon spawning timing in the lower American River (see Appendix X [LAR Spawning WUA Appendix] for details on the five-step procedure).

USACE used the lagged asymmetric logistic curve resulting from the five-step procedure to calculate expected daily spawning proportions by subtraction. The daily expected proportions were rounded to four decimal places and scaled to sum to 1 over the spawning period of fall-run Chinook salmon to generate the final temporal weighting coefficients (**Figure 3**). The range of dates for which the proportions are greater than zero defined the fall-run Chinook salmon spawning period in the lower American River that extends from October 13 through January 18, a period of $k = 98$ days.

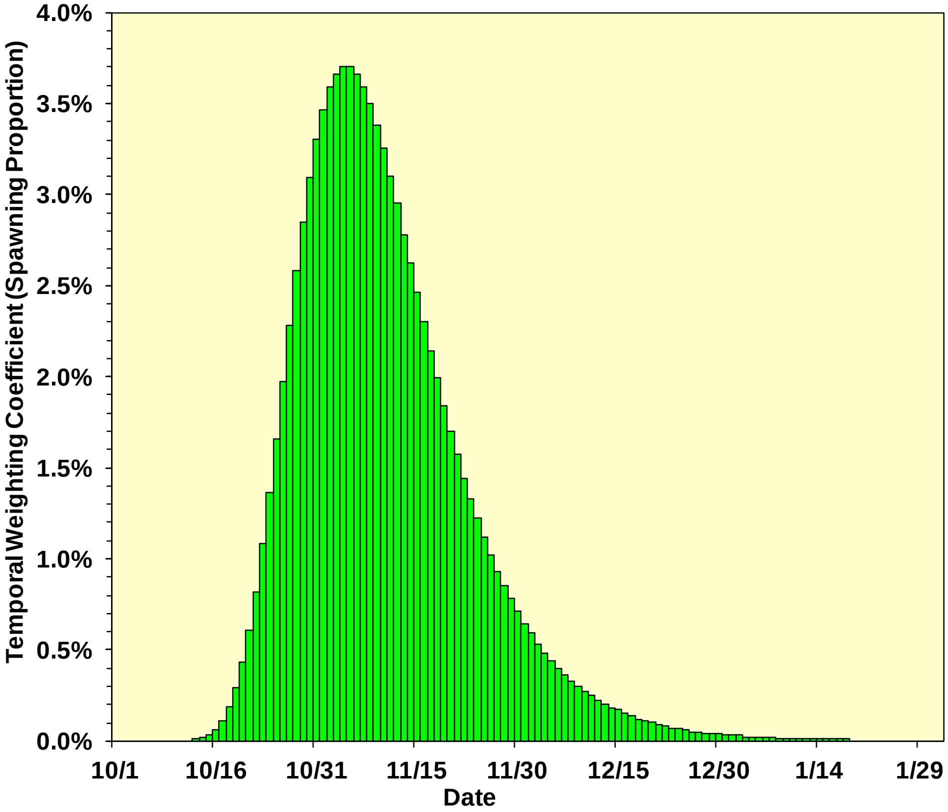


Figure 3. Temporal Weighting Coefficients Used for Fall-run Chinook Salmon Spawning in the Lower American River from October 13 through January 18.

1.1.2.2 Steelhead

USACE derived the temporal weighting coefficients used for steelhead spawning in the lower American River from the steelhead redd surveys performed by Reclamation and CDFW from February 2002 through April 2013 (Chase 2010; Hannon 2011, 2012, 2013; Hannon and Healey 2002; Hannon et al. 2003; Hannon and Deason 2004, 2005, 2007; See and Chase 2009). Data from eight annual steelhead redd surveys were used in the fitting of the asymmetric logistic function (equation 2). The available data correspond to cumulative redd proportions for the sampled weeks of the 2002/2003, 2003/2004, 2004/2005, 2006/2007, 2009/2010, 2010/2011, 2011/2012 and 2012/2013 spawning seasons (see Appendix X [LAR Spawning WUA Appendix] for details on the fitting of equation 2).

The cumulative distribution resulting from the fit of equation 2 was first trimmed to daily cumulative values between 0.005 and 0.995, and the remaining daily cumulative values were used to calculate the expected daily spawning proportions by subtraction. Finally, the daily temporal coefficients for steelhead were obtained by rounding the daily proportions to four decimal places and rescaling to the sum of the rounded proportions.

Figure 4 displays the final temporal weighting coefficients for steelhead spawning in the lower American River and the resulting spawning period used in the calculation of the annual redd dewatering index

($CWUA_Y$) for steelhead. The resulting steelhead spawning period extends from December 14 through April 5, a period of $k = 114$ days.

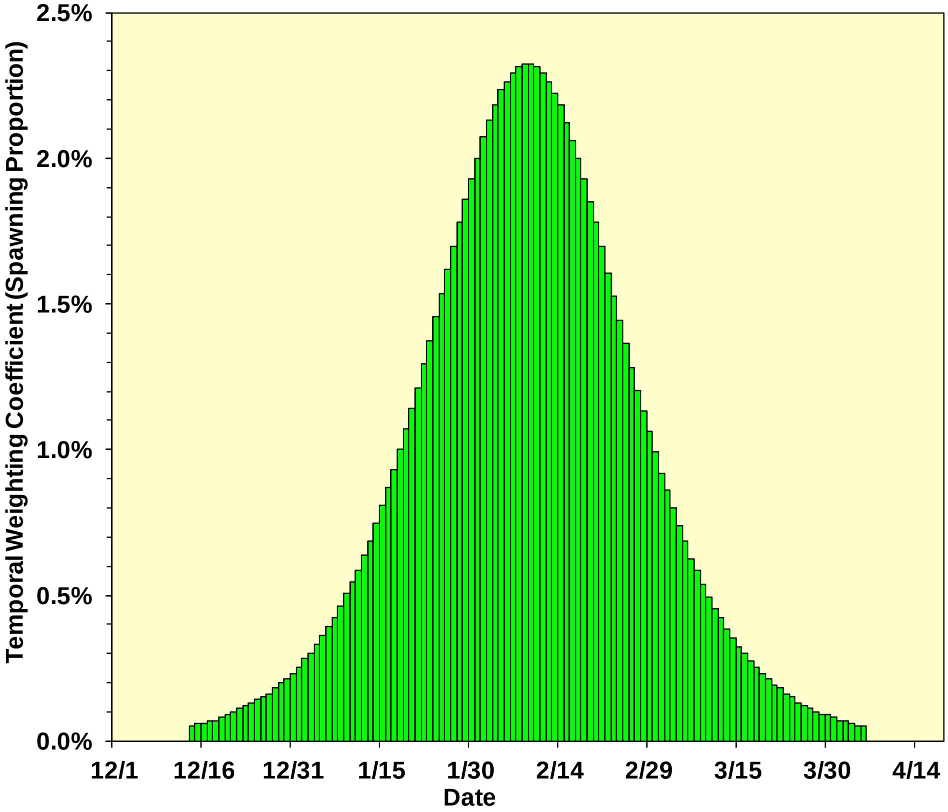


Figure 4. Temporal Weighting Coefficients Used for Steelhead Spawning in the Lower American River from December 14 through April 5.

1.1.3 Spatial Weighting Coefficients

The spatial weighting coefficients (wh) indicate the relative importance of particular spawning areas h with respect to the entire spawning grounds of the species, as represented by the proportions of redds built in a particular area relative to all the redds expected to be built on any given day of the spawning season over the fall-run Chinook salmon and steelhead spawning grounds in the lower American River.

The numbers of observed newly built redds by each river mile of the lower American River obtained from available fall-run Chinook salmon and steelhead redd surveys suggested the demarcation of 18 reaches or spawning areas that summarize the spawning activity of both species along the lower American River. USACE obtained the values of the spatial weighting coefficients for fall-run Chinook and steelhead spawning in the lower American River by summing the redd observations from available redd survey data within each reach and dividing by the total number of redds observed along the entire spawning grounds for fall-run Chinook and for steelhead.

1.1.3.1 Fall-run Chinook Salmon

USACE calculated the spatial weighting coefficients for fall-run Chinook salmon from redd observations by river mile collected during the 1991/1992 through the 1995/1996 fall-run Chinook salmon spawning seasons (Snider and McEwan 1992; Snider, Urquhart, McEwan, and Munos 1993; Snider et al. 1996; Snider and Vyverberg 1995, 1996). **Table 1** displays the redd data and the resulting spatial weighting coefficients for fall-run Chinook salmon spawning in the lower American River.

1.1.3.2 Steelhead

USACE calculated the spatial weighting coefficients for steelhead from redd observations by river mile collected during seven steelhead spawning seasons: 2002/2003, 2003/2004, 2004/2005, 2006/2007, 2010/2011, 2011/2012, and 2012/2013 (Hannon 2013, Table 3). **Table 2** displays the redd data and the resulting spatial weighting coefficients for steelhead spawning in the lower American River.

Table 1. Distribution of Observed Redds by River Mile for Fall-run Chinook Salmon in the Lower American River from 1991 through 1995 and Derived Spatial Weighting Coefficients by Spawning Reach.

RM	Number of redds by river mile in survey year:					Total Redds	Spatial Weighting Coefficients	
	1991	1992	1993	1994	1995			
22	121	369	1,277	418	560	2,745	0.174729	(17.5%)
21	191	2	1,322	280	561	2,356	0.149968	(15.0%)
20	427	266	1,587	572	1,054	3,906	0.248631	(24.9%)
19	314	220	663	391	595	2,183	0.138956	(13.9%)
18	154	96	164	297	115	826	0.052578	(5.3%)
17	189	9	787	424	601	2,010	0.127944	(12.8%)
16	86	123	13	83	63	368	0.023425	(2.3%)
15	11	0	177	58	66	312	0.019860	(2.0%)
14	33	38	49	56	115	291	0.018523	(1.9%)
13	20	0	20	59	87	186	0.011840	(1.2%)
12	30	1	0	15	45	91	0.005792	(0.6%)
11	0	1	30	0	1	32	0.002037	(0.2%)
10	6	0	4	61	39	110	0.007002	(0.7%)
9	32	6	71	12	12	133	0.008466	(0.8%)
8	0	0	0	1	17	18	0.001146	(0.1%)
7	0	0	21	14	28	63	0.004010	(0.4%)
6	12	7	20	18	15	72	0.004583	(0.5%)
5	0	0	0	6	2	8	0.000509	(0.1%)
Totals	1,626	1,138	6,205	2,765	3,976	15,710	1	(100%)

Table 2. Distribution of Observed Redds by River Mile for Steelhead in the Lower American River from 2003 through 2013 and Derived Spatial Weighting Coefficients by Spawning Reach.

RM	Number of redds by river mile in survey year:							Total Redds	Spatial Weighting Coefficients
	2003	2004	2005	2007	2011	2012	2013		
22	28	31	40	33	32	38	65	267	0.225507 (22.6%)
21	46	45	27	25	17	17	118	295	0.249155 (24.9%)
20	11	2	6	9	0	6	19	53	0.044764 (4.5%)
19	21	21	10	21	2	10	33	118	0.099662 (10.0%)
18	16	8	3	13	1	1	11	53	0.044764 (4.5%)
17	11	10	0	18	3	1	4	47	0.039696 (4.0%)
16	4	2	3	18	9	1	28	65	0.054899 (5.5%)
15	22	20	11	7	10	0	2	72	0.060811 (6.1%)
14	15	13	5	3	4	0	2	42	0.035473 (3.5%)
13	15	6	3	1	0	0	1	26	0.021959 (2.2%)
12	5	17	2	9	9	0	21	63	0.053209 (5.3%)
11	7	2	3	1	0	0	0	13	0.010980 (1.1%)
10	5	0	1	12	0	0	0	18	0.015203 (1.5%)
9	9	9	3	2	0	0	12	35	0.029561 (3.0%)
8	0	0	0	0	0	0	0	0	0 (0%)
7	0	0	0	0	0	0	0	0	0 (0%)
6	0	0	0	0	0	0	0	0	0 (0%)
5	0	1	14	0	1	1	0	17	0.014358 (1.4%)
Totals	215	187	131	172	88	75	316	1,184	1 (100%)

1.1.4 Water Temperatures and Duration of Embryo Incubation

The annual dewatering index requires the calculation of the estimated duration of embryo incubation, in days, corresponding to each daily redd cohort being evaluated (i.e., $ED_{d,h,Y}$ for the proportion of redds built on day *d* of year *Y* at spawning area *h*). The approach to calculate the embryo incubation period for each fall-run Chinook salmon or steelhead redd cohort is based on lower American River daily water temperatures modeled at location *h* during the day of redd construction *d* and all subsequent days until fry emergence, expressed as accumulated thermal units (ATUs). An ATU is defined as degrees Fahrenheit (°F) above 32°F accumulated during a 24-hour period (CDFW 1998).

USACE used modeled daily average water temperatures for a given simulated year, starting on the day of a given redd's construction, to calculate the number of days required to reach the species-specific threshold ATUs (in °F) for egg incubation through fry emergence (detailed in sections **F-4.1 and F-4-2**, below). These calculations of the duration of embryo incubation are based on ATUs using annual series of daily water temperatures modeled with the Folsom WCM alternatives and the bases of comparison at locations corresponding to the 18 spawning reaches *h*.

The following sections provide details regarding how USACE obtained the ATU thresholds used in the calculations of the duration of embryo incubation for fall-run Chinook salmon and steelhead in the lower American River.

1.1.4.1 Fall-run Chinook Salmon Embryo Incubation

Several ATU thresholds have been identified in the literature for the development of Chinook salmon eggs from fertilization to hatching and from hatching through fry emergence. In its status review of spring-run Chinook salmon in the Sacramento River drainage, CDFW (1998), referring to Armour (1991), stated that the required number of ATUs from the time of egg fertilization to fry emergence was 1,550°F. Moreover, Amour (1991) stated that the development from fertilization to hatching required 850°F ATUs and that the development from hatching to fry emergence required an additional 700°F ATUs.

In a paper evaluating the development and applicability of an early version of the Chinook Salmon Early Lifestage Mortality Model, HCI (1996) stated that key model assumptions were the requirements of 750°F ATUs for the development from fertilized egg to hatching and of another 750°F ATUs for the development from hatching to emergent fry (i.e., a total of 1,500°F from fertilized egg to fry emergence).

In the technical memorandum describing the recent update of the Chinook Salmon Early Lifestage Mortality Model for the lower American River, the Water Forum and USACE (2015; **Appendix X**) reviewed the duration (days) to median hatch (50 percent hatch) and to median emergence (50 percent emergence) for fertilized eggs and pre-emergent fry reported in Seymour (1956), Beacham and Murray (1989), Murray and McPhail (1988), and Jensen and Groot (1991) and used these data to calculate the ATUs to 50 percent hatch and 50 percent fry emergence. They then combined these calculated ATUs with the ATUs to 50 percent hatch and 50 percent emergence for Chinook salmon eggs and pre-emergent fry from variable temperature incubations reported in Geist et al. (2011) to calculate the average ATU to 50 percent hatch (936°F) and the average ATU from 50 percent hatch to 50 percent emergence (713°F).

Therefore, USACE used an ATU threshold of 1,649°F (936°F + 713°F) to calculate the duration of embryo incubation through fry emergence ($ED_{d,h,Y}$) for all fall-run Chinook salmon redd cohorts. For each redd cohort represented by the proportion of fall-run Chinook salmon redds built on day *d* of year *Y* at spawning area *h* ($w_d \times w_h$ with *d* ranging from 1 through 98 and *h* from 1 through 18), the daily thermal units of day *d* (daily water temperature - 32°F) and subsequent days measured at location *h* were summed. A day was added to the embryo incubation period of the redd cohort under consideration while the sum of daily thermal units remained below or equal to 1,649°F.

1.1.4.2 F-4.2. Steelhead Embryo Incubation

Several ATU thresholds corresponding to the duration of embryo incubation through 50 percent hatch and fry emergence for steelhead have been reported in the literature. CDFW's restoration and management plan for California steelhead (McEwan and Jackson 1996) reported that steelhead preferred water temperatures for embryo incubation and fry emergence ranging from 48°F to 52°F. Additionally, they stated:

> *The length of time it takes for eggs to hatch depends mostly on water temperature. Hatching of steelhead eggs in hatcheries takes about 30 days at 51°F (Leitritz and Lewis 1980). Fry emerge from the gravel usually about four to six weeks after hatching, but factors such as redd depth, gravel size, siltation, and temperature can speed or retard this time (Shapovalov and Taft 1954).*

In a manual of hatchery methods for salmon and trout culture, Leitritz (1959) published a table indicating the number of days and ATUs required for development of eggs of various trout species, including *Oncorhynchus mykiss*, to hatch when incubating at constant temperatures ranging from 40°F to 60°F. In a more recent study on steelhead supplementation in rivers in Idaho, Byrne (1996) reported that Thurow (Intermountain Research Station, Boise, Idaho, unpublished data) estimated that 556 degrees Celsius (°C) (1,001°F) ATUs were needed for fry emergence to begin and 722°C (1,300°F) ATUs were needed for 95 percent emergence of hatchery steelhead that spawned naturally in the upper Salmon River, and used Thurow's estimated ATUs to predict the date of first fry emergence and the date that 95 percent of the fry had emerged in Beaver and Frenchman Creeks.

Kraus (1999), in a guide to classroom egg incubation in Alaska, stated that spring-run steelhead eggs require 360°C (648°F) ATUs to hatch and 600°C (1,080°F) ATUs to reach fry emergence. Hannon et al. (2003) used the same requirement of 600°C (1,080°F) ATUs to estimate the time to fry emergence in the report on American River steelhead spawning for 2001–2003.

For many salmonids, including steelhead, various models have been developed in recent decades to calculate the incubation and emergence times, expressed in days or hours, by fitting various functions of constant water temperatures to experimental embryo development data. For example, Crisp (1981) presented four models using a desktop study of the relationship between temperature and hatching time for the eggs of five species of salmonids, including *O. mykiss*. The equations of the four models presented for *O. mykiss* were obtained by fitting the models to 23 pairs of data points, each pair consisting of the water temperatures (T in °C) at which a batch of fertilized eggs is incubated and the corresponding time from egg fertilization to 50 percent hatch, expressed as days (D). The equations of the four *O. mykiss* models were:

- ***Model 1a***: $\log(D) = 2.6638 - 1.1623 \times \log(T)$ with $r^2 = 0.978$;
- ***Model 1b***: $\log(D) = 4.0313 - 2.0961 \times \log(T+6)$ with $r^2 = 0.982$;
- ***Model 2***: $\ln(D) = 4.9023 - 0.1384 \times T$ with $r^2 = 0.960$; and
- ***Model 3b***: $\log(D) = 2.3475 - 0.1123 \times T + 0.00278 \times T^2$ with $r^2 = 0.976$.

Recognizing the limited data available to develop species-specific equations relating water temperatures (T in °C) at which a batch of fertilized eggs is incubated and the corresponding time from egg fertilization to 50 percent fry emergence, Crisp (1988) collected data on time to 50 percent hatch and corresponding time to 50 percent fry emergence, both expressed in days, obtained from embryo incubation experiments conducted at various constant temperatures ranging from 2.8°C to 12°C (37.0°F to 53.6°F). The data consisted of 60 pairs of duration data encompassing six salmonid species (*Salmo salar*, *S. trutta*, *O. keta*, *O. kisutch*, *O. tshawytscha*, and *O. gorbuscha*). Disregarding the individual species, Crisp (1988) used the data for all species to fit a common linear relationship that would allow the prediction of time to 50 percent fry emergence ($D_{50\%E}$, days) based on the more abundant data on time to 50 percent hatch (

$D_{50\%H}$, days). The fitted equation, $D_{50\%E} = 5.367 + 1.660 \times D_{50\%H}$, was statistically significant ($P <$ 0.001) with an $r^2 = 0.947$.

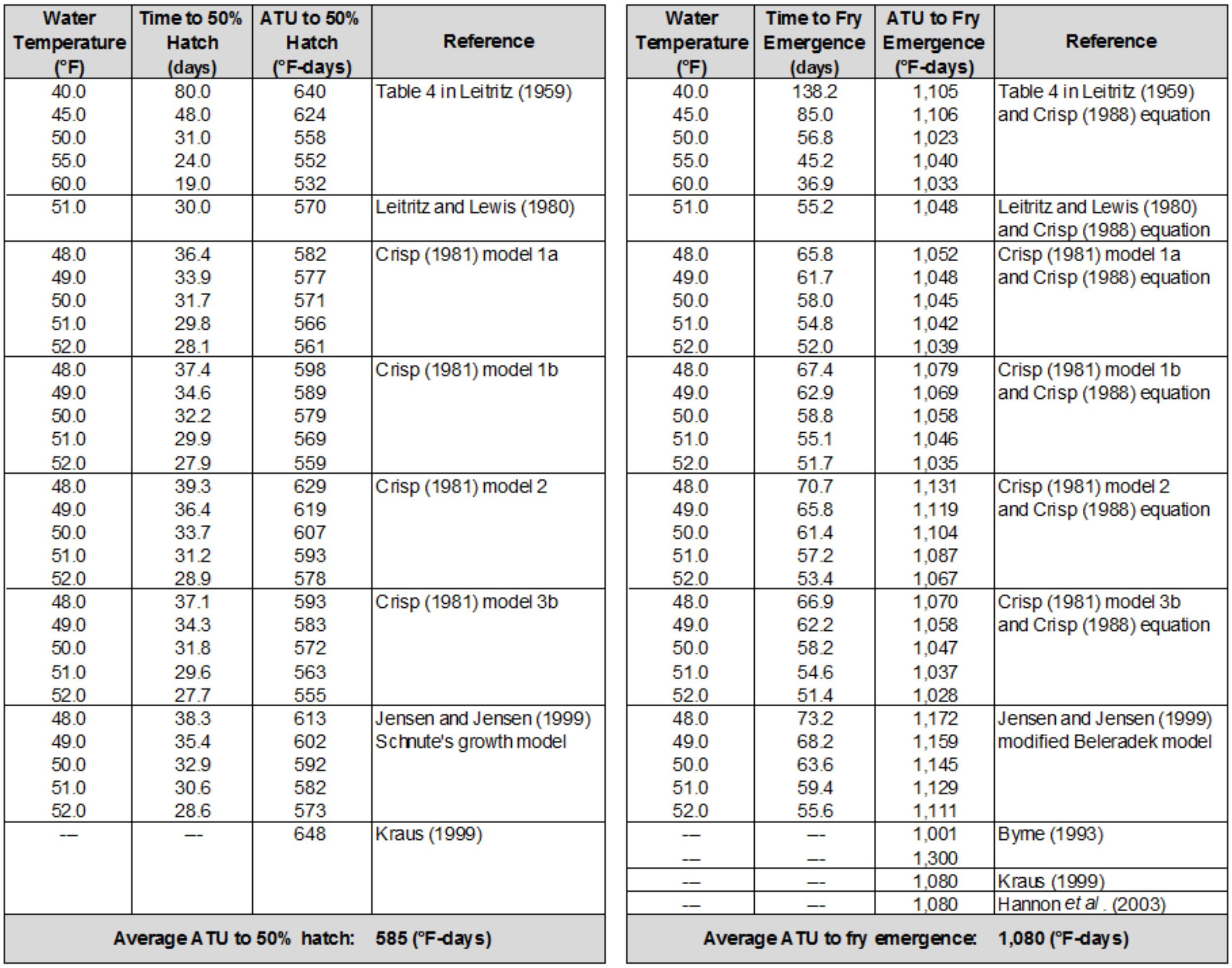
More recently, in the program IncubWin (Jensen and Jensen 1999) and in its updated version WinSIRP (Jensen et al. 2009), the time to 50 percent hatch of steelhead eggs was derived from a set of two equations resulting from fitting Schnute's Growth Model to water temperatures (T in °C) and developmental time expressed in hours (D). The two equations describing the time to 50 percent hatch are:

$D = 24 \times \left(139.2562^{2.3613821} + \left(139.2562^{2.3613821} - 18.3476^{2.3613821}\right) \times Z\ \right)^{1/2.3613821}$ with Z expressed as $Z = \dfrac{\left(1 - \exp\left(-1 \times 0.408414 \times (T - 1)\right)\right)}{\left(1 - \exp\left(-1 \times 0.408414 \times (19)\right)\right)}$.

In the same programs, the time to steelhead fry emergence expressed in hours was described by a modified Bělehrádek model, with a fitted equation of $D = \dfrac{22{,}129{,}193.76}{(T + 14.1975994)^{3.00725581}}$.

The above information on steelhead time to 50 percent hatch and time to fry emergence expressed in days is summarized in **Table 3** and was used by USACE to calculate steelhead ATUs in °F-day to 50 percent hatch and fry emergence. USACE used the equations reported in Crisp (1981, 1988), Jensen and Jensen (1999), and Jensen et al. (2009)to estimate the time to 50 percent hatch ($D_{50\%H}$) and time to fry emergence (D_E) for temperatures (T) within the 48°F–52°F range reported by McEwan and Jackson (1996) as preferred temperatures for steelhead embryo incubation and fry emergence. The corresponding ATUs were then calculated as the products of $D_{50\%H}$ or D_E and T – 32°F.

Table 3. Estimated Times (in Days) and Accumulated Thermal Units (ATUs) to 50 Percent Hatch and Fry Emergence for Steelhead Embryos Incubating at Temperatures Ranging from 40°F to 52°F.



Water Temperature (°F)	Time to 50% Hatch (days)	ATU to 50% Hatch (°F-days)	Reference
40.0	80.0	640	Table 4 in Leitritz (1959)
45.0	48.0	624	
50.0	31.0	558	
55.0	24.0	552	
60.0	19.0	532	
51.0	30.0	570	Leitritz and Lewis (1980)
48.0	36.4	582	Crisp (1981) model 1a
49.0	33.9	577	
50.0	31.7	571	
51.0	29.8	566	
52.0	28.1	561	
48.0	37.4	598	Crisp (1981) model 1b
49.0	34.6	589	
50.0	32.2	579	
51.0	29.9	569	
52.0	27.9	559	
48.0	39.3	629	Crisp (1981) model 2
49.0	36.4	619	
50.0	33.7	607	
51.0	31.2	593	
52.0	28.9	578	
48.0	37.1	593	Crisp (1981) model 3b
49.0	34.3	583	
50.0	31.8	572	
51.0	29.6	563	
52.0	27.7	555	
48.0	38.3	613	Jensen and Jensen (1999) Schnute's growth model
49.0	35.4	602	
50.0	32.9	592	
51.0	30.6	582	
52.0	28.6	573	
---	---	648	Kraus (1999)
Average ATU to 50% hatch: 585 (°F-days)			

Water Temperature (°F)	Time to Fry Emergence (days)	ATU to Fry Emergence (°F-days)	Reference
40.0	138.2	1,105	Table 4 in Leitritz (1959) and Crisp (1988) equation
45.0	85.0	1,106	
50.0	56.8	1,023	
55.0	45.2	1,040	
60.0	36.9	1,033	
51.0	55.2	1,048	Leitritz and Lewis (1980) and Crisp (1988) equation
48.0	65.8	1,052	Crisp (1981) model 1a and Crisp (1988) equation
49.0	61.7	1,048	
50.0	58.0	1,045	
51.0	54.8	1,042	
52.0	52.0	1,039	
48.0	67.4	1,079	Crisp (1981) model 1b and Crisp (1988) equation
49.0	62.9	1,069	
50.0	58.8	1,058	
51.0	55.1	1,046	
52.0	51.7	1,035	
48.0	70.7	1,131	Crisp (1981) model 2 and Crisp (1988) equation
49.0	65.8	1,119	
50.0	61.4	1,104	
51.0	57.2	1,087	
52.0	53.4	1,067	
48.0	66.9	1,070	Crisp (1981) model 3b and Crisp (1988) equation
49.0	62.2	1,058	
50.0	58.2	1,047	
51.0	54.6	1,037	
52.0	51.4	1,028	
48.0	73.2	1,172	Jensen and Jensen (1999) modified Beleradek model
49.0	68.2	1,159	
50.0	63.6	1,145	
51.0	59.4	1,129	
52.0	55.6	1,111	
---	---	1,001	Byrne (1993)
---	---	1,300	
---	---	1,080	Kraus (1999)
---	---	1,080	Hannon *et al*. (2003)
Average ATU to fry emergence: 1,080 (°F-days)			

USACE's analysis of redd dewatering for American River steelhead uses an ATU threshold of 1,080°F (the average ATU to fry emergence displayed in Table 3) to evaluate the duration of embryo incubation through fry emergence ($ED_{d,h,Y}$) for all steelhead redd cohorts in the calculations of the annual dewatering index. For each redd cohort represented by the proportion of steelhead redds built on day *d* of year *Y* at spawning area *h* ($w_d \times w_h$ with *d* ranging from 1 through 98 and *h* from 1 through 3), the daily thermal units of day *d* (daily water temperature – 32°F) and subsequent days measured at location *h* are summed. A day is added to the embryo incubation period of the redd cohort while the sum of daily thermal units remains below or equal to 1,080°F.

1.1.5 Depth Frequency Distributions of Redds

The annual dewatering indices require the use of relative cumulative frequency distributions of the redd water depths of fall-run Chinook salmon and steelhead spawning in the lower American River to evaluate the probability that the redds built on spawning day *d* in reach *h* have of being constructed at particular depths, expressed in tenths of a foot.

Specifically, the annual dewatering indices use the relative cumulative frequency distributions of the depths of redds to calculate the expected proportions of redds of each cohort that were constructed at depths less or equal to the maximum river stage difference experienced by redds built in spawning reach *h* on day *d* throughout their corresponding embryo incubation periods. The proportions are described as $\Pr\left(Redd\ Depth \le \underset{i=d+1 \rightarrow ED_{d,h,Y}}{\operatorname{Max}} \left(Stage_{d,h,Y} - Stage_{i,h,Y} \right) \right)$ in equation 1.

In general, USACE obtained the relative cumulative frequency distributions of the redd depths by fitting available redd depth data to asymmetric logistic functions (equation 2), as described in the following sections.

1.1.5.1 Fall-run Chinook Salmon

The relative cumulative frequency distribution of fall-run Chinook salmon redd depths was the result of USACE’s fitting an asymmetric logistic function to two combined annual series of Chinook salmon redd depths (**Figure 5**). The data, provided by Mark Gard, were collected by the U.S. Fish and Wildlife Service (USFWS) during November 6 and 7, 1996 (N = 218 redd depths) and during December 14 to 17, 1998 (N = 189 redd depths). These same data were used by USACE to develop the WUA-flow relationships for fall-run Chinook salmon spawning in the lower American River. The shallowest fall-run Chinook salmon redd depth in this database was 0.4 foot, while the deepest redd was observed at a depth of 6 feet.

The asymmetric logistic function fitted to the data had the following expression:

$$\Pr(D) = \left(\frac{1}{1 + \exp(-4.9417 - 1.4896 \times D)} \right)^{1/0.0007}, \qquad \textbf{(3)}$$

where *D* is the redd depth in feet. The mean-square error of this fit was 0.00011.

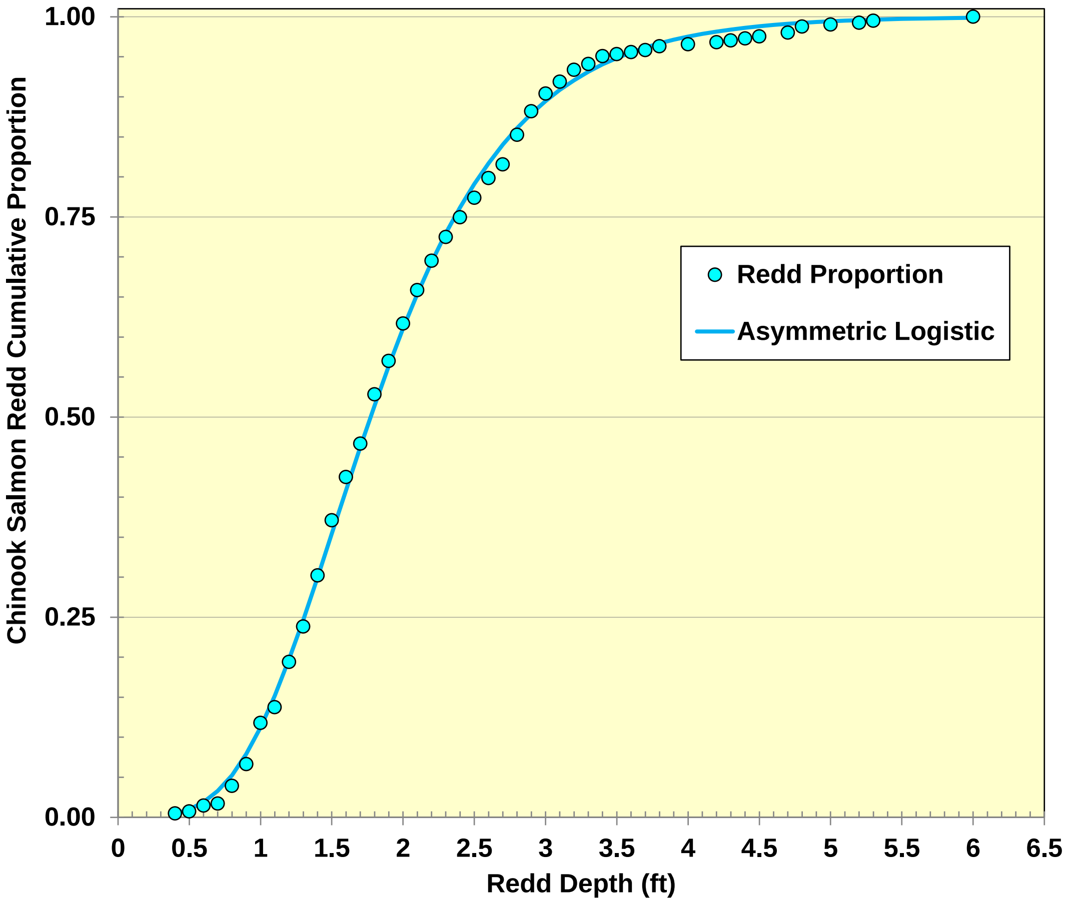


Figure 5. Cumulative Proportions of 407 Fall-run Chinook Salmon Redd Depths Measured in the Lower American River in November 1996 and December 1998 and the Fitted Asymmetric Logistic Curve.

USACE re-scaled the asymmetric logistic function in equation 3 to the observed range of fall-run Chinook salmon redd depths (0.4 foot through 6 feet) and used the function to build a look-up table providing the expected cumulative proportions of redd depths at every hundredth of a foot (**Table 4**).

Table 4. Re-scaled Cumulative Proportions of Fall-run Chinook Salmon Redd Depths Used in the Analysis of Potential Redd Dewatering for the Lower American River.

Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion
0.39	0	**0.83**	0.057951	**1.27**	0.233282	**1.71**	0.471161	**2.15**	0.677271
0.40	0.000396	**0.84**	0.060577	**1.28**	0.238407	**1.72**	0.476456	**2.16**	0.681201
0.41	0.000819	**0.85**	0.063272	**1.29**	0.243565	**1.73**	0.481730	**2.17**	0.685096
0.42	0.001268	**0.86**	0.066036	**1.30**	0.248753	**1.74**	0.486984	**2.18**	0.688954
0.43	0.001746	**0.87**	0.068868	**1.31**	0.253970	**1.75**	0.492214	**2.19**	0.692777
0.44	0.002253	**0.88**	0.071769	**1.32**	0.259216	**1.76**	0.497422	**2.20**	0.696564
0.45	0.002791	**0.89**	0.074740	**1.33**	0.264488	**1.77**	0.502607	**2.21**	0.700314
0.46	0.003360	**0.90**	0.077779	**1.34**	0.269785	**1.78**	0.507767	**2.22**	0.704029
0.47	0.003964	**0.91**	0.080886	**1.35**	0.275106	**1.79**	0.512902	**2.23**	0.707709
0.48	0.004601	**0.92**	0.084062	**1.36**	0.280449	**1.80**	0.518012	**2.24**	0.711352
0.49	0.005274	**0.93**	0.087306	**1.37**	0.285812	**1.81**	0.523095	**2.25**	0.714960
0.50	0.005985	**0.94**	0.090619	**1.38**	0.291195	**1.82**	0.528152	**2.26**	0.718532
0.51	0.006734	**0.95**	0.093998	**1.39**	0.296596	**1.83**	0.533181	**2.27**	0.722069
0.52	0.007522	**0.96**	0.097445	**1.40**	0.302014	**1.84**	0.538182	**2.28**	0.725570
0.53	0.008351	**0.97**	0.100958	**1.41**	0.307447	**1.85**	0.543155	**2.29**	0.729037
0.54	0.009223	**0.98**	0.104538	**1.42**	0.312893	**1.86**	0.548099	**2.30**	0.732468
0.55	0.010137	**0.99**	0.108183	**1.43**	0.318352	**1.87**	0.553014	**2.31**	0.735864
0.56	0.011097	**1.00**	0.111893	**1.44**	0.323822	**1.88**	0.557898	**2.32**	0.739225
0.57	0.012103	**1.01**	0.115668	**1.45**	0.329302	**1.89**	0.562752	**2.33**	0.742551
0.58	0.013155	**1.02**	0.119506	**1.46**	0.334790	**1.90**	0.567576	**2.34**	0.745843
0.59	0.014257	**1.03**	0.123407	**1.47**	0.340285	**1.91**	0.572368	**2.35**	0.749100
0.60	0.015408	**1.04**	0.127369	**1.48**	0.345786	**1.92**	0.577129	**2.36**	0.752323
0.61	0.016609	**1.05**	0.131394	**1.49**	0.351292	**1.93**	0.581857	**2.37**	0.755512
0.62	0.017863	**1.06**	0.135478	**1.50**	0.356801	**1.94**	0.586553	**2.38**	0.758666
0.63	0.019170	**1.07**	0.139622	**1.51**	0.362311	**1.95**	0.591217	**2.39**	0.761787
0.64	0.020531	**1.08**	0.143825	**1.52**	0.367822	**1.96**	0.595848	**2.40**	0.764874
0.65	0.021948	**1.09**	0.148085	**1.53**	0.373333	**1.97**	0.600445	**2.41**	0.767928
0.66	0.023421	**1.10**	0.152401	**1.54**	0.378842	**1.98**	0.605009	**2.42**	0.770948
0.67	0.024952	**1.11**	0.156773	**1.55**	0.384348	**1.99**	0.609539	**2.43**	0.773936
0.68	0.026541	**1.12**	0.161199	**1.56**	0.389850	**2.00**	0.614035	**2.44**	0.776890
0.69	0.028190	**1.13**	0.165679	**1.57**	0.395347	**2.01**	0.618497	**2.45**	0.779812
0.70	0.029899	**1.14**	0.170210	**1.58**	0.400838	**2.02**	0.622924	**2.46**	0.782701
0.71	0.031669	**1.15**	0.174792	**1.59**	0.406321	**2.03**	0.627317	**2.47**	0.785558
0.72	0.033502	**1.16**	0.179424	**1.60**	0.411795	**2.04**	0.631675	**2.48**	0.788383
0.73	0.035397	**1.17**	0.184105	**1.61**	0.417260	**2.05**	0.635997	**2.49**	0.791176
0.74	0.037356	**1.18**	0.188832	**1.62**	0.422714	**2.06**	0.640285	**2.50**	0.793937
0.75	0.039379	**1.19**	0.193605	**1.63**	0.428156	**2.07**	0.644537	**2.51**	0.796667
0.76	0.041467	**1.20**	0.198423	**1.64**	0.433586	**2.08**	0.648754	**2.52**	0.799365
0.77	0.043621	**1.21**	0.203284	**1.65**	0.439002	**2.09**	0.652935	**2.53**	0.802033
0.78	0.045841	**1.22**	0.208187	**1.66**	0.444404	**2.10**	0.657080	**2.54**	0.804670
0.79	0.048128	**1.23**	0.213130	**1.67**	0.449790	**2.11**	0.661190	**2.55**	0.807276
0.80	0.050482	**1.24**	0.218113	**1.68**	0.455159	**2.12**	0.665264	**2.56**	0.809852
0.81	0.052904	**1.25**	0.223133	**1.69**	0.460512	**2.13**	0.669302	**2.57**	0.812397
0.82	0.055393	**1.26**	0.228190	**1.70**	0.465846	**2.14**	0.673305	**2.58**	0.814913

Table 4. Re-scaled Cumulative Proportions of Fall-run Chinook Salmon Redd Depths Used in the Analysis of Potential Redd Dewatering for the Lower American River.(Continued).

Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion
2.59	0.817400	**3.03**	0.901172	**3.47**	0.947985	**3.91**	0.973238	**4.35**	0.986613
2.60	0.819857	**3.04**	0.902577	**3.48**	0.948752	**3.92**	0.973646	**4.36**	0.986828
2.61	0.822284	**3.05**	0.903963	**3.49**	0.949508	**3.93**	0.974049	**4.37**	0.987040
2.62	0.824683	**3.06**	0.905331	**3.50**	0.950253	**3.94**	0.974446	**4.38**	0.987249
2.63	0.827053	**3.07**	0.906680	**3.51**	0.950988	**3.95**	0.974837	**4.39**	0.987454
2.64	0.829395	**3.08**	0.908012	**3.52**	0.951713	**3.96**	0.975223	**4.40**	0.987657
2.65	0.831709	**3.09**	0.909326	**3.53**	0.952428	**3.97**	0.975603	**4.41**	0.987857
2.66	0.833995	**3.10**	0.910622	**3.54**	0.953132	**3.98**	0.975978	**4.42**	0.988054
2.67	0.836253	**3.11**	0.911901	**3.55**	0.953827	**3.99**	0.976347	**4.43**	0.988248
2.68	0.838483	**3.12**	0.913162	**3.56**	0.954511	**4.00**	0.976711	**4.44**	0.988439
2.69	0.840687	**3.13**	0.914407	**3.57**	0.955187	**4.01**	0.977069	**4.45**	0.988627
2.70	0.842863	**3.14**	0.915635	**3.58**	0.955852	**4.02**	0.977423	**4.46**	0.988813
2.71	0.845013	**3.15**	0.916846	**3.59**	0.956508	**4.03**	0.977771	**4.47**	0.988996
2.72	0.847136	**3.16**	0.918041	**3.60**	0.957155	**4.04**	0.978114	**4.48**	0.989176
2.73	0.849233	**3.17**	0.919220	**3.61**	0.957793	**4.05**	0.978453	**4.49**	0.989354
2.74	0.851304	**3.18**	0.920383	**3.62**	0.958422	**4.06**	0.978786	**4.50**	0.989529
2.75	0.853350	**3.19**	0.921530	**3.63**	0.959042	**4.07**	0.979115	**4.51**	0.989702
2.76	0.855370	**3.20**	0.922661	**3.64**	0.959653	**4.08**	0.979439	**4.52**	0.989872
2.77	0.857364	**3.21**	0.923778	**3.65**	0.960256	**4.09**	0.979758	**4.53**	0.990039
2.78	0.859334	**3.22**	0.924879	**3.66**	0.960850	**4.10**	0.980073	**4.54**	0.990204
2.79	0.861279	**3.23**	0.925965	**3.67**	0.961435	**4.11**	0.980383	**4.55**	0.990367
2.80	0.863200	**3.24**	0.927036	**3.68**	0.962012	**4.12**	0.980688	**4.56**	0.990527
2.81	0.865096	**3.25**	0.928092	**3.69**	0.962581	**4.13**	0.980989	**4.57**	0.990685
2.82	0.866969	**3.26**	0.929134	**3.70**	0.963142	**4.14**	0.981286	**4.58**	0.990840
2.83	0.868817	**3.27**	0.930162	**3.71**	0.963695	**4.15**	0.981578	**4.59**	0.990994
2.84	0.870642	**3.28**	0.931176	**3.72**	0.964240	**4.16**	0.981867	**4.60**	0.991145
2.85	0.872444	**3.29**	0.932176	**3.73**	0.964778	**4.17**	0.982151	**4.61**	0.991294
2.86	0.874223	**3.30**	0.933162	**3.74**	0.965308	**4.18**	0.982431	**4.62**	0.991440
2.87	0.875979	**3.31**	0.934134	**3.75**	0.965830	**4.19**	0.982707	**4.63**	0.991585
2.88	0.877713	**3.32**	0.935094	**3.76**	0.966344	**4.20**	0.982978	**4.64**	0.991727
2.89	0.879424	**3.33**	0.936039	**3.77**	0.966852	**4.21**	0.983246	**4.65**	0.991868
2.90	0.881113	**3.34**	0.936972	**3.78**	0.967352	**4.22**	0.983510	**4.66**	0.992006
2.91	0.882781	**3.35**	0.937892	**3.79**	0.967845	**4.23**	0.983770	**4.67**	0.992142
2.92	0.884427	**3.36**	0.938800	**3.80**	0.968331	**4.24**	0.984027	**4.68**	0.992276
2.93	0.886051	**3.37**	0.939694	**3.81**	0.968810	**4.25**	0.984280	**4.69**	0.992409
2.94	0.887654	**3.38**	0.940576	**3.82**	0.969282	**4.26**	0.984529	**4.70**	0.992539
2.95	0.889237	**3.39**	0.941447	**3.83**	0.969747	**4.27**	0.984774	**4.71**	0.992667
2.96	0.890799	**3.40**	0.942304	**3.84**	0.970206	**4.28**	0.985016	**4.72**	0.992794
2.97	0.892340	**3.41**	0.943151	**3.85**	0.970658	**4.29**	0.985254	**4.73**	0.992919
2.98	0.893861	**3.42**	0.943985	**3.86**	0.971104	**4.30**	0.985489	**4.74**	0.993042
2.99	0.895363	**3.43**	0.944807	**3.87**	0.971543	**4.31**	0.985720	**4.75**	0.993163
3.00	0.896844	**3.44**	0.945619	**3.88**	0.971976	**4.32**	0.985948	**4.76**	0.993282
3.01	0.898306	**3.45**	0.946419	**3.89**	0.972403	**4.33**	0.986173	**4.77**	0.993399
3.02	0.899749	**3.46**	0.947207	**3.90**	0.972823	**4.34**	0.986395	**4.78**	0.993515

Table 4. Re-scaled Cumulative Proportions of Fall-run Chinook Salmon Redd Depths Used in the Analysis of Potential Redd Dewatering for the Lower American River.(Continued).

Redd Depth (ft)	Scaled Cumulative Proportion
4.79	0.993629
4.80	0.993742
4.81	0.993853
4.82	0.993962
4.83	0.994069
4.84	0.994175
4.85	0.994280
4.86	0.994383
4.87	0.994484
4.88	0.994584
4.89	0.994682
4.90	0.994779
4.91	0.994875
4.92	0.994969
4.93	0.995062
4.94	0.995153
4.95	0.995243
4.96	0.995332
4.97	0.995419
4.98	0.995506
4.99	0.995590
5.00	0.995674
5.01	0.995756
5.02	0.995838
5.03	0.995918
5.04	0.995997
5.05	0.996074
5.06	0.996151
5.07	0.996226
5.08	0.996300
5.09	0.996374
5.10	0.996446
5.11	0.996517
5.12	0.996587
5.13	0.996656
5.14	0.996724
5.15	0.996791
5.16	0.996857
5.17	0.996922
5.18	0.996986
5.19	0.997049
5.20	0.997111
5.21	0.997172
5.22	0.997233
5.23	0.997292
5.24	0.997351
5.25	0.997408
5.26	0.997465
5.27	0.997521
5.28	0.997577
5.29	0.997631
5.30	0.997685
5.31	0.997737
5.32	0.997789
5.33	0.997841
5.34	0.997891
5.35	0.997941
5.36	0.997990
5.37	0.998038
5.38	0.998086
5.39	0.998133
5.40	0.998179
5.41	0.998225
5.42	0.998269
5.43	0.998314
5.44	0.998357
5.45	0.998400
5.46	0.998442
5.47	0.998484
5.48	0.998525
5.49	0.998565
5.50	0.998605
5.51	0.998644
5.52	0.998683
5.53	0.998721
5.54	0.998759
5.55	0.998796
5.56	0.998832
5.57	0.998868
5.58	0.998903
5.59	0.998938
5.60	0.998973
5.61	0.999006
5.62	0.999040
5.63	0.999073
5.64	0.999105
5.65	0.999137
5.66	0.999168
5.67	0.999199
5.68	0.999230
5.69	0.999260
5.70	0.999289
5.71	0.999318
5.72	0.999347
5.73	0.999375
5.74	0.999403
5.75	0.999431
5.76	0.999458
5.77	0.999484
5.78	0.999511
5.79	0.999537
5.80	0.999562
5.81	0.999587
5.82	0.999612
5.83	0.999636
5.84	0.999660
5.85	0.999684
5.86	0.999707
5.87	0.999730
5.88	0.999753
5.89	0.999775
5.90	0.999797
5.91	0.999819
5.92	0.999840
5.93	0.999861
5.94	0.999882
5.95	0.999902
5.96	0.999923
5.97	0.999942
5.98	0.999962
5.99	0.999981
6.00	1

1.1.5.2 Steelhead

The relative cumulative frequency distribution of steelhead redd depths was the result of USACE's fitting an asymmetric logistic function to three annual series of steelhead redd depths combined (**Figure 6**). The redd depth data, provided by John Hannon, were collected during the 2002, 2003, and 2004 steelhead redd surveys performed by USBR in the lower American River on February 25 through March 15, 2002 (N = 80 redd depths); on January 7 through March 19, 2003 (N = 113 redd depths); and on January 13 through April 16, 2004 (N = 133 redd depths). The shallowest redd depth in this database was 0.6 foot, while the deepest steelhead redd was observed at 4.6 feet.

The asymmetric logistic function fitted to the resulting data had the following expression:

$$\Pr\left(D\right)=\left(\frac{1}{1+\exp\left(4.7384-2.2891\times D\right)}\right)^{1/0.9992}, \qquad \textbf{(4)}$$

where *D* is the redd depth in feet. The mean-square error of this fit was 0.00045.

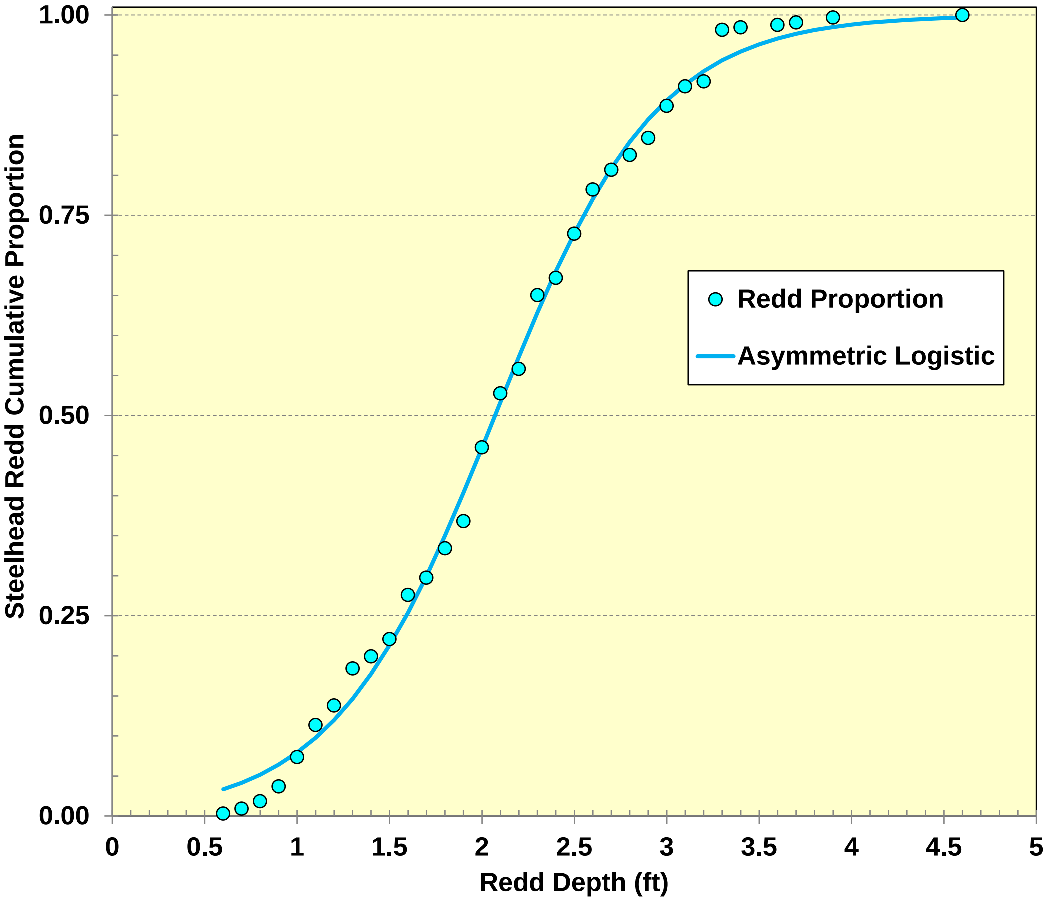


Figure 6. Cumulative Proportions of 326 Steelhead Redd Depths Measured in the Lower American River during the 2001/2002, 2002/2003 and 2003/2004 Redd Surveys, and Fitted Asymmetric Logistic Curve.

The asymmetric logistic function in equation 4 was re-scaled to the observed range of steelhead redd depths (0.6 ft. through 4.6 ft.) and used to build a look-up table providing the expected cumulative proportions of redd depths for every hundredth of a foot (**Table 5**).

1.1.6 Stage-Flow Relationships

The calculation of the annual weighted redd dewatering index (WRD_Y) requires estimates of the mean daily stages or water surface elevations at each spawning reach *h* during each redd construction day *d* of the evaluated year *Y*, as well as during any subsequent day until the last day of the corresponding embryo incubation period ($ED_{d,h,Y}$).

Table 5. Re-scaled Cumulative Proportions of Steelhead Redd Depths Used in the Analysis of Potential Redd Dewatering for the Lower American River.

Redd Depth (ft)	Scaled Cumulative Proportion
0.59	0
0.60	0.000774
0.61	0.001564
0.62	0.002372
0.63	0.003197
0.64	0.004039
0.65	0.004900
0.66	0.005779
0.67	0.006677
0.68	0.007594
0.69	0.008530
0.70	0.009486
0.71	0.010463
0.72	0.011460
0.73	0.012478
0.74	0.013518
0.75	0.014580
0.76	0.015663
0.77	0.016770
0.78	0.017899
0.79	0.019052
0.80	0.020229
0.81	0.021430
0.82	0.022656
0.83	0.023907
0.84	0.025184
0.85	0.026488
0.86	0.027817
0.87	0.029174
0.88	0.030558
0.89	0.031971
0.90	0.033411
0.91	0.034881
0.92	0.036380
0.93	0.037909
0.94	0.039469
0.95	0.041059
0.96	0.042681
0.97	0.044335
0.98	0.046021
0.99	0.047740
1.00	0.049493
1.01	0.051279
1.02	0.053101
1.03	0.054957
1.04	0.056848
1.05	0.058776
1.06	0.060740
1.07	0.062741
1.08	0.064780
1.09	0.066856
1.10	0.068972
1.11	0.071126
1.12	0.073321
1.13	0.075555
1.14	0.077830
1.15	0.080146
1.16	0.082504
1.17	0.084904
1.18	0.087347
1.19	0.089833
1.20	0.092363
1.21	0.094937
1.22	0.097555
1.23	0.100218
1.24	0.102927
1.25	0.105682
1.26	0.108484
1.27	0.111332
1.28	0.114227
1.29	0.117170
1.30	0.120162
1.31	0.123201
1.32	0.126290
1.33	0.129427
1.34	0.132615
1.35	0.135852
1.36	0.139139
1.37	0.142476
1.38	0.145865
1.39	0.149304
1.40	0.152795
1.41	0.156337
1.42	0.159930
1.43	0.163576
1.44	0.167273
1.45	0.171022
1.46	0.174824
1.47	0.178678
1.48	0.182584
1.49	0.186543
1.50	0.190554
1.51	0.194617
1.52	0.198732
1.53	0.202900
1.54	0.207120
1.55	0.211391
1.56	0.215715
1.57	0.220090
1.58	0.224516
1.59	0.228993
1.60	0.233521
1.61	0.238099
1.62	0.242727
1.63	0.247405
1.64	0.252132
1.65	0.256908
1.66	0.261732
1.67	0.266603
1.68	0.271522
1.69	0.276487
1.70	0.281497
1.71	0.286553
1.72	0.291652
1.73	0.296796
1.74	0.301982
1.75	0.307210
1.76	0.312479
1.77	0.317788
1.78	0.323136
1.79	0.328522
1.80	0.333945
1.81	0.339405
1.82	0.344899
1.83	0.350427
1.84	0.355988
1.85	0.361581
1.86	0.367204
1.87	0.372856
1.88	0.378536
1.89	0.384242
1.90	0.389974
1.91	0.395729
1.92	0.401507
1.93	0.407307
1.94	0.413125
1.95	0.418962
1.96	0.424816
1.97	0.430686
1.98	0.436569
1.99	0.442464
2.00	0.448371
2.01	0.454286
2.02	0.460210
2.03	0.466140
2.04	0.472074
2.05	0.478012
2.06	0.483951
2.07	0.489891
2.08	0.495829
2.09	0.501763
2.10	0.507694
2.11	0.513618
2.12	0.519534
2.13	0.525441
2.14	0.531338
2.15	0.537222
2.16	0.543092
2.17	0.548947
2.18	0.554786
2.19	0.560606
2.20	0.566407
2.21	0.572187
2.22	0.577944
2.23	0.583677
2.24	0.589386
2.25	0.595068
2.26	0.600722
2.27	0.606347
2.28	0.611942
2.29	0.617506
2.30	0.623037
2.31	0.628534
2.32	0.633996
2.33	0.639422
2.34	0.644812
2.35	0.650163
2.36	0.655475
2.37	0.660747
2.38	0.665978
2.39	0.671168
2.40	0.676315
2.41	0.681418
2.42	0.686477
2.43	0.691491
2.44	0.696460
2.45	0.701382
2.46	0.706257
2.47	0.711085
2.48	0.715865
2.49	0.720596
2.50	0.725278
2.51	0.729910
2.52	0.734493
2.53	0.739025
2.54	0.743506
2.55	0.747937
2.56	0.752316
2.57	0.756644
2.58	0.760920
2.59	0.765144
2.60	0.769316
2.61	0.773436
2.62	0.777504
2.63	0.781519
2.64	0.785482
2.65	0.789393
2.66	0.793251
2.67	0.797058
2.68	0.800812
2.69	0.804514
2.70	0.808164
2.71	0.811762
2.72	0.815308
2.73	0.818804
2.74	0.822248
2.75	0.825640
2.76	0.828983
2.77	0.832274
2.78	0.835516

Table 5. Re-scaled Cumulative Proportions of Steelhead Redd Depths Used in the Analysis of Potential Redd Dewatering for the Lower American River (Continued).

Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion	Redd Depth (ft)	Scaled Cumulative Proportion
2.79	0.838708	**3.23**	0.936341	**3.67**	0.977673	**4.11**	0.993661	**4.55**	0.999626
2.80	0.841850	**3.24**	0.937756	**3.68**	0.978235	**4.12**	0.993872	**4.56**	0.999705
2.81	0.844943	**3.25**	0.939144	**3.69**	0.978784	**4.13**	0.994079	**4.57**	0.999781
2.82	0.847987	**3.26**	0.940504	**3.70**	0.979321	**4.14**	0.994281	**4.58**	0.999856
2.83	0.850983	**3.27**	0.941837	**3.71**	0.979847	**4.15**	0.994479	**4.59**	0.999929
2.84	0.853931	**3.28**	0.943143	**3.72**	0.980362	**4.16**	0.994672	**4.60**	1
2.85	0.856831	**3.29**	0.944423	**3.73**	0.980865	**4.17**	0.994861		
2.86	0.859683	**3.30**	0.945677	**3.74**	0.981358	**4.18**	0.995046		
2.87	0.862489	**3.31**	0.946906	**3.75**	0.981839	**4.19**	0.995227		
2.88	0.865248	**3.32**	0.948110	**3.76**	0.982311	**4.20**	0.995403		
2.89	0.867962	**3.33**	0.949290	**3.77**	0.982772	**4.21**	0.995576		
2.90	0.870630	**3.34**	0.950446	**3.78**	0.983223	**4.22**	0.995745		
2.91	0.873252	**3.35**	0.951578	**3.79**	0.983664	**4.23**	0.995910		
2.92	0.875830	**3.36**	0.952687	**3.80**	0.984096	**4.24**	0.996071		
2.93	0.878364	**3.37**	0.953774	**3.81**	0.984518	**4.25**	0.996229		
2.94	0.880855	**3.38**	0.954838	**3.82**	0.984931	**4.26**	0.996383		
2.95	0.883302	**3.39**	0.955880	**3.83**	0.985335	**4.27**	0.996534		
2.96	0.885706	**3.40**	0.956901	**3.84**	0.985730	**4.28**	0.996682		
2.97	0.888068	**3.41**	0.957901	**3.85**	0.986116	**4.29**	0.996826		
2.98	0.890389	**3.42**	0.958880	**3.86**	0.986494	**4.30**	0.996967		
2.99	0.892668	**3.43**	0.959839	**3.87**	0.986864	**4.31**	0.997105		
3.00	0.894906	**3.44**	0.960778	**3.88**	0.987226	**4.32**	0.997239		
3.01	0.897105	**3.45**	0.961697	**3.89**	0.987579	**4.33**	0.997371		
3.02	0.899263	**3.46**	0.962597	**3.90**	0.987925	**4.34**	0.997500		
3.03	0.901383	**3.47**	0.963479	**3.91**	0.988263	**4.35**	0.997626		
3.04	0.903463	**3.48**	0.964342	**3.92**	0.988594	**4.36**	0.997749		
3.05	0.905506	**3.49**	0.965187	**3.93**	0.988918	**4.37**	0.997869		
3.06	0.907511	**3.50**	0.966014	**3.94**	0.989234	**4.38**	0.997987		
3.07	0.909479	**3.51**	0.966823	**3.95**	0.989544	**4.39**	0.998102		
3.08	0.911410	**3.52**	0.967616	**3.96**	0.989847	**4.40**	0.998214		
3.09	0.913306	**3.53**	0.968392	**3.97**	0.990143	**4.41**	0.998324		
3.10	0.915166	**3.54**	0.969152	**3.98**	0.990432	**4.42**	0.998431		
3.11	0.916990	**3.55**	0.969895	**3.99**	0.990715	**4.43**	0.998536		
3.12	0.918781	**3.56**	0.970623	**4.00**	0.990992	**4.44**	0.998639		
3.13	0.920537	**3.57**	0.971335	**4.01**	0.991263	**4.45**	0.998739		
3.14	0.922260	**3.58**	0.972032	**4.02**	0.991527	**4.46**	0.998837		
3.15	0.923949	**3.59**	0.972715	**4.03**	0.991786	**4.47**	0.998933		
3.16	0.925607	**3.60**	0.973382	**4.04**	0.992039	**4.48**	0.999027		
3.17	0.927232	**3.61**	0.974036	**4.05**	0.992287	**4.49**	0.999118		
3.18	0.928826	**3.62**	0.974675	**4.06**	0.992529	**4.50**	0.999208		
3.19	0.930389	**3.63**	0.975301	**4.07**	0.992765	**4.51**	0.999295		
3.20	0.931921	**3.64**	0.975914	**4.08**	0.992997	**4.52**	0.999381		
3.21	0.933424	**3.65**	0.976513	**4.09**	0.993223	**4.53**	0.999465		
3.22	0.934897	**3.66**	0.977099	**4.10**	0.993444	**4.54**	0.999547		

In equation 1, the variable $Stage_{d,h,Y}$ indicates the mean daily river stage in spawning reach *h* on redd construction day *d* of year *Y*, and the variable $Stage_{i,h,Y}$ indicates the mean daily river stage in the same spawning area, on any day *i* subsequent to the date of redd construction, until the last day of the embryo incubation period for the redds built on day *d*. Eighteen reach-specific stage-flow relationships were used to interpolate daily stage or water surface elevation that corresponds to the simulated average daily flow output.

The 18 reach-specific stage-flow relationships used (**Figure 7**) were developed by cbec on March 2015 and used by USACE for this analysis of potential redd dewatering in the lower American River with the Folsom WCM alternatives and the bases of comparison. The reach-specific stage-flow relationships were constructed by first developing individual stage-flow relationships for each of the available measured cross-sections spaced 0.25 mile apart and then averaging the resulting stage-flow relationships into 1-mile sections. Each of the resulting 18 reach-specific stage-flow relationships provides water surface elevations expressed in feet for 139 flows ranging from 200 cfs to 180,000 cfs, in increasing steps of 100 cfs (19 values), 500 cfs (12 values), 1,000 cfs (92 values), and 5,000 cfs (16 values).

Because the calculation of the annual weighted redd dewatering index (WRD_Y) requires the derivation of mean daily stages from simulated mean daily flows with the Folsom WCM alternatives and the bases of comparison for each spawning reach *h* during each redd construction day *d* of the evaluated year *Y*, as well as during any subsequent day until the last day of the corresponding embryo incubation period ($ED_{d,h,Y}$), and because the 18 reach-specific stage-flow relationships provide stage values for only 139 flows, daily stages were determined by linear interpolation between the available stage values for the flows immediately below and above the target flow $Q_{d,Y}$.

1.1.7 Annual Weighted Redd Dewatering Index Calculation

The calculations of the annual weighted redd dewatering indices (WRD_Y) for fall-run Chinook salmon and steelhead spawning in the lower American River for the simulated daily flows and water temperatures with the Folsom WCM alternatives and the bases of comparison during each of the simulation years were performed using Microsoft Excel templates and a macro. The step-by-step calculations included in these templates and the macro are summarized in the following paragraphs.

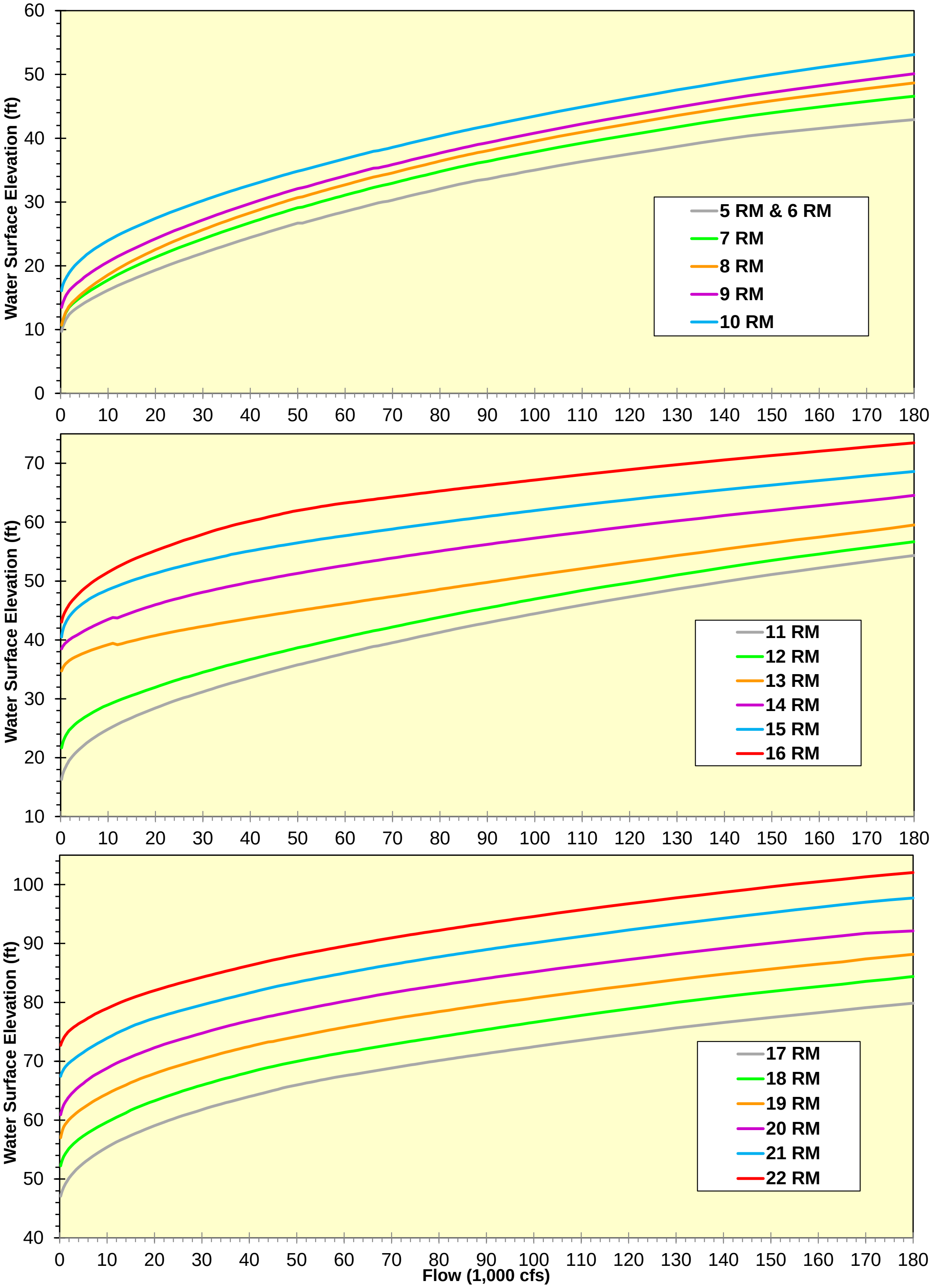


Figure 7. Relationships between Water Surface Elevation (Feet) and Flow (Thousand cfs) Developed by cbec for Each of the 18 Spawning Reaches Used in the Redd Dewatering Analysis for Chinook Salmon and Steelhead in the Lower American River.

Step 1. For the first spawning reach (h = RM 22) and the first day of the spawning period (d = October 13 for fall-run Chinook salmon and d = December 14 for steelhead) during the first year Y of the entire simulation period, count the number of days while the daily ATUs, derived from the reach-specific simulated daily water temperatures, remain below a target of 1,649°F for Chinook salmon and 1,080°F for steelhead. The resulting counts ($ED_{d,h,Y}$) are the durations of fall-run Chinook salmon and steelhead embryo incubation for redds built on day d of year Y, in spawning area h.

Step 2. For the same year Y, spawning reach h and spawning day d, calculate the daily flow at which the fall-run Chinook salmon or steelhead redds are built using the simulated average daily flows. For fall-run Chinook salmon, the spawning flow ($Q_{h,d,Y}$) is calculated as the minimum of the modeled daily flows for day d and the previous 7 days. For steelhead, the spawning flow ($Q_{h,d,Y}$) are calculated as the minimum of the modeled daily flows for day d and the previous 3 days.

Step 3. Using the stage-flow relationship for spawning reach h, calculate the stage or water surface elevation ($Stage_{d,h,Y}$) that corresponds to the spawning flow ($Q_{h,d,Y}$) calculated in the previous step, using linear interpolation if needed.

Step 4. Using the stage-flow relationship for spawning reach h, calculate the stages or water surface elevations ($Stage_{i,h,Y}$) that correspond to the simulated daily average flows for all days within the range $i = d + 1$ through $i = d + ED_{d,h,Y}$.

Step 5. Calculate the maximum positive difference between the spawning-day stage ($Stage_{d,h,Y}$) and the stages on subsequent days (from step 4). This value represents the maximum drop in water elevation experienced by redds built in spawning area h on day d of year Y throughout their embryo incubation period.

Step 6. Compute the proportion of the redds built in spawning area h on day d of year Y potentially dewatered by the maximum drop in water elevation calculated in step 5 by using the Excel function VLOOKUP with the value from step 5 rounded to two decimal places, and Table 4 for fall-run Chinook salmon or Table 5 for steelhead.

Step 7. Multiply the proportions derived from step 6 by the temporal weighting coefficient corresponding to spawning day *d* (w_d) and by the spatial weighting coefficient corresponding to spawning reach *h* (w_h). The result of this step ($WRD_{d,h,Y}$) represents the maximum proportion of the redds built on spawning day *d* of year *Y* in reach *h* that are potentially exposed to at least 1 day of dewatering during their embryo incubation period, weighted over all redds built in year *Y*.

Step 8. For spawning day *d* and year *Y*, repeat steps 1 through 7 with each of the 17 remaining spawning reaches (*h* = RM 21 through *h* = RM 5) and save the resulting partial dewatering proportions $WRD_{d,h,Y}$.

Step 9. Repeat steps 1 through 8 for each of the remaining 97 Chinook salmon spawning days (*d* = October 12 through January 18) and 113 steelhead spawning days (*d* = December 15 through April 5) and save the resulting partial dewatering proportions $WRD_{d,h,Y}$.

Step 10. Sum the partial dewatering proportions $WRD_{d,h,Y}$ from steps 7, 8, and 9 to obtain WRD_Y, the annual weighted redd dewatering index for year *Y*.

Step 11. Repeat steps 1 through 10 for the remaining years of the simulation period.

Once all of the annual weighted redd dewatering indices for fall-run Chinook salmon and steelhead in the lower American River were calculated using simulated daily flows and associated river stages, and simulated daily water temperatures with the Folsom WCM alternatives and the bases of comparison, the resulting annual indices were averaged over the entire simulation period and by water year type, and were ranked and sorted to produce probability of exceedance distributions, for comparison of the redd dewatering indices, with the Folsom WCM alternatives relative to the bases of comparison.

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LOWER AMERICAN RIVER
CHINOOK SALMON EARLY LIFESTAGE MORTALITY MODEL: *UPDATES AND REFINEMENTS*

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1.0 Introduction

1.1 Background

In 1983, the first version of a Chinook Salmon Early Lifestage Mortality Model ("Mortality Model") was developed by the U.S. Bureau of Reclamation (USBR) for application on the lower Sacramento River to estimate annual, thermally-induced losses of initial Chinook salmon year-class production. In 1990, this Mortality Model was further revised and refined through a collaborative effort by the U.S. Fish and Wildlife Service (USFWS), the California Department of Fish and Wildlife (CDFW, formerly CDFG), and the USBR for use in the Shasta Reservoir temperature control device studies (USBR 1991). The USFWS and CDFW worked cooperatively to produce a list of biological criteria and assumptions that served as the underlying biological basis for the model's refinement. From these fishery assumptions and biological criteria, the USBR revised the Mortality Model to assess spawning and hatching success of the various Chinook salmon runs that use the lower Sacramento River, under different in-river thermal regimes that would result from various alternatives for controlling release temperatures from Shasta Reservoir.

Since 1990, the Mortality Model has been further modified by the USBR to facilitate its application to the lower American River. The Sacramento Water Forum (Water Forum) has used this "lower American River version" of the Mortality Model (LAR Mortality Model) as one tool for assessing the relative benefits of alternative flow patterns to fall-run Chinook salmon production in the lower American River. Because of the importance of the modeling output in identifying preferred lower American River flow regimes and Folsom Reservoir coldwater pool management, and because additional information has become available since the LAR Mortality Model was originally developed in the mid-1990s that could be incorporated into the model to improve its accuracy, a Water Forum directed effort, in collaboration with the U.S. Army Corps of Engineers (Corps), to update the LAR Mortality Model was undertaken in 2013. This technical memorandum documents the model refinements made as part of that effort.

1.2 USBR Chinook Salmon Lower American River Mortality Model

1.2.1 Model Description

In April of 1995, the USBR developed the LAR Mortality Model, based on the Mortality Model initially developed for the lower Sacramento River. The LAR Mortality Model calculates daily temperature-induced mortality for three early lifestages of Chinook salmon: (1) pre-spawn eggs; (2) fertilized eggs; and (3) pre-emergent fry. Accumulated thermal units (ATU), defined as the difference between in-river water temperatures and 32°F, are accounted for on a daily basis by the model, and are used to track lifestage development. For example, incubating eggs exposed to 42°F water for one day would experience 10 ATUs. Eggs are assumed to hatch upon exposure to 750 ATUs following fertilization. Similarly, the model assumes that fry emerge from the gravel upon being exposed to 750 ATUs following hatching.

Mortality incurred by the three early lifestages defined above, during a specified period of time, is based on in-river temperatures (i.e., thermal exposures). The LAR Mortality Model was designed to be coupled with the USBR's water temperature model. This monthly temperature model consists of a USBR-modified version of a Corps' monthly reservoir model and a stream model developed by the USBR. The reservoir model simulates one-dimensional, vertical distribution of reservoir water temperature using monthly input data on initial storage and temperature conditions, inflow, outflow, evaporation, precipitation, radiation, and average air temperature to compute release water temperatures from Folsom and Nimbus dams. Using these data, the USBR's stream model calculates resultant monthly mean water temperatures in the lower American River at specified locations downstream of Nimbus Dam.

While the USBR's water temperature model can be used to determine monthly mean water temperatures, it does not define day-to-day temperature variations within a month and, therefore, its output cannot be used to quantify fishery impacts on a daily basis. A daily temperature model would be required for such evaluations. Because a daily temperature model that could work effectively with the 82 years of hydrologic record was unavailable at the time that the LAR Mortality Model was developed, the LAR Mortality Model was programmed to interpolate daily mean water temperatures from the monthly mean water temperature data output from the USBR water temperature model.

1.2.2 Model Approach to Estimating Early Lifestage Mortality

To understand how the model calculates early lifestage losses, the LAR Mortality Model input parameters must be identified and understood. The principal model parameters are as follows.

JD - Julian day (1-365)

ESD - Daily percent of run spawning. The ESD is reduced by prior pre-spawning losses (AKIL).

FRY - Daily percent of run hatching from the egg to pre-emergent fry stage. The FRY occurs 750 ATUs after the ESD and is reduced by prior egg losses (EKIL).

EFRY - Daily percent of run developing from a pre-emergent fry into an emergent fry. The fry emerge 750 ATUs after they hatch into a pre-emergent fry and are reduced by prior pre-emergent fry losses (FKIL).

AD - Percent of pre-spawning adults present on each day. AD is computed from the adults from the previous day plus daily arrivals (PSD), minus daily spawn (SD), minus pre-spawning losses occurring that day (AKIL). The PSD and SD are distributed over river reaches by multiplying each of these factors by RD.

RD - Reach distribution.

ED - Percent of eggs present on each day. ED is computed from the eggs of the previous day plus the daily ESD, minus the daily FRY, minus the egg losses occurring that day (EKIL).

FD - Percent of pre-emergent fry present on each day. FD is computed from the pre-emergent fry of the previous day plus the daily FRY, minus the daily EFRY, minus the pre-emergent fry losses occurring that day (FKIL).

TR - The average daily river temperature within the reach (e.g., Reach 2) computed from the river temperature model output (T) in °F.

PSM - The daily pre-spawn egg mortality (in percent) computed via a step-function from TR and the pre-spawn egg criteria (PSC). The average exposure time for these data was assumed to be 30 days.

EM - The daily egg mortality (in percent) computed via a step-function from TR and the fertilized egg criteria (EC).

FM - The daily pre-emergent fry mortality (in percent) computed via a step-function from TR and the pre-emergent fry criteria (FC).

PSC - Set of instantaneous daily mortality rates for pre-spawn eggs at various temperatures.

EC - Set of instantaneous daily mortality rates for fertilized-eggs at various temperatures.

FC - Set of instantaneous daily mortality rates for pre-emergent fry at various temperatures.

AKIL - The daily pre-spawning loss in percent. This is computed from the AD prior to the pre-spawning loss (previous day AD + daily arrivals - daily spawn) multiplied by the PSM for that day.

EKIL - The daily egg loss in percent. This is computed from the ED prior to the egg loss multiplied by the EM for that day.

FKIL - The daily pre-emergent fry loss in percent. This is computed from the FD prior to the fry loss multiplied by the FM for that day.

Based on these parameters, the LAR Mortality Model calculates the annual percent loss of total production potential (i.e., eggs brought to the river by female salmon). The model accounts for the daily loss of eggs and/or fry in the calculation of total mortality over the exposure period. To do so, the model independently calculates a daily percent pre-spawning loss (AKIL), a daily percent egg loss (EKIL), and a daily percent pre-emergent fry loss (FKIL) for distinct river reaches between Nimbus Dam and the lower end of the spawning grounds.

The daily AKIL value is computed using the percent of pre-spawning adults present on each day (AD), daily arrivals, daily spawning, and the daily pre-spawning mortality of adults (PSM), which is based on water temperature exposure (i.e., thermal exposure to date). A given day's AKIL value is equal to: (AD from previous day + current day PSD – current day SD), multiplied by the current day PSM. Similarly, daily EKIL values are computed using the percent of spawning on each day (ED), prior to egg loss, multiplied by a daily egg mortality factor in percent (EM) for that day, based on thermal exposure. Finally, daily FKIL values are computed using the percent of pre-emergent fry present on each day (FD), prior to fry loss, multiplied by the daily pre-emergent fry mortality factor (FM - %) for that day, based on thermal exposure.

Daily pre-spawning, egg, and fry mortalities are calculated by summing AKIL, EKIL, and FKIL, respectively, for all river reaches identified in the model. Monthly and annual salmon mortalities for the river are computed by summing the daily losses for all reaches and lifestages.

Because the mortality estimates calculated by the model are based on modeled mean monthly water temperatures, mortality estimates should not be interpreted to be true quantitative predictions, but rather viewed as a "relative index" of Chinook salmon early lifestage losses resulting from different thermal exposure scenarios.

A Water Forum Issue Paper (HCI 1996) documented additional assumptions and criteria coded into the LAR Mortality Model. These assumptions and criteria are summarized below.

- The temporal spawning distribution for fall-run Chinook salmon in the lower American River was defined using CDFW angler creel survey data for the years 1990-1994 and historic (1944-1946) fall-run Chinook salmon passage at the fishway at Old Folsom Dam.

- The spatial spawning distribution for fall-run Chinook salmon in the lower American River was defined based on aerial redd survey data collected by the CDFW in the fall of 1991, 1992, and 1993.

- Annual lower American River spawning was to be initiated (by the model) when the daily mean river water temperature declined to 60°F each year, rather than on a characteristic temporal distribution. The threshold temperature of 60°F for initiation of spawning (spawning initiation trigger) was set for the model after consultation and agreement with CDFW. This decision was based on data generated from aerial redd surveys conducted on the lower American River by CDFW from 1991-1993.

- The model did not account for Chinook salmon arriving annually prior to September 1 each year. Adult Chinook salmon entering the lower American River to spawn prior to the time when daily mean water temperatures decrease to 60°F are "held" by the model and are not "spawned" until after in-river water temperatures declined to ≤60°F (i.e., until after the "60°F date" was reached) during the fall.

- Immigrating adult Chinook salmon arriving at the lower American River spawning grounds when daily mean river temperatures are ≤60°F (i.e., after the "60°F date") are "spawned" by the model one week (7 days) later.

The lower American River-specific assumptions and criteria defined above were programmed into the LAR Mortality Model code by the USBR in April of 1995, which finalized the development of the original 1995 LAR Mortality Model.

1.3 Purpose and Intended Use of this Memorandum

The purpose of this memorandum is to document the methodology used to update and refine the LAR Mortality Model assumptions and coding. The following LAR Mortality Model assumptions were refined based on new data and information that has become available since the model was originally developed.

- The temporal distribution for the arrival of spawning fall-run Chinook salmon in the lower American River.

- The temporal distribution for fall-run Chinook salmon spawning in the lower American River.

- The spatial distribution of pre-spawn arriving and 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 ATU thresholds associated with the end of the fertilized-egg and pre-emergent fry lifestages.

Following their refinement based on new data/information, these updated assumptions were coded into the LAR model to produce the updated 2015 version of the LAR Mortality Model. This memorandum also documents the code corrections and programming language conversion that was performed on the original model, in addition to the updates and refinements. Finally, this memorandum conducts a progressive model sensitivity analysis to identify the effects of each of the major updates and refinements made to the model on its annual average mortality estimates for the lower American River.

2.0 Chinook Salmon Adult Temporal and Spatial Distributions

The LAR Mortality Model requires input regarding: (1) the temporal distribution of pre-spawning adult fall-run Chinook salmon arrival and staging in the lower American River; (2) the temporal distribution of adult fall-run Chinook salmon spawning in the lower American River; and (3) the spatial distribution of fall-run Chinook salmon spawning in the lower American River. For this technical memorandum, the timing of adult fall-run Chinook salmon arriving in the lower American River is referred to as "pre-spawn arrival temporal distribution", the time at which fall-run Chinook salmon spawn is referred to as the "spawning temporal distribution", and the location (i.e., river mile) at which spawning occurs is referred to as "spawning spatial distribution." The approach used for refining the calculations and the model weighting coefficients for pre-spawn arrival and spawning temporal distributions, and spawning spatial distributions are provided in the following subsections.

2.1 Chinook Salmon Pre-Spawn Arrival Temporal Distribution

It has generally been reported in the literature that fall-run Chinook salmon spend a variable amount of time in their natal rivers prior to the onset of the spawning activity. For example, Moyle (2002) states that, in California, fall-run Chinook salmon typically spawn within a few days or weeks of arriving on the spawning grounds. The lifestage of adult fall-run Chinook salmon in a river prior to spawning is referred to as "staging".

Estimates of the time spent staging by fall-run Chinook salmon prior to spawning are typically based upon enumeration of immigrating adult fall-run Chinook salmon through a weir located in the lower reaches of a river, or through monitoring surveys of live fish concurrently with redd surveys. Such data have not been collected in the lower American River. However, as part of a study to evaluate angler effort and harvest of anadromous fishes in the Central Valley recreational river fishery, CDFW has performed periodic creel censuses in the lower American River that provide estimates of the fall-run Chinook salmon monthly catch, both retained and released, that can be used to assess the temporal distribution of pre-spawning adult fall-run Chinook salmon in the lower American River.

During each annual angler survey, the number of anglers and the number of fish caught and retained, and caught and released, were sampled over 3 sections of the lower American River extending from Discovery Park to Nimbus Dam, on 8 randomly selected days (4 weekend, 4 weekday) per month and river section. Three primary statistical descriptors were calculated for each month and river section: (1) angling effort in terms of angler-hours; (2) catch-per-unit-effort (CPUE) in terms of fish per angler-hour for each target species; and (3) catch for each target species. For each species, results were presented in tables displaying the total number of angler-hours targeting the species, the estimated catch kept and the estimated catch released by month and river section.

The estimated monthly catches of adult fall-run Chinook salmon in the lower American River obtained from available CDFW angler survey reports[5] (e.g., Wixom et al. 1995; Murphy et al. 1999; Murphy et al. 2001a and 2001b; Schroyer et al. 2002; Massa and Schroyer 2003; and Titus et al. 2008, 2009 and 2010) were used to obtain the temporal distribution of in-river adult fall-run Chinook salmon prior to spawning by applying the following steps:

1.) The monthly catches of Chinook salmon kept and released from available annual angler survey reports were summed over the three river sections and organized annually over the period extending from June 1 through May 31 of the following calendar year (**Table 1**).

2.) The monthly catches (of both kept and released fish) each year were divided by the annual total catch to obtain relative monthly catch proportions. These proportions were summed and plotted against time (days extending from June 1 through May 31) by allocating each monthly proportion to the last day of the sampled month.

3.) An asymmetric logistic function was fitted to all of the monthly cumulative proportions of fish caught during all of the ten years of available data. The resulting curve (**Figure 1**) was used to represent the temporal distribution of adult Chinook salmon arriving in the lower American River prior to and during the fall-run Chinook salmon spawning season.

The lower American River Chinook salmon pre-spawn arrival temporal distributions have the potential to be influenced by the straying of late fall-run Chinook salmon into the lower American River, as was particularly evidenced during the 2008/09 spawning season. Chinook salmon have been encountered in the CDFG carcass surveys (Vincik and Kirsch 2009; Healey and Redding 2008; Healey and Fresz 2007; Healey 2005, 2004) through the month of January, although a low percentage of fresh carcasses have been encountered after the first week of January (generally 0.2 to 3%). The highest number of fresh Chinook salmon carcasses encountered after the first week of January was observed during the 2008/2009 survey season, when 12% of all fresh carcasses were observed after the first week of January 2009 (Vincik and Kirsch 2009). Spawning during the latter part of January is somewhat atypical of fall-run, but is phenotypically consistent with late fall-run Chinook salmon. During the 2008/2009 surveys, recovery and analysis of 53 coded-wire tagged (CWT) carcasses obtained throughout the month of January 2009 documented that all of them were late fall-run Chinook salmon strays

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[5] Brown and Titus (2007) also was available, although no survey information was reported for the period extending from June through October and, therefore, was not included in the dataset used to develop the cumulative temporal distribution.

originating from the Coleman National Fish Hatchery on Battle Creek. In addition to adipose fin-clipped (i.e., hatchery) carcasses, non-adipose fin-clipped carcasses also were encountered during January. Vincik and Kirsch (2009) speculated that the late spawning Chinook salmon in the lower American River may be attributable to the straying of hatchery and presumed wild Chinook salmon from other systems and is not likely a self-sustaining run within the lower American River. However, they recognize the need to further explore this issue in future monitoring efforts. More recently, Kormos et al. (2012) found that relative to the total of 23,945 Chinook salmon carcasses sampled during 2010/2011, 162 (less than 1% of all Chinook salmon) were classified as late fall-run Chinook salmon, of which approximately 23% (37 fish) were of hatchery origin.

Table 1. Estimated angler's monthly catch of Chinook salmon (both retained and released) in the lower American River, organized by biological years that extend from June 1 through May 31 of the following calendar year.

Year	Estimated Chinook Salmon Angler's Retained and Released Catch (No. of Fish)													Source
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total	
1991/92	0	1,056	5,999	1,567	2,450	3,906	49	0	0	0	0	0	15,027	Wixon *et al.* (1995)
1992/93	438	503	1,164	219	816	2,461	1,359	0	0	0	0	0	6,960	Wixon *et al.* (1995)
1993/94	73	455	796	2,061	4,685	12,219	211	131	0	0	0	0	20,631	Wixon *et al.* (1995)
1998/99	120	---	933	4,744	16,824	14,697	943	228	0	0	0	0	38,489	Murphy and Hanson (1998); Murphy *et al.* (2001a)
1999/00	707	1,452	1,976	4,840	17,962	20,697	2,728	60	0	0	0	0	50,422	Murphy *et al.* (2001a, 2001b)
2000/01	1,109	693	582	2,020	25,806	10,294	2,559	57	---	0	0	0	43,120	Murphy *et al.* (2001b); Schroyer *et al.* (2002)
2002/03	491	1,330	7,375	4,604	22,136	12,547	258	---	---	---	---	---	48,741	Massa and Schroyer (2003)
2007/08	0	0	464	238	618	1,310	483	524	127	36	0	0	3,800	Titus *et al.* (2008)
2008/09	28	165	295	432	311	1,678	592	451	67	0	0	0	4,019	Titus *et al.* (2009)
2009/10	0	41	0	78	746	547	306	81	90	0	0	0	1,889	Titus *et al.* (2010)

The fitting of the asymmetric logistic function in step 3 was performed in Excel using the Solver function with a weighted non-linear least squares procedure. The weighting procedure was used to avoid the disproportionate influence of individual monthly proportions (e.g., the years 1991/92 and 1992/93) relative to all monthly proportions in the estimation of the parameters of the asymmetric logistic function.

The weights were calculated as the ratio of the annual estimated total of Chinook salmon caught to the total number of Chinook salmon caught over the 10 years (i.e., 233,098 fish). For example, the 7 monthly proportions for the 1992/93 biological year that had a total annual catch of 6,960 fish each received a weight of 0.029859 (i.e., 6,960 / 233,098 = 0.029859).

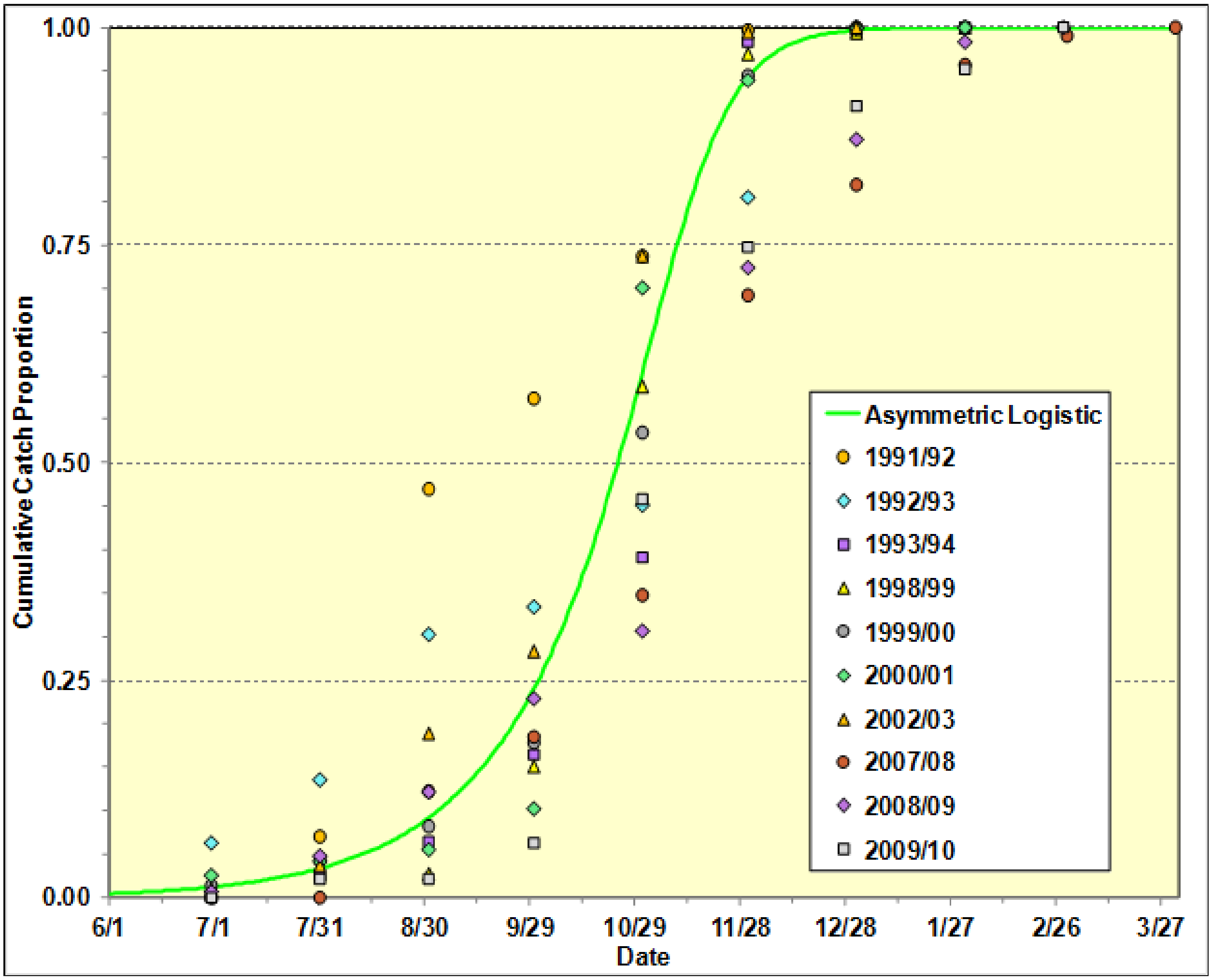


Figure 1. Chinook salmon monthly proportions of estimated angler's catch in the lower American River, during the 1991/92 – 1993/94, 1998/99 – 2000/01, 2002/03, and 2007/08 – 2009/10 biological years, and the common fitted asymmetric logistic curve representing the cumulative temporal distribution for all years.

In the Central Valley, adult fall-run Chinook salmon are reported to generally begin migrating upstream annually in July, with immigration continuing through December in most years (Vogel and Marine 1991). It has been reported that adult fall-run Chinook salmon typically begin entering the lower American River in September and October, and continue through January (SWRI 2001). Both historic (fish passage at Old Folsom Dam, 1944-1946) and recent survey data indicate that adult Chinook salmon arrivals in the lower American River peak in November.

CDFW does not make any distinction by run assignation to the Chinook salmon in the creel survey reports, and it is not possible to know which fish caught during January (or later) are fall-run or late fall-run Chinook salmon, or a mixed stock. Because there is no dependable quantitative basis to rely upon to exclude data in the analysis, all CDFW Chinook salmon catch data were included in the temporal weighting procedure without arbitrary rejection of certain data. In addition, because fish typically exhibit life history periodicities and behaviors that vary somewhat from the anthropogenic characterization of the species/run as a whole, it is likely that some fish spawning later in the season (i.e., January) are indeed fall-run Chinook salmon that exhibit a very truncated staging period. Although it might be reasonable to conclude that most of the fish spawning during February and March are late fall-run Chinook salmon, the fish caught after January represent only about 0.1% of the total number of fish caught included in the CDFW dataset. In subsequent steps of the analysis, the right hand tail of the resultant fall-run Chinook salmon pre-spawn arrival temporal distribution is adjusted to not extend beyond the completion of the assumed fall-run Chinook salmon spawning period (January 18), as further described below. Because the adult Chinook salmon arrival data are presented on a monthly basis, it is not possible to parse out those fish that may have arrived during January after the spawning end date (January 18) from those that arrived prior to the spawning end date.

It was necessary for the asymmetric logistic function resulting from the catch cumulative proportions to correspond with the asymmetric logistic function describing the temporal distribution for Chinook salmon spawning (see Section 2.2). Consequently, the curve estimated in step 3 was constrained to predict a cumulative proportion of adult fall-run Chinook salmon arrivals equal to 0.999490 by day 140 (i.e., January 18), because the asymmetric logistic function describing the temporal distribution of Chinook salmon spawning (Section 2.2) ends on January 18 (Day 140) and predicts a proportion of 0.999490 (or 99.95%) on day 140.

The asymmetric logistic function resulting from the constrained weighted least squares fit to the cumulative catch proportions in Figure 1 had the following expression (Equation 1):

$$Y_D = \left(\frac{1}{1 + \exp\left(7.2295 - 0.0972 \times D\right)} \right)^{1/3.0211} \tag{1}$$

where D is the day number starting September 1 of each year (*e.g.*, during the 1992/93 year, D = 1 corresponds to September 1, 1992, while D = -91 corresponds to June 1, 1992 and D = 123 corresponds to January 1, 1993). The mean square error of the fitted common asymmetric logistic function was 0.0250 (indicating a relatively minor amount of variability in the data set not accounted for by the fitted model).

The asymmetric logistic curve of Equation 1 was used to calculate the expected daily proportions of Chinook salmon arriving in the lower American River between June 1 and January 18 by subtraction. The resulting daily proportions were first rounded to four decimal places and finally rescaled by dividing each daily value by the sum of all daily rounded values (that equaled to 0.9944 or 99.44%). The final daily temporal weighting coefficients describing the temporal distribution of adult fall-run Chinook salmon arriving in the lower American River are presented in **Figure 2**.

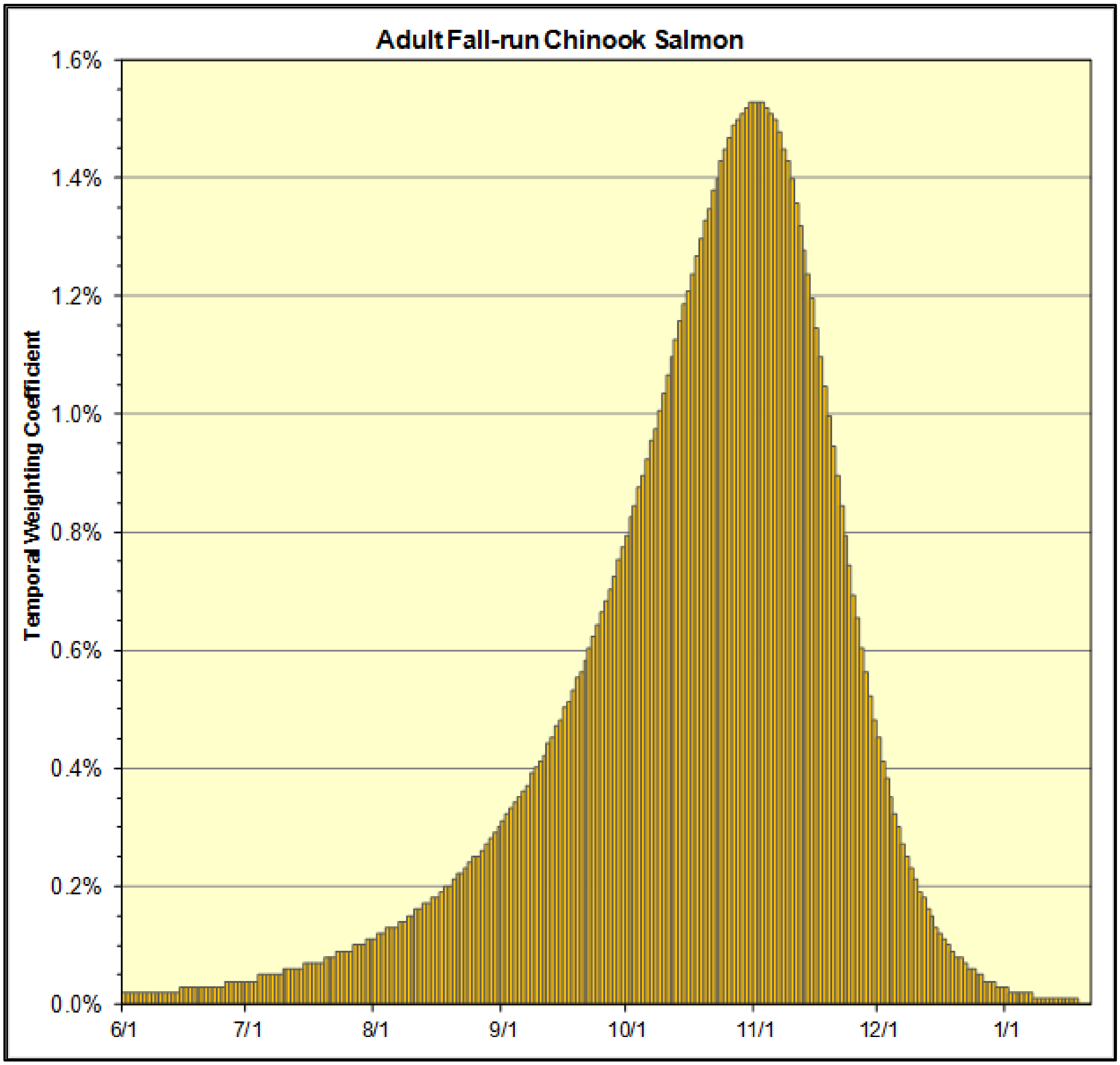


Figure 2. Daily temporal weighting coefficients used for adult fall-run Chinook salmon arrival in the lower American River.

2.2 Chinook Salmon Spawning Temporal Distribution

The timing of adult Chinook salmon spawning activity is influenced by inherent behavioral characteristics and the occurrence of appropriate spawning temperatures. It has been previously reported that fall-run Chinook salmon spawning in the lower American River is initiated when water temperatures decline to about 60°F (SWRI 2001) and the original LAR Mortality Model stated that annual lower American River spawning was to be initiated (by the model) when the daily mean river water temperature became $\leq 60^{o}$F each year, rather than on a characteristic temporal distribution (HCI 1996). However, as discussed below, more recent lower American River water temperature and temporal Chinook salmon spawning distribution data indicate that the 60°F threshold is not a reliable assumption for determining the initiation of Chinook salmon spawning in the lower American River.

Water temperature monitoring data from the U. S. Geological Survey (USGS) Fair Oaks Gage from 1998 through 2012 were compared with temporal Chinook salmon spawning distributions (**Figure 3**) that were estimated using Chinook salmon carcass and redd survey data, as discussed in further detail later in this section. Based on carcass survey data (and estimation of the lag period between spawning and appearance of fresh carcasses in the carcass surveys) in the lower American River from 1998 through 2012, the initiation of fall-run Chinook salmon spawning (represented by 10% of the annual cumulative distribution) occurs when daily average water temperatures decreased to values generally ranging from 59.7 to 64.0°F, and to 67.4°F during one year (2001), with an average of 62.3°F (Figure 3).

As discussed in detail in Section 3.0, relatively high water temperatures (≥ ~60°F) at the beginning of the fall-run Chinook salmon spawning season can induce pre-spawning adult losses and decrease early lifestage viability. In recent years, mean daily water temperatures at or below 60°F in the upper reaches of the lower American River have not occurred until dates ranging from October 28 to November 16. From 1998 through 2012, the average date on which mean daily water temperatures declined to 60°F in the upper reaches of the lower American River was November 6. For these same years, an average of 43% of the annual runs of fall-run Chinook salmon was estimated to have spawned by November 6. Thus, lower American River water temperature regimes during the fall in recent years may have the potential to reduce the initial year class strength and eventual productivity of fall-run Chinook salmon.

The LAR Mortality Model requires input regarding the temporal distribution of spawning adult fall-run Chinook salmon in the lower American River. For LAR Mortality Model application purposes, it appears that the assumption that fall-run Chinook salmon do not spawn until water temperatures decline to 60°F in the lower American River is not valid. By contrast, it is more appropriate to base the model’s temporal spawning distribution on fall-run Chinook salmon redd and carcass data.

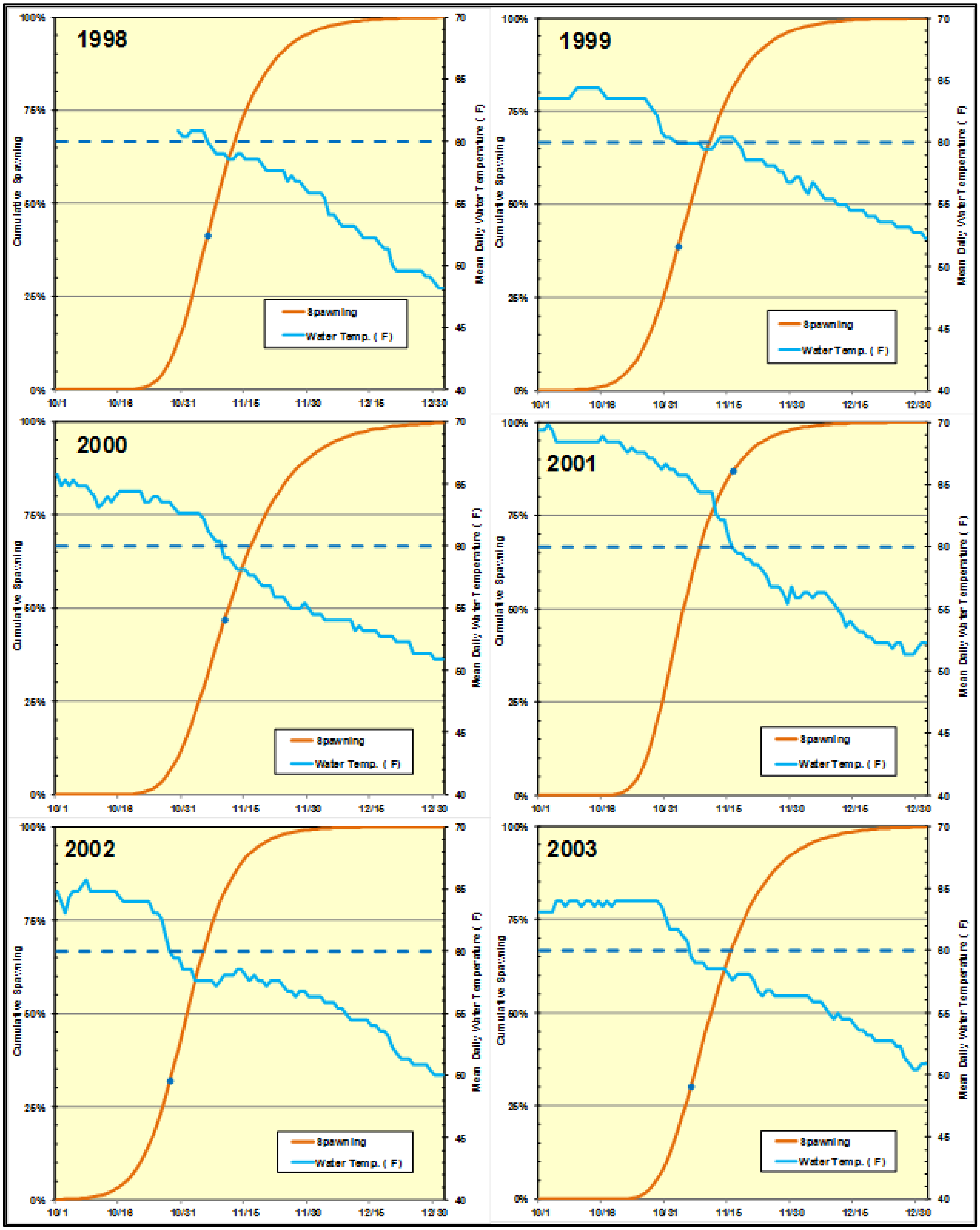


Figure 3. Mean daily water temperature at the USGS Fair Oaks Gage and the cumulative temporal distribution of adult fall-run Chinook salmon spawning in the lower American River from 1998 through 2012.

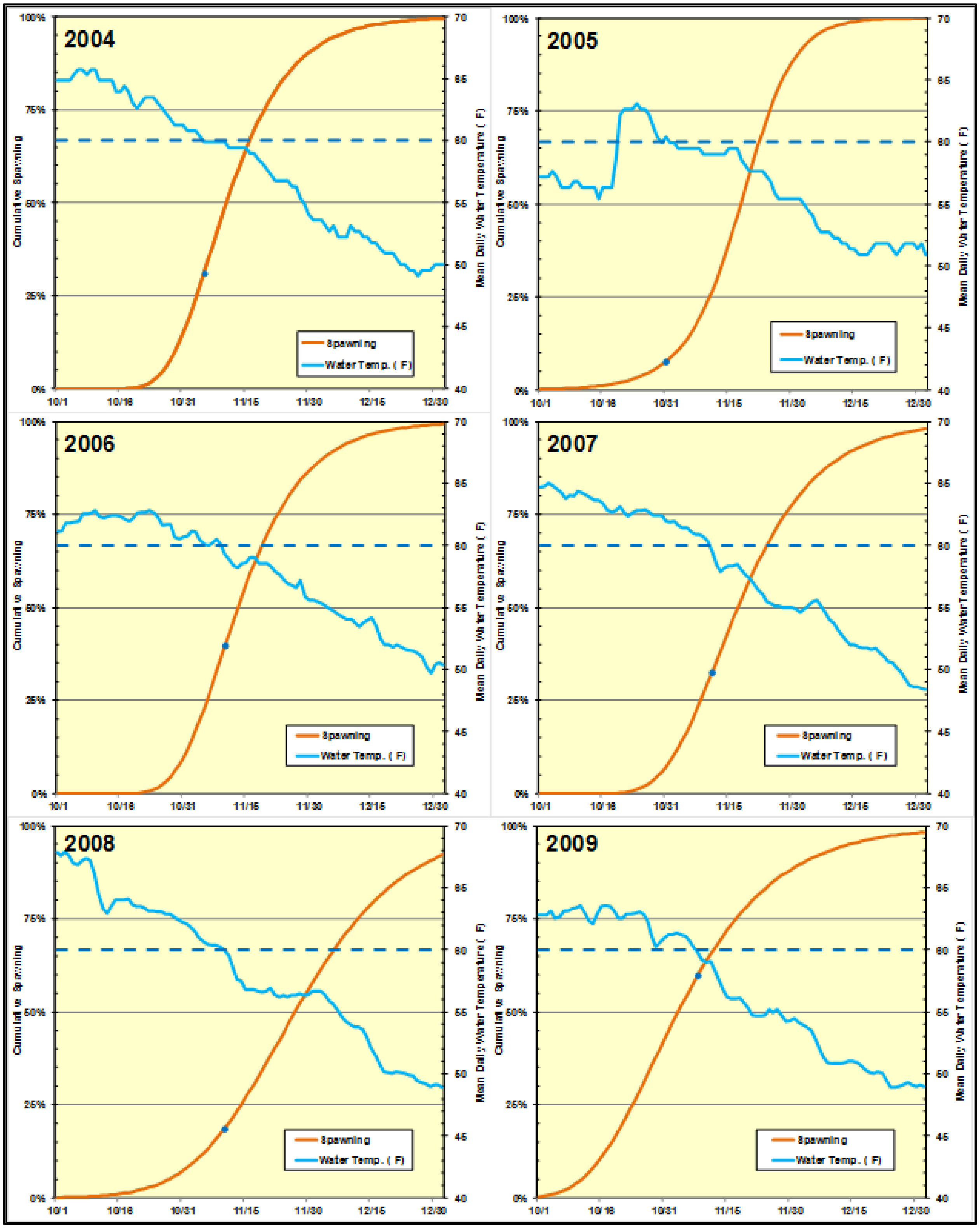


Figure 3 (continued). Mean daily water temperature at the USGS Fair Oaks Gage and the cumulative temporal distribution of adult fall-run Chinook salmon spawning in the lower American River from 1998 through 2012.

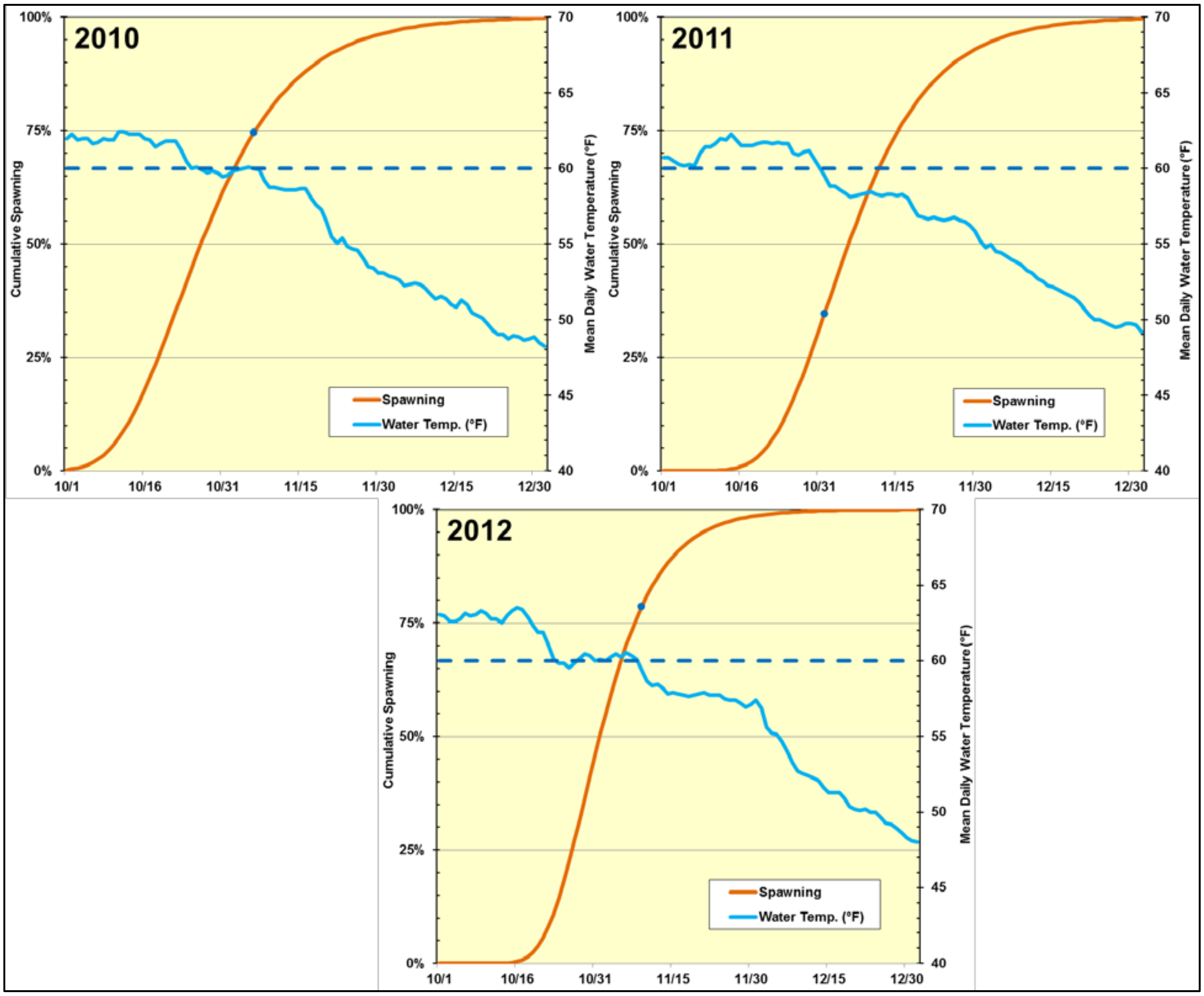


Figure 3 (continued). Mean daily water temperature at the USGS Fair Oaks Gage and the cumulative temporal distribution of adult fall-run Chinook salmon spawning in the lower American River from 1998 through 2012.

Both photogrammetric redd surveys and spawning stock escapement surveys ("carcass surveys") were used in the first step toward the derivation of a temporal distribution of spawning adult fall-run Chinook salmon. The aerial redd surveys conducted on the lower American River provide data that can be used to develop the cumulative distribution of newly built redds over time, and are better descriptors of spawning timing than carcass surveys. However, approximately weekly aerial redd surveys were conducted only during the 1991/92 through the 1995/96 fall-run Chinook salmon spawning seasons in the lower American River (Snider and McEwan 1992; Snider et al. 1993, 1996; Snider and Vyverberg 1995, 1996). By contrast, fall-run Chinook salmon carcass surveys have been performed annually since the late 1960s, and data or reports are available for all surveys performed from October 1992 through October 2012 (e.g., Snider and Bandner 1996; Snider and Reavis 1996; Snider et al. 1993 and 1995; Healey 2002, 2003, 2004, 2005 and 2006; Healey and Fresz 2007; Healey and Redding 2008; Vincik and Kirsch

2009; Vincik and Mamola 2010; Maher et al. 2012; Phillips and Maher 2013; and Phillips and Helstab 2013). The temporal distributions of fresh carcasses described in these reports can be used to estimate an overall cumulative distribution of fresh carcasses over time that describe when fresh carcasses appear in the surveys, which is subsequent to the actual time of spawning. When adjusted by the time elapsing between spawning and appearance of fresh carcasses in the surveys, the carcass surveys also describe spawning timing. The time elapsing between redd construction, spawning and post-spawning mortality, or life expectancy after spawning, has been reported to be between 2 and 4 weeks (Briggs 1953).

To take advantage of the information on lower American River fall-run Chinook salmon spawning timing contained in the available redd and carcass surveys, a 5-step procedure was developed to estimate the cumulative temporal distribution of fall-run Chinook salmon spawning in the lower American River that, in turn, was used in the calculation of the temporal weighting coefficients to be input into the LAR Mortality Model. The 5-step procedure consists of the following steps.

1.) Fit an asymmetric logistic function to the weekly cumulative proportions of newly built redds obtained from the four annual photogrammetric redd surveys performed during the 1992/93 through the 1995/96 fall-run Chinook salmon spawning seasons.

2.) Fit an asymmetric logistic function to the cumulative proportions of fresh carcasses obtained from the four annual carcass surveys performed during the 1992/93 through 1995/96 fall-run Chinook salmon spawning seasons.

3.) Calculate the lag times between the fitted redd and fresh-carcass cumulative distributions (i.e., the number of days separating particular cumulative proportions under the asymmetric logistic functions fitted in Steps 1 and 2, above).

4.) Fit an asymmetric logistic function to the cumulative proportions of fresh carcasses obtained from the available carcass surveys performed during the 1992/93 through the 2012/13 fall-run Chinook salmon spawning seasons.

5.) Apply the lag times calculated in Step 3 to the curve fitted in Step 4 by subtracting the corresponding lag times from the days for particular cumulative proportions of fresh carcasses expected under the curve obtained in Step 4. The resulting adjusted asymmetric logistic function was used to describe fall-run Chinook salmon spawning timing in the lower American River based on carcass surveys from 1992/93 through the 2012/13 fall-run Chinook salmon spawning seasons, and to calculate the temporal weighting coefficients required as input into the Mortality Model.

Each of the steps in the spawning temporal distribution determination are described in detail, below.

Step 1

During the four photogrammetric redd surveys performed from late September or October through early January during the 1992/93 through the 1995/96 fall-run Chinook salmon spawning seasons, a total of 14,084 newly-built redds were counted, ranging from a low of 1,138 redds during the 1992/93 spawning season to a high of 6,205 redds during the 1993/94 spawning season. Given the variation in total number of redds counted each season, as well as the number of weekly aerial surveys performed during each spawning season, a weighted nonlinear least squares procedure was used to fit a common asymmetric logistic function to the four sets of daily cumulative proportions of newly built redds.

The weights were calculated as the ratio of the annually counted redds to the overall total number of counted redds (i.e., a total of 14,084 newly-built redds). For example, the data points associated with each aerial redd survey representing the cumulative proportions of redds built during the 1992/93 spawning season (a total of 1,138 redds counted) each received a weight of 0.0808 (i.e., 1,138/14,084 = 0.0808), while the data points associated with each aerial redd survey representing the cumulative proportions of redds built during the 1995/96 spawning season (a total of 3,976 redds counted) each received a weight of 0.2823 (i.e., 3,976/14,084 = 0.2823). The common asymmetric logistic function fitted to the redd data for all four years had the following expression (Equation 2):

$$Y_D = \left(\frac{1}{1 + \exp\left(8.6114 - 0.1430 \times D\right)} \right)^{1/0.2330} \tag{2}$$

where D is the day number at which new redds were observed during a particular annual survey, starting September 1 of each year. The mean square error of the fitted common asymmetric logistic function was 0.0513 (indicating a relatively minor amount of variability in the data set not accounted for by the fitted model). **Figure 4** displays the four sets of daily cumulative proportions and the fitted curve of Equation 2.

Step 2

During the four annual carcass surveys performed from October through mid-January during the 1992/93 through the 1995/96 fall-run Chinook salmon spawning seasons, a total of 5,788 fresh carcasses were counted, ranging from a low of 360 fresh carcasses during the 1992/93 spawning season to a high of 1,980 fresh carcasses during the 1995/96 spawning season. A weighted nonlinear least squares procedure was used to fit a common asymmetric logistic function to the four annual sets of cumulative proportions of fresh carcasses. The weights were calculated as the ratio of the annually counted fresh carcasses to the overall number of counted fresh carcasses (i.e., 5,788 carcasses), similar to the procedure described above for redd surveys.

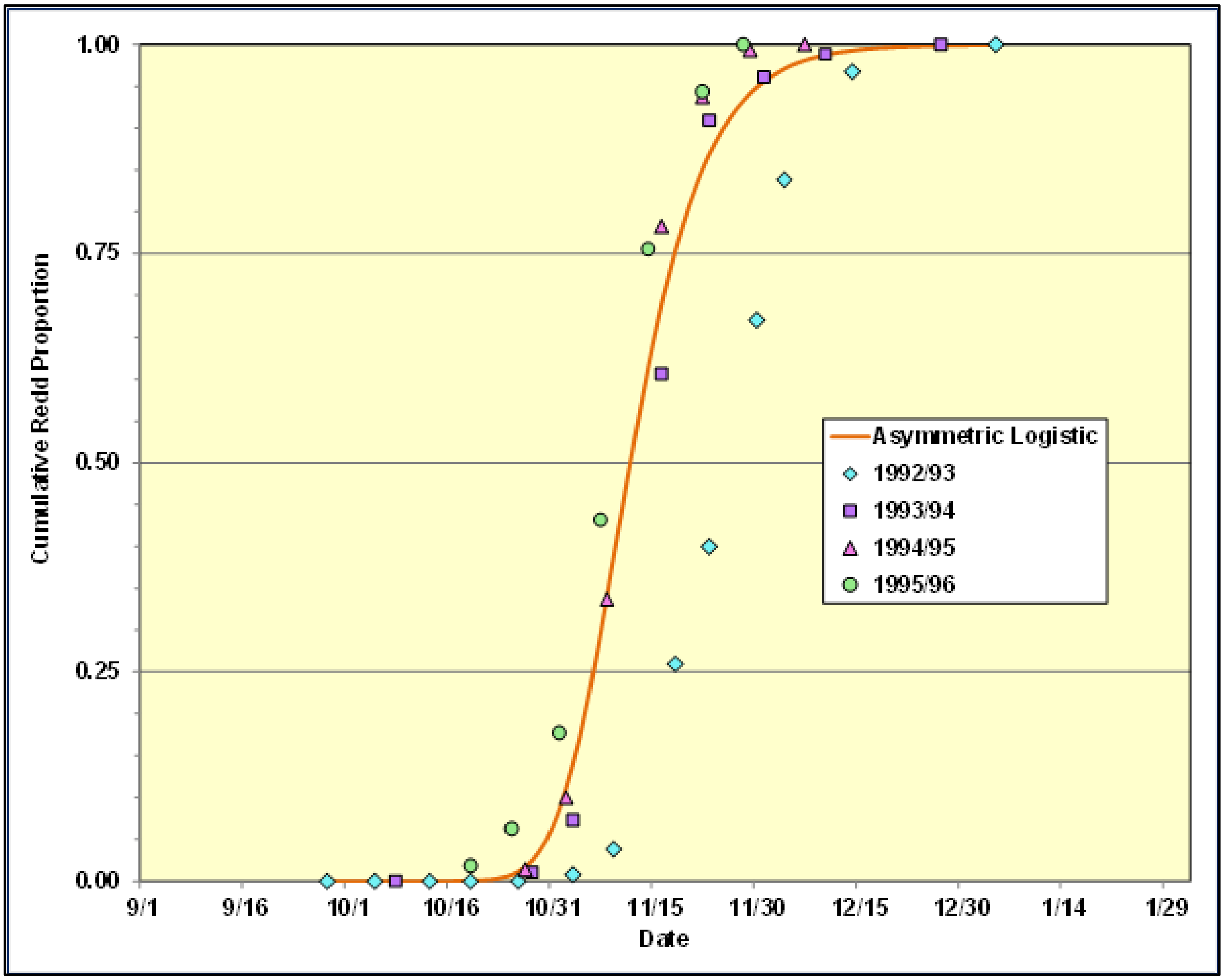


Figure 4. Fall-run Chinook salmon cumulative proportions of newly constructed redds in the lower American River from weekly aerial redd surveys conducted during the 1992/93 – 1995/96 spawning seasons, and the common fitted asymmetric logistic curve for all years.

The common asymmetric logistic function fitted to the fresh carcass data had the following expression (Equation 3):

$$Y_D = \left(\frac{1}{1 + \exp\left(14.5710 - 0.1677 \times D\right)} \right)^{1/1.0518} \tag{3}$$

The mean square error of this fit was 0.0396 (indicating a relatively minor amount of variability in the data set not accounted for by the fitted model). **Figure 5** displays the four annual sets of cumulative proportions and the fitted curve of Equation 3.

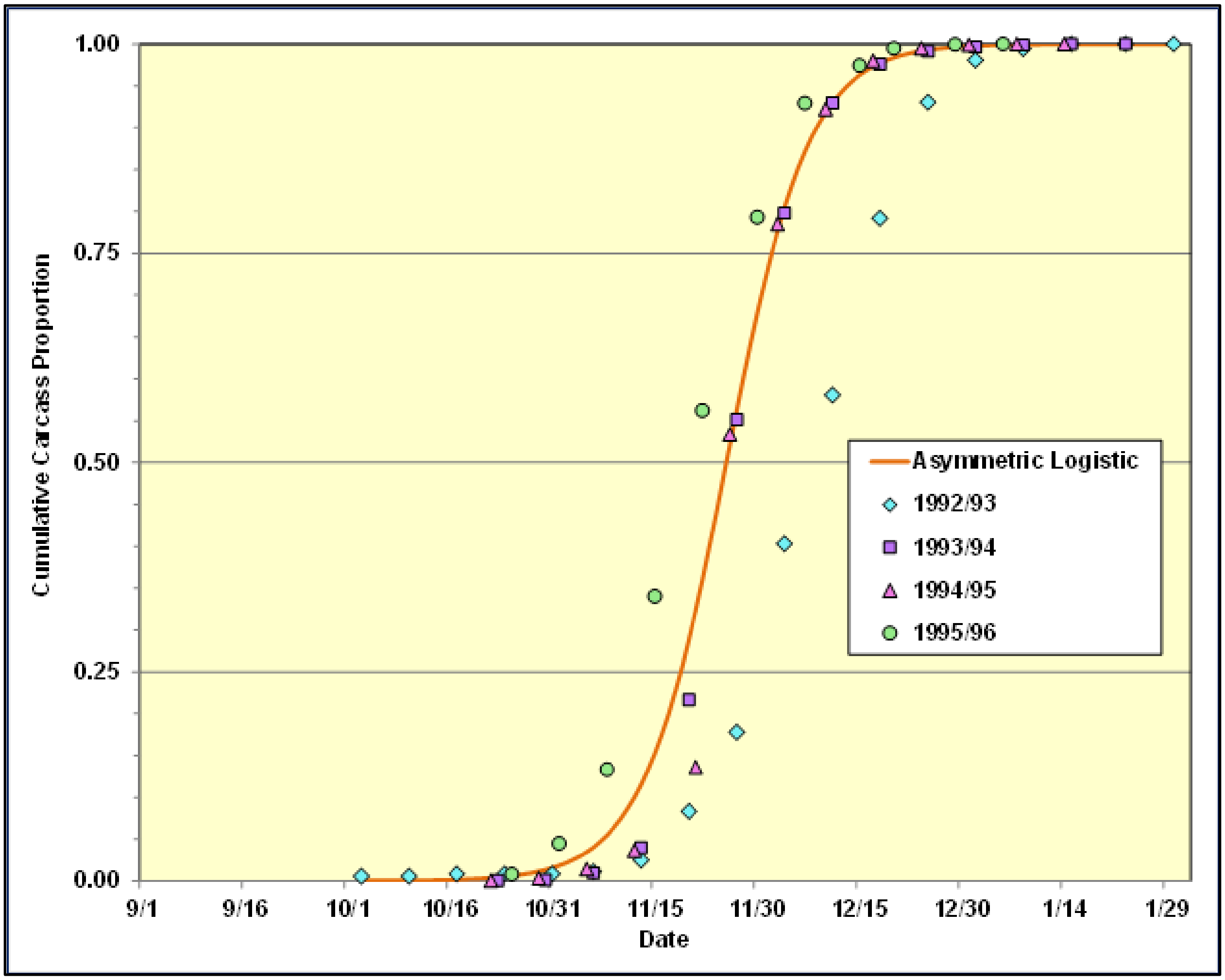


Figure 5. Fall-run Chinook salmon cumulative proportions of fresh carcasses in the lower American River, during the 1992/93 – 1995/96 spawning seasons, and the common fitted asymmetric logistic curve for all years.

Step 3

As part of the third procedural step, where the lag times between the fitted redd and fresh-carcass cumulative temporal distributions are computed, the parameter values of Equations 2 and 3 are applied to the following expression (Equation 4):

$$D_{Y'} = \frac{\ln\left[\left(\frac{1}{Y'}\right)^{\hat{\delta}} - 1\right] - \hat{\alpha}}{\hat{\beta}} \qquad \textbf{(4)}$$

where *Y’* are particular expected cumulative proportions under fitted Equations 2 and 3 (e.g., 0.05, 0.1, 0.25, 0.5, etc.), $D_{Y'}$ are the days at which those proportion are achieved, and $\hat{\alpha}$, $\hat{\beta}$ and

$\hat{\delta}$ are the parameter values in Equations 2 and 3. After calculating Equation 4 with both sets of parameter estimates, there are two $D_{Y'}$ values for each particular expected cumulative proportion *Y'* – one for the fitted redd cumulative distribution (Equation 2), and the other for the fitted fresh-carcass cumulative distribution (Equation 3). The lag times between the fitted redd and fresh-carcass cumulative distributions are then calculated as the differences between the pairs of $D_{Y'}$ values. **Table 2** summarizes the results of these lag-time calculations for representative expected cumulative proportions, encompassing the vast majority of the range of the cumulative distributions.

Table 2. Lag times between cumulative proportions (Y'%) of the redd and fresh-carcass cumulative temporal distributions fitted to data for the 1992/93 – 1995/96 Chinook salmon spawning seasons.

Cumulative Proportion (*Y'%*)	Day under Fitted Redd Cumulative Curve ($D_{Y'}$)	Day under Fitted Carcass Cumulative Curve ($D_{Y'}$)	Lag Time (days)
1%	55.6	58.1	2.4
5%	60.2	68.4	8.2
10%	62.6	73.0	10.4
15%	64.3	75.9	11.5
20%	65.7	78.0	12.3
25%	67.0	79.8	12.8
50%	72.4	86.5	14.1
75%	78.9	93.1	14.2
80%	80.7	94.8	14.1
85%	83.0	96.9	13.9
90%	86.1	99.7	13.6
95%	91.1	104.1	13.0
99%	102.6	114.0	11.4
$D_{Y'}$ and lag times are expressed in days starting from September 1 each year.			

Step 4

As part of the fourth procedural step, a new common asymmetric logistic function was fitted to the cumulative proportions of fresh fall-run Chinook salmon carcasses obtained from all of the 21 years of available carcass surveys (1992/93 through 2012/2013) to incorporate additional information on spawning timing not present in the shorter data sets used in steps 1 and 2. Consistent with the previously described weighting methods, a weighted least square procedure was used, in which weights were calculated as the ratios of the annually counted fresh carcasses during a season to the overall number of counted fresh carcasses (i.e., a total of 38,366 carcasses). **Figure 6** displays the results of this new fitted asymmetric logistic function (Equation 5).

$$Y_D = \left(\frac{1}{1 + \exp\left(8.3944 - 0.1100 \times D\right)} \right)^{1/0.5373} \qquad \textbf{(5)}$$

The mean square error of this fit was 0.0220 (indicating a relatively minor amount of variability in the data set not accounted for by the fitted model). Examination of Figure 6 indicates relatively high variability in the temporal cumulative distributions of fresh carcasses among years, with no consistent trend (i.e., "shifting") in the timing of spawning between early and late years included in the analysis.

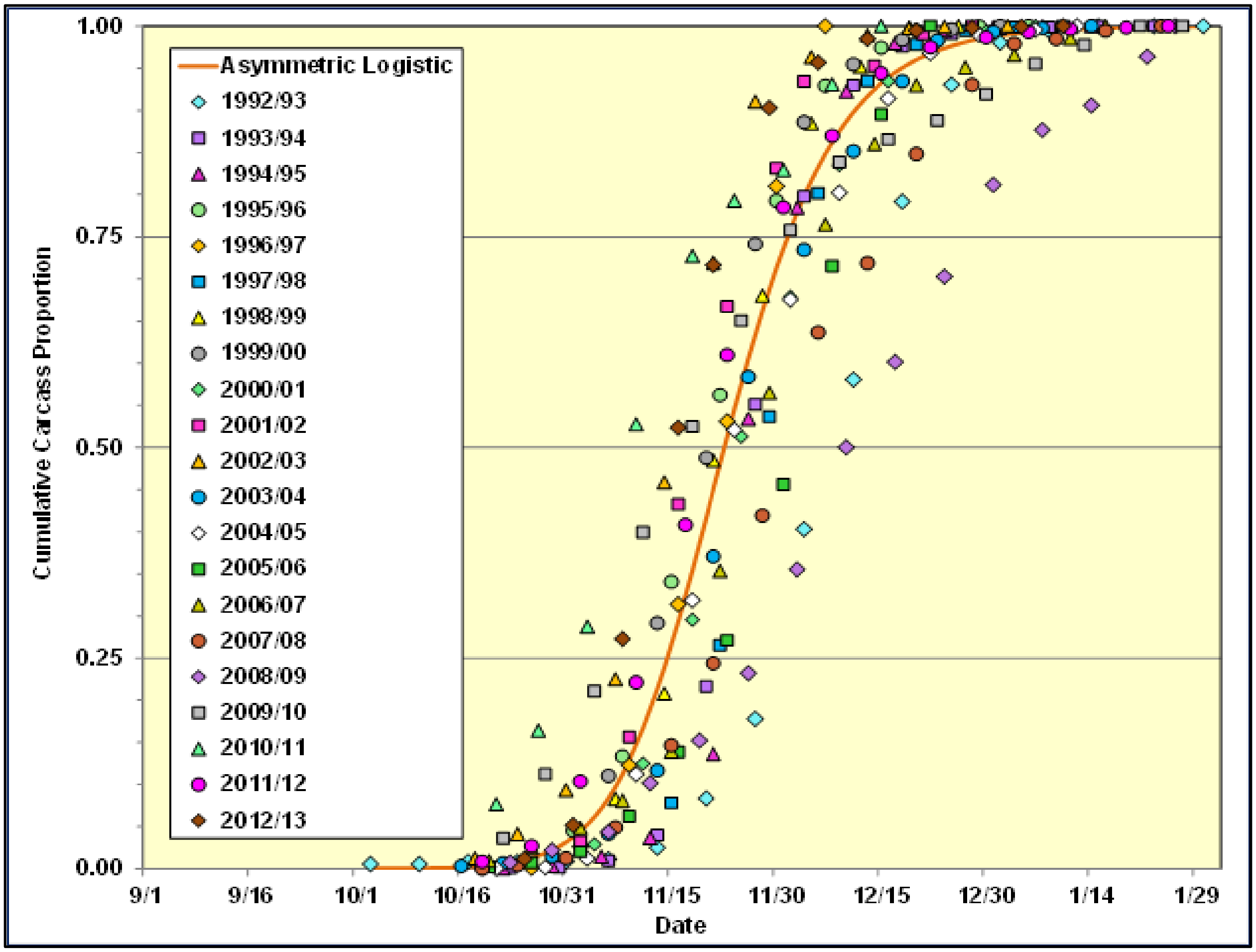


Figure 6. Fall-run Chinook salmon cumulative proportions of fresh carcasses in the lower American River, during the 1992/93 – 2012/13 spawning seasons, and the common fitted asymmetric logistic curve for all years.

Step 5

Finally, as part of the fifth procedural step, the parameter values of Equation 5 are applied to Equation 4 to calculate new $D_{Y'}$ values (i.e., days at particular cumulative proportions of the new fitted curve), and the lag times in Table 2 are subtracted from the new $D_{Y'}$ values. The resulting adjusted asymmetric logistic curve had the following expression (Equation 6):

$$Y_D = \left(\frac{1}{1 + \exp\left(1.2818 - 0.1010 \times D\right)} \right)^{1/0.0046} \qquad \textbf{(6)}$$

Figure 7 displays the 4 asymmetric logistic curves obtained from the 5-step procedure used to describe fall-run Chinook salmon spawning timing in the lower American River.

Because a logistic equation essentially can range from values approaching negative infinity to positive infinity, and because all of the daily values associated with the distribution must sum to 1, the practical application of the logistic equation to describe the temporal distribution of spawning required identifying the potential starting and ending dates of fall-run Chinook salmon spawning in the lower American River. Therefore, the asymmetric logistic curve of Equation 6 was used to calculate expected daily spawning proportions by subtraction. Finally, the daily temporal coefficients for fall-run Chinook salmon were obtained by rounding the daily proportions to four decimal places and rescaling to the sum of the rounded proportions (that equaled 0.9995 or 99.95%). **Figure 8** displays the final daily weighting coefficients that are presented in **Table 3**. The resulting spawning period extends from October 13 through January 18, a period consisting of 98 days.

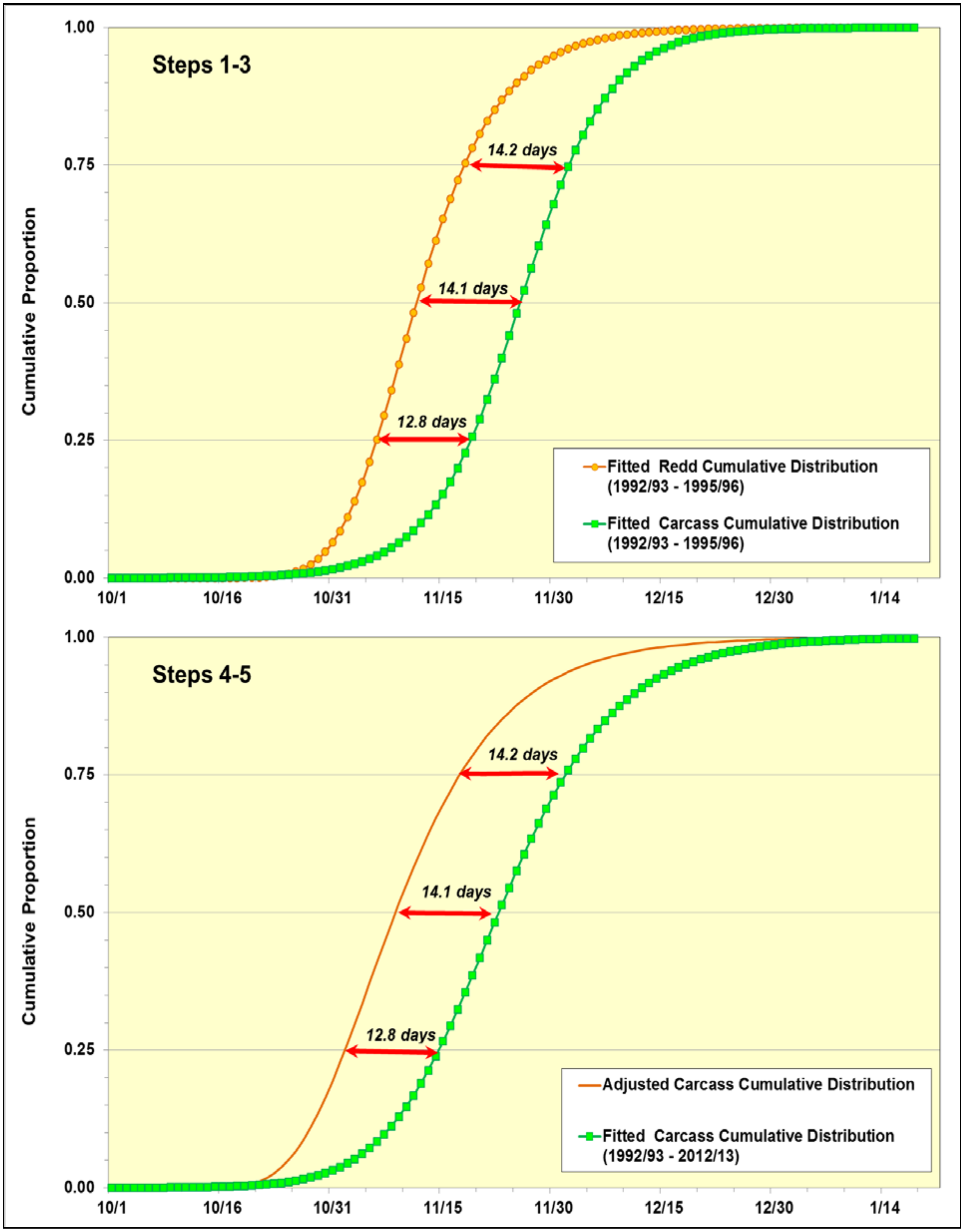


Figure 7. Asymmetric logistic curves obtained from 5-Step procedure used to describe fall-run Chinook salmon spawning timing in the lower American River during the 1992/93 - 2012/13 spawning seasons.

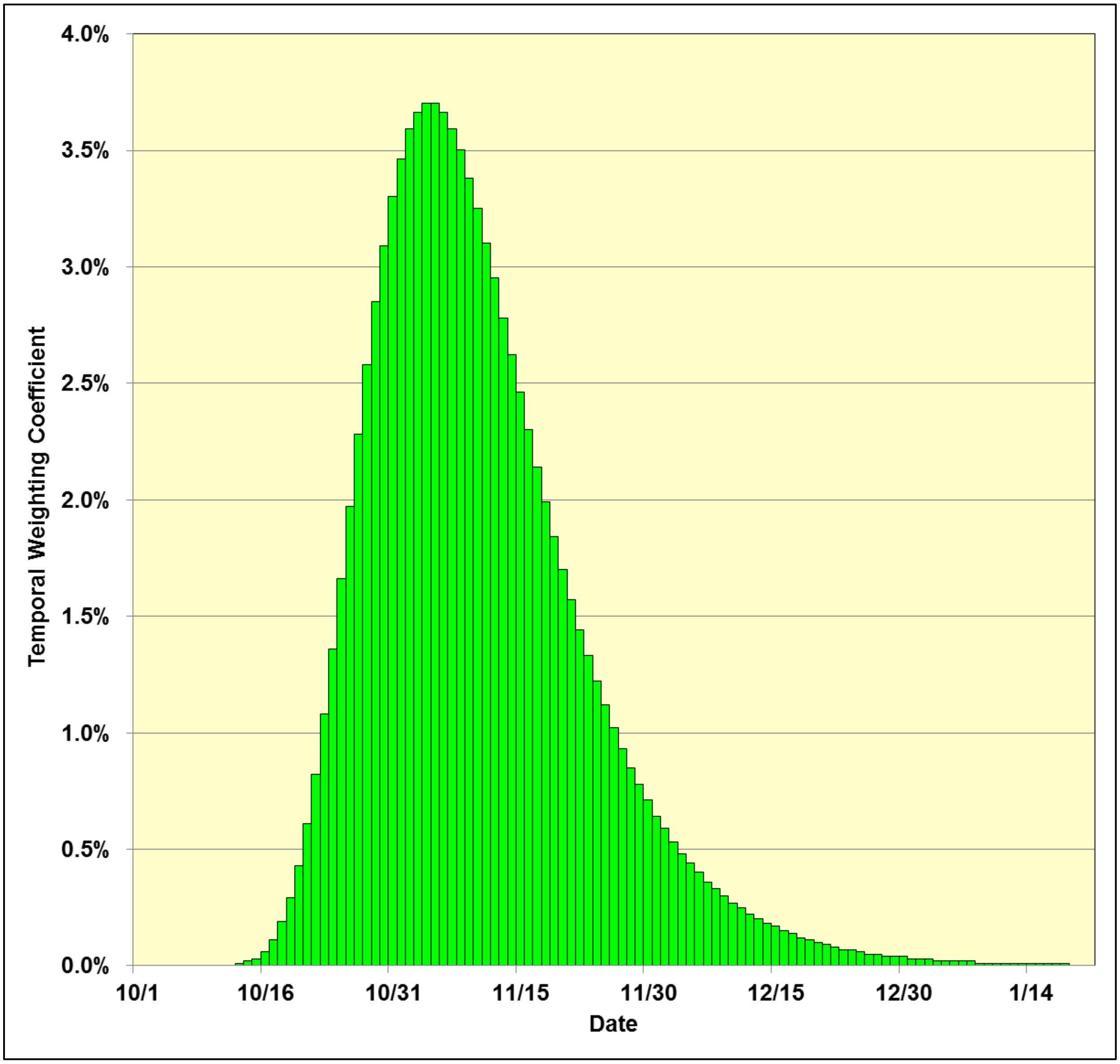
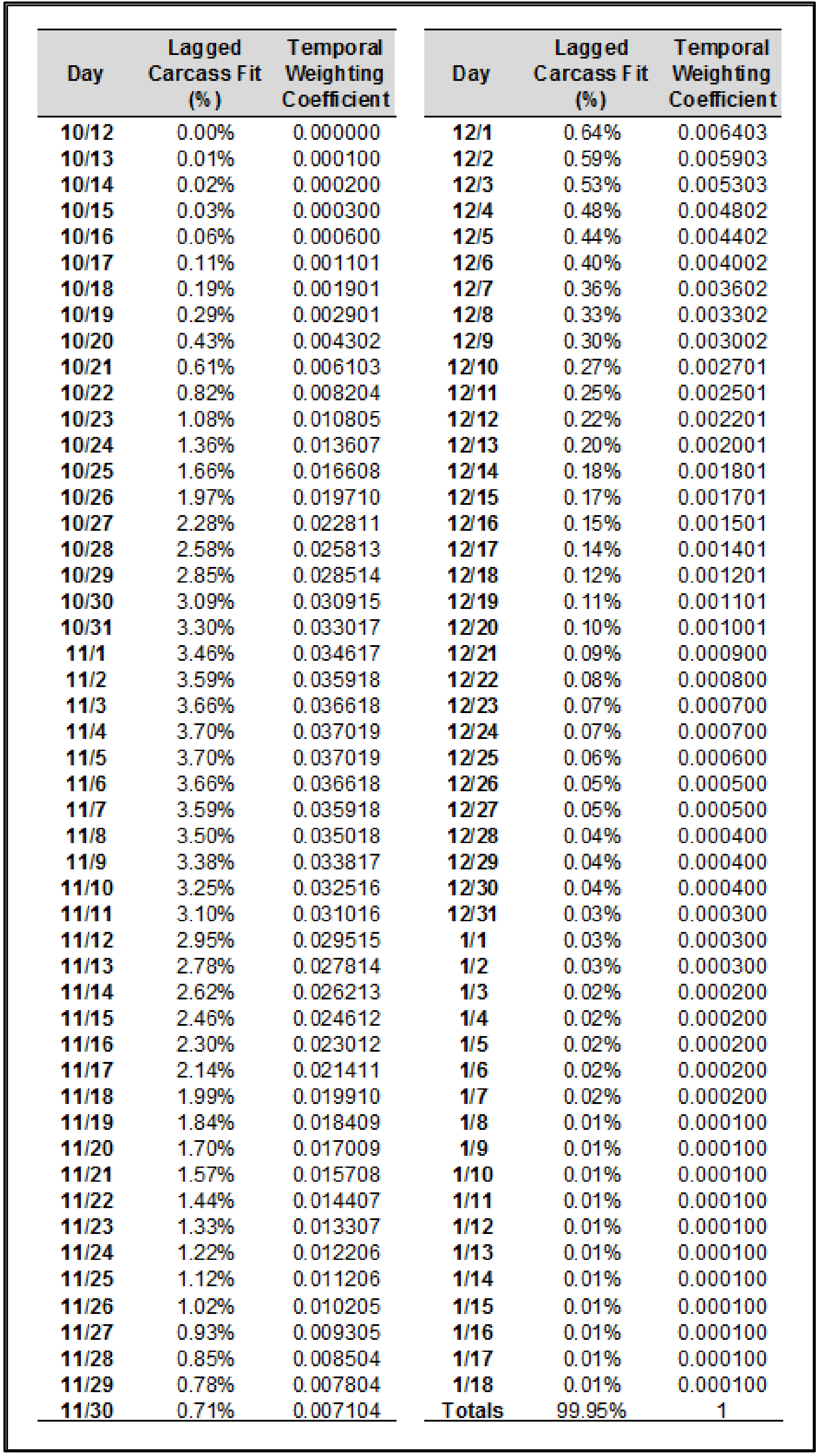


Figure 8. Daily temporal weighting coefficients used for fall-run Chinook salmon spawning in the lower American River.

Table 3. Temporal weighting coefficients used for fall-run Chinook salmon spawning in the lower American River.



Day	Lagged Carcass Fit (%)	Temporal Weighting Coefficient	Day	Lagged Carcass Fit (%)	Temporal Weighting Coefficient
10/12	0.00%	0.000000	**12/1**	0.64%	0.006403
10/13	0.01%	0.000100	**12/2**	0.59%	0.005903
10/14	0.02%	0.000200	**12/3**	0.53%	0.005303
10/15	0.03%	0.000300	**12/4**	0.48%	0.004802
10/16	0.06%	0.000600	**12/5**	0.44%	0.004402
10/17	0.11%	0.001101	**12/6**	0.40%	0.004002
10/18	0.19%	0.001901	**12/7**	0.36%	0.003602
10/19	0.29%	0.002901	**12/8**	0.33%	0.003302
10/20	0.43%	0.004302	**12/9**	0.30%	0.003002
10/21	0.61%	0.006103	**12/10**	0.27%	0.002701
10/22	0.82%	0.008204	**12/11**	0.25%	0.002501
10/23	1.08%	0.010805	**12/12**	0.22%	0.002201
10/24	1.36%	0.013607	**12/13**	0.20%	0.002001
10/25	1.66%	0.016608	**12/14**	0.18%	0.001801
10/26	1.97%	0.019710	**12/15**	0.17%	0.001701
10/27	2.28%	0.022811	**12/16**	0.15%	0.001501
10/28	2.58%	0.025813	**12/17**	0.14%	0.001401
10/29	2.85%	0.028514	**12/18**	0.12%	0.001201
10/30	3.09%	0.030915	**12/19**	0.11%	0.001101
10/31	3.30%	0.033017	**12/20**	0.10%	0.001001
11/1	3.46%	0.034617	**12/21**	0.09%	0.000900
11/2	3.59%	0.035918	**12/22**	0.08%	0.000800
11/3	3.66%	0.036618	**12/23**	0.07%	0.000700
11/4	3.70%	0.037019	**12/24**	0.07%	0.000700
11/5	3.70%	0.037019	**12/25**	0.06%	0.000600
11/6	3.66%	0.036618	**12/26**	0.05%	0.000500
11/7	3.59%	0.035918	**12/27**	0.05%	0.000500
11/8	3.50%	0.035018	**12/28**	0.04%	0.000400
11/9	3.38%	0.033817	**12/29**	0.04%	0.000400
11/10	3.25%	0.032516	**12/30**	0.04%	0.000400
11/11	3.10%	0.031016	**12/31**	0.03%	0.000300
11/12	2.95%	0.029515	**1/1**	0.03%	0.000300
11/13	2.78%	0.027814	**1/2**	0.03%	0.000300
11/14	2.62%	0.026213	**1/3**	0.02%	0.000200
11/15	2.46%	0.024612	**1/4**	0.02%	0.000200
11/16	2.30%	0.023012	**1/5**	0.02%	0.000200
11/17	2.14%	0.021411	**1/6**	0.02%	0.000200
11/18	1.99%	0.019910	**1/7**	0.02%	0.000200
11/19	1.84%	0.018409	**1/8**	0.01%	0.000100
11/20	1.70%	0.017009	**1/9**	0.01%	0.000100
11/21	1.57%	0.015708	**1/10**	0.01%	0.000100
11/22	1.44%	0.014407	**1/11**	0.01%	0.000100
11/23	1.33%	0.013307	**1/12**	0.01%	0.000100
11/24	1.22%	0.012206	**1/13**	0.01%	0.000100
11/25	1.12%	0.011206	**1/14**	0.01%	0.000100
11/26	1.02%	0.010205	**1/15**	0.01%	0.000100
11/27	0.93%	0.009305	**1/16**	0.01%	0.000100
11/28	0.85%	0.008504	**1/17**	0.01%	0.000100
11/29	0.78%	0.007804	**1/18**	0.01%	0.000100
11/30	0.71%	0.007104	**Totals**	99.95%	1

2.3 Comparison of Chinook Salmon Pre-Spawn Arrival and Spawning Temporal Distributions

Figure 9 compares the cumulative distribution of fall-run Chinook salmon spawning (orange curve) with the cumulative distribution of fall-run Chinook salmon arrival (green curve) in the lower American River in order to estimate staging duration. Estimates of staging duration are required input into the LAR Mortality Model. The red arrows indicate the time (in days) to the onset of spawning associated with particular cumulative proportions of arriving fish. The final daily temporal weighting coefficients describing the temporal distribution of adult fall-run Chinook salmon arriving in the lower American River, including the number of days until spawning for each daily cohort, are presented in **Table 4**.

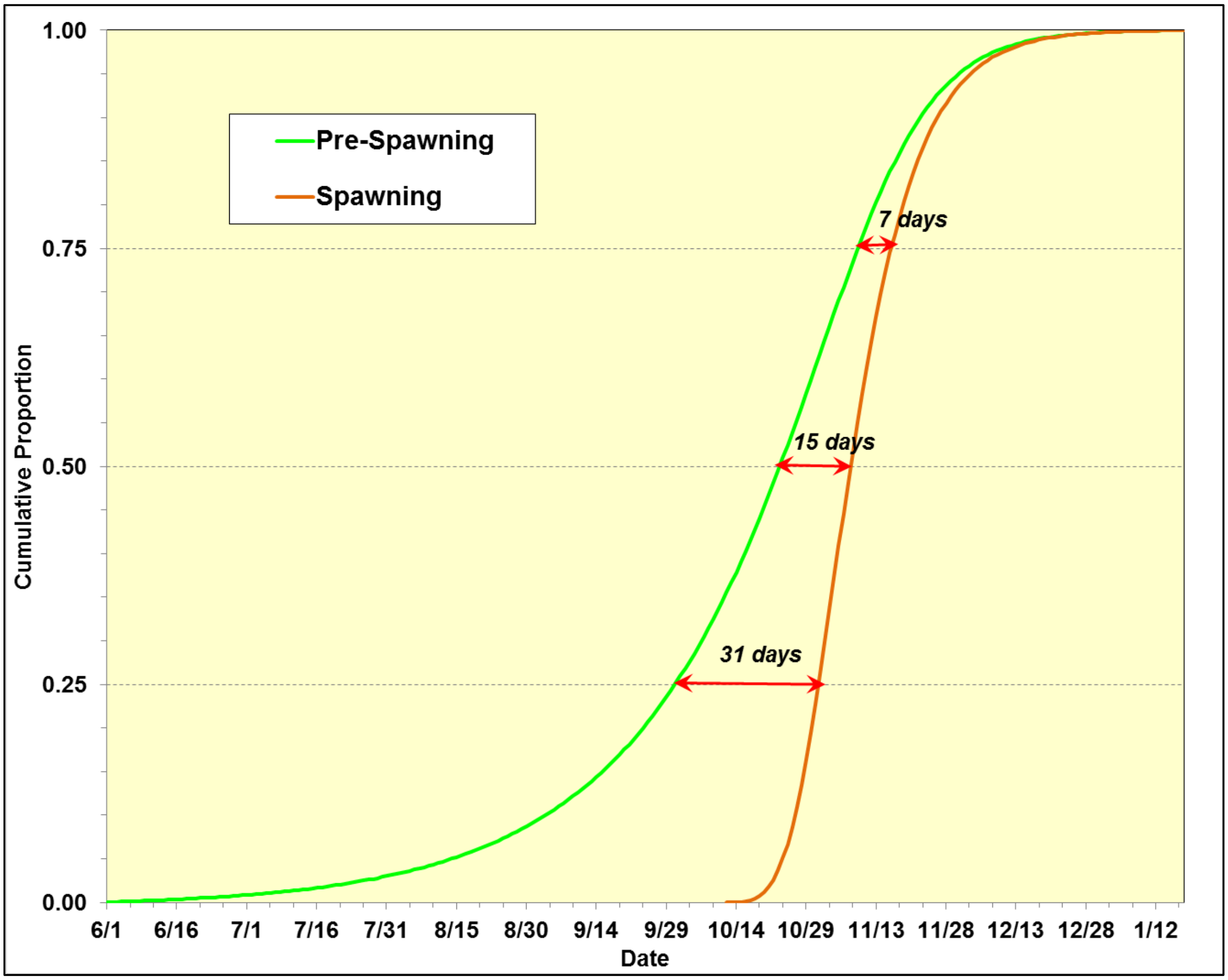
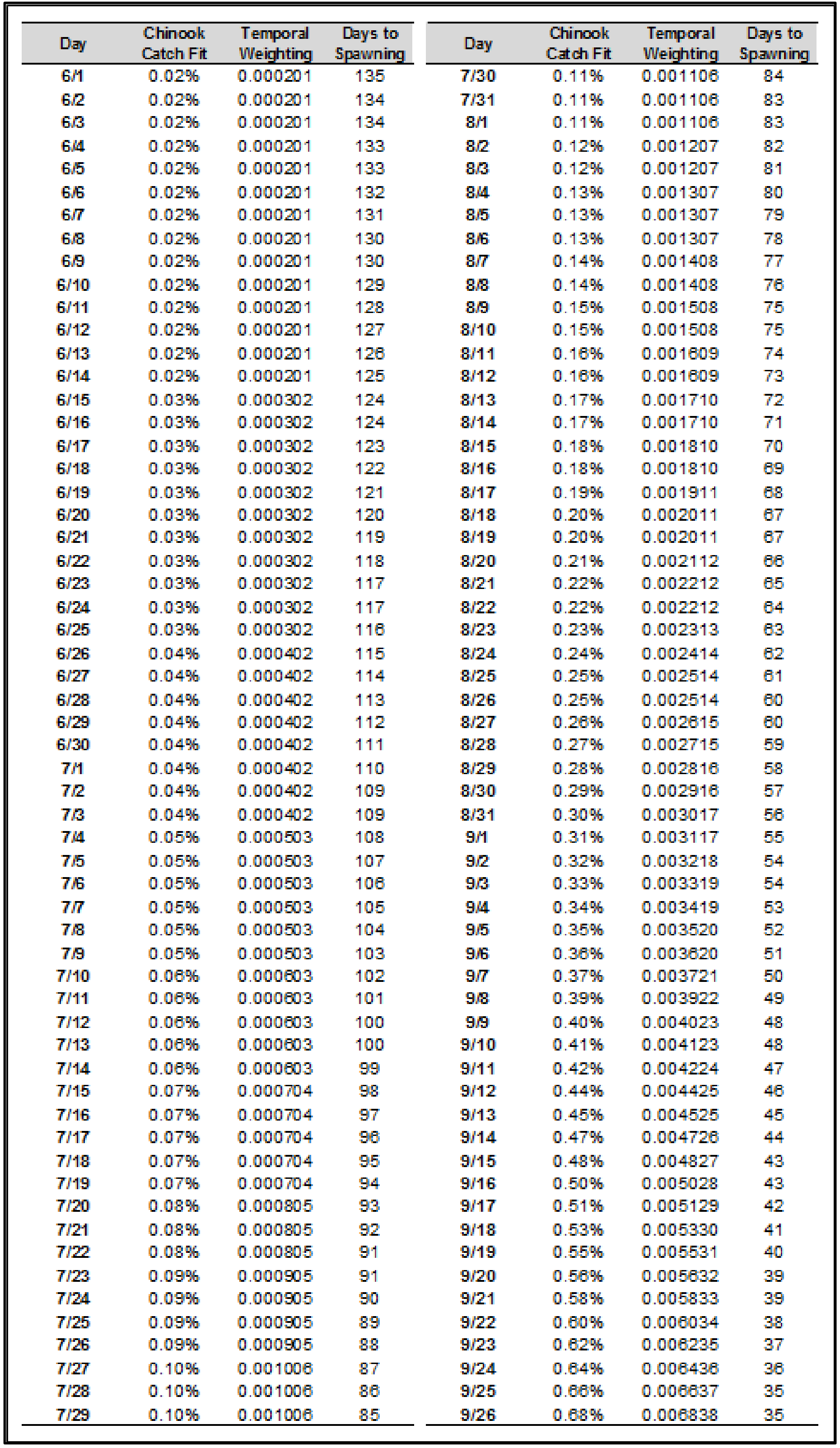


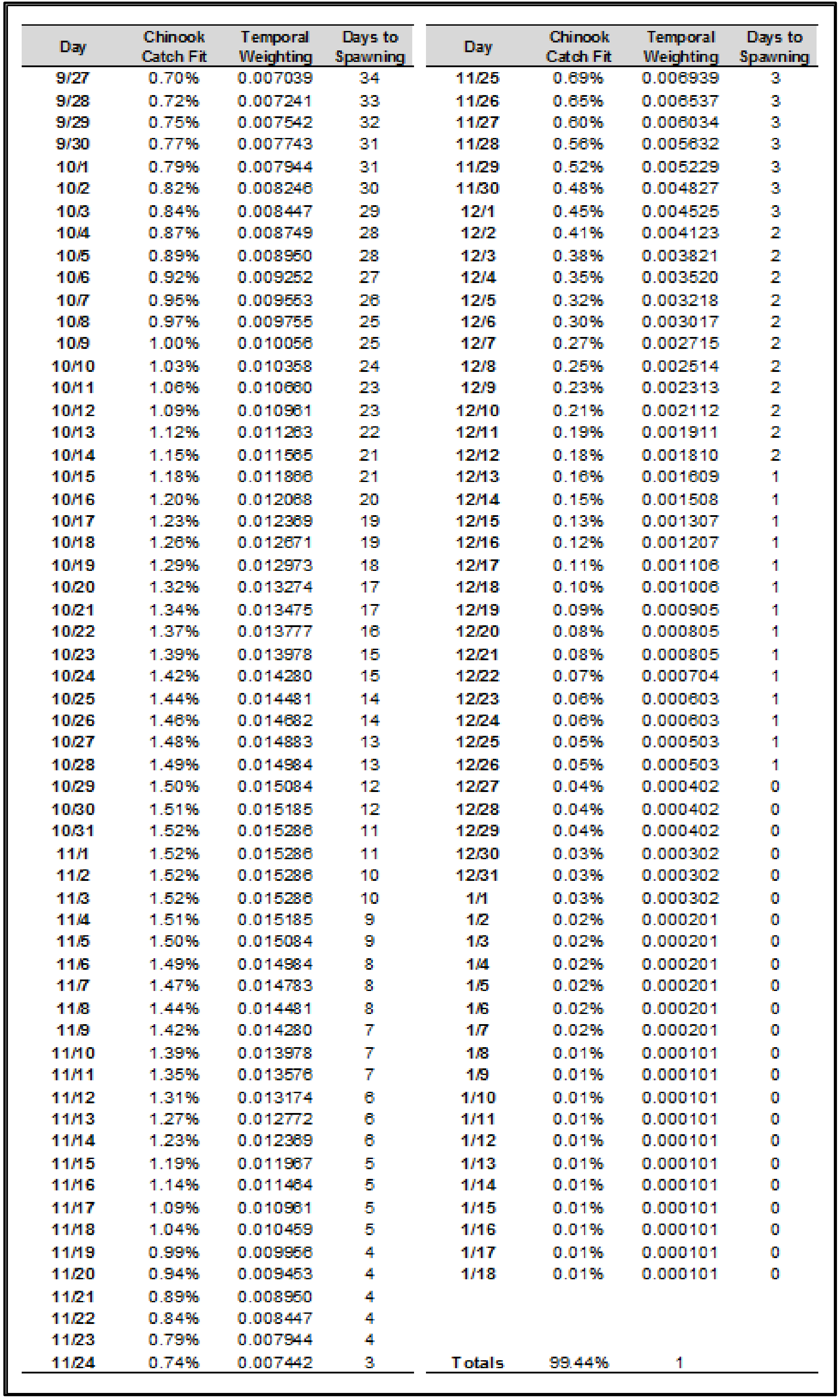
Figure 9. Comparison of the estimated cumulative temporal distributions developed for pre-spawning and spawning fall-run Chinook salmon in the lower American River.

Table 4. Temporal weighting coefficients used for adult fall-run Chinook salmon arrival in the lower American River, including the estimated days to spawning for each daily cohort.



Day	Chinook Catch Fit	Temporal Weighting	Days to Spawning
6/1	0.02%	0.000201	135
6/2	0.02%	0.000201	134
6/3	0.02%	0.000201	134
6/4	0.02%	0.000201	133
6/5	0.02%	0.000201	133
6/6	0.02%	0.000201	132
6/7	0.02%	0.000201	131
6/8	0.02%	0.000201	130
6/9	0.02%	0.000201	130
6/10	0.02%	0.000201	129
6/11	0.02%	0.000201	128
6/12	0.02%	0.000201	127
6/13	0.02%	0.000201	126
6/14	0.02%	0.000201	125
6/15	0.03%	0.000302	124
6/16	0.03%	0.000302	124
6/17	0.03%	0.000302	123
6/18	0.03%	0.000302	122
6/19	0.03%	0.000302	121
6/20	0.03%	0.000302	120
6/21	0.03%	0.000302	119
6/22	0.03%	0.000302	118
6/23	0.03%	0.000302	117
6/24	0.03%	0.000302	117
6/25	0.03%	0.000302	116
6/26	0.04%	0.000402	115
6/27	0.04%	0.000402	114
6/28	0.04%	0.000402	113
6/29	0.04%	0.000402	112
6/30	0.04%	0.000402	111
7/1	0.04%	0.000402	110
7/2	0.04%	0.000402	109
7/3	0.04%	0.000402	109
7/4	0.05%	0.000503	108
7/5	0.05%	0.000503	107
7/6	0.05%	0.000503	106
7/7	0.05%	0.000503	105
7/8	0.05%	0.000503	104
7/9	0.05%	0.000503	103
7/10	0.06%	0.000603	102
7/11	0.06%	0.000603	101
7/12	0.06%	0.000603	100
7/13	0.06%	0.000603	100
7/14	0.06%	0.000603	99
7/15	0.07%	0.000704	98
7/16	0.07%	0.000704	97
7/17	0.07%	0.000704	96
7/18	0.07%	0.000704	95
7/19	0.07%	0.000704	94
7/20	0.08%	0.000805	93
7/21	0.08%	0.000805	92
7/22	0.08%	0.000805	91
7/23	0.09%	0.000905	91
7/24	0.09%	0.000905	90
7/25	0.09%	0.000905	89
7/26	0.09%	0.000905	88
7/27	0.10%	0.001006	87
7/28	0.10%	0.001006	86
7/29	0.10%	0.001006	85
7/30	0.11%	0.001106	84
7/31	0.11%	0.001106	83
8/1	0.11%	0.001106	83
8/2	0.12%	0.001207	82
8/3	0.12%	0.001207	81
8/4	0.13%	0.001307	80
8/5	0.13%	0.001307	79
8/6	0.13%	0.001307	78
8/7	0.14%	0.001408	77
8/8	0.14%	0.001408	76
8/9	0.15%	0.001508	75
8/10	0.15%	0.001508	75
8/11	0.16%	0.001609	74
8/12	0.16%	0.001609	73
8/13	0.17%	0.001710	72
8/14	0.17%	0.001710	71
8/15	0.18%	0.001810	70
8/16	0.18%	0.001810	69
8/17	0.19%	0.001911	68
8/18	0.20%	0.002011	67
8/19	0.20%	0.002011	67
8/20	0.21%	0.002112	66
8/21	0.22%	0.002212	65
8/22	0.22%	0.002212	64
8/23	0.23%	0.002313	63
8/24	0.24%	0.002414	62
8/25	0.25%	0.002514	61
8/26	0.25%	0.002514	60
8/27	0.26%	0.002615	60
8/28	0.27%	0.002715	59
8/29	0.28%	0.002816	58
8/30	0.29%	0.002916	57
8/31	0.30%	0.003017	56
9/1	0.31%	0.003117	55
9/2	0.32%	0.003218	54
9/3	0.33%	0.003319	54
9/4	0.34%	0.003419	53
9/5	0.35%	0.003520	52
9/6	0.36%	0.003620	51
9/7	0.37%	0.003721	50
9/8	0.39%	0.003922	49
9/9	0.40%	0.004023	48
9/10	0.41%	0.004123	48
9/11	0.42%	0.004224	47
9/12	0.44%	0.004425	46
9/13	0.45%	0.004525	45
9/14	0.47%	0.004726	44
9/15	0.48%	0.004827	43
9/16	0.50%	0.005028	43
9/17	0.51%	0.005129	42
9/18	0.53%	0.005330	41
9/19	0.55%	0.005531	40
9/20	0.56%	0.005632	39
9/21	0.58%	0.005833	39
9/22	0.60%	0.006034	38
9/23	0.62%	0.006235	37
9/24	0.64%	0.006436	36
9/25	0.66%	0.006637	35
9/26	0.68%	0.006838	35

Table 4 (continued). Temporal weighting coefficients used for adult fall-run Chinook salmon arrival in the lower American River, including the estimated days to spawning for each daily cohort.



Day	Chinook Catch Fit	Temporal Weighting	Days to Spawning	Day	Chinook Catch Fit	Temporal Weighting	Days to Spawning
9/27	0.70%	0.007039	34	11/25	0.69%	0.006939	3
9/28	0.72%	0.007241	33	11/26	0.65%	0.006537	3
9/29	0.75%	0.007542	32	11/27	0.60%	0.006034	3
9/30	0.77%	0.007743	31	11/28	0.56%	0.005632	3
10/1	0.79%	0.007944	31	11/29	0.52%	0.005229	3
10/2	0.82%	0.008246	30	11/30	0.48%	0.004827	3
10/3	0.84%	0.008447	29	12/1	0.45%	0.004525	3
10/4	0.87%	0.008749	28	12/2	0.41%	0.004123	2
10/5	0.89%	0.008950	28	12/3	0.38%	0.003821	2
10/6	0.92%	0.009252	27	12/4	0.35%	0.003520	2
10/7	0.95%	0.009553	26	12/5	0.32%	0.003218	2
10/8	0.97%	0.009755	25	12/6	0.30%	0.003017	2
10/9	1.00%	0.010056	25	12/7	0.27%	0.002715	2
10/10	1.03%	0.010358	24	12/8	0.25%	0.002514	2
10/11	1.06%	0.010660	23	12/9	0.23%	0.002313	2
10/12	1.09%	0.010961	23	12/10	0.21%	0.002112	2
10/13	1.12%	0.011263	22	12/11	0.19%	0.001911	2
10/14	1.15%	0.011565	21	12/12	0.18%	0.001810	2
10/15	1.18%	0.011866	21	12/13	0.16%	0.001609	1
10/16	1.20%	0.012068	20	12/14	0.15%	0.001508	1
10/17	1.23%	0.012369	19	12/15	0.13%	0.001307	1
10/18	1.26%	0.012671	19	12/16	0.12%	0.001207	1
10/19	1.29%	0.012973	18	12/17	0.11%	0.001106	1
10/20	1.32%	0.013274	17	12/18	0.10%	0.001006	1
10/21	1.34%	0.013475	17	12/19	0.09%	0.000905	1
10/22	1.37%	0.013777	16	12/20	0.08%	0.000805	1
10/23	1.39%	0.013978	15	12/21	0.08%	0.000805	1
10/24	1.42%	0.014280	15	12/22	0.07%	0.000704	1
10/25	1.44%	0.014481	14	12/23	0.06%	0.000603	1
10/26	1.46%	0.014682	14	12/24	0.06%	0.000603	1
10/27	1.48%	0.014883	13	12/25	0.05%	0.000503	1
10/28	1.49%	0.014984	13	12/26	0.05%	0.000503	1
10/29	1.50%	0.015084	12	12/27	0.04%	0.000402	0
10/30	1.51%	0.015185	12	12/28	0.04%	0.000402	0
10/31	1.52%	0.015286	11	12/29	0.04%	0.000402	0
11/1	1.52%	0.015286	11	12/30	0.03%	0.000302	0
11/2	1.52%	0.015286	10	12/31	0.03%	0.000302	0
11/3	1.52%	0.015286	10	1/1	0.03%	0.000302	0
11/4	1.51%	0.015185	9	1/2	0.02%	0.000201	0
11/5	1.50%	0.015084	9	1/3	0.02%	0.000201	0
11/6	1.49%	0.014984	8	1/4	0.02%	0.000201	0
11/7	1.47%	0.014783	8	1/5	0.02%	0.000201	0
11/8	1.44%	0.014481	8	1/6	0.02%	0.000201	0
11/9	1.42%	0.014280	7	1/7	0.02%	0.000201	0
11/10	1.39%	0.013978	7	1/8	0.01%	0.000101	0
11/11	1.35%	0.013576	7	1/9	0.01%	0.000101	0
11/12	1.31%	0.013174	6	1/10	0.01%	0.000101	0
11/13	1.27%	0.012772	6	1/11	0.01%	0.000101	0
11/14	1.23%	0.012369	6	1/12	0.01%	0.000101	0
11/15	1.19%	0.011967	5	1/13	0.01%	0.000101	0
11/16	1.14%	0.011464	5	1/14	0.01%	0.000101	0
11/17	1.09%	0.010961	5	1/15	0.01%	0.000101	0
11/18	1.04%	0.010459	5	1/16	0.01%	0.000101	0
11/19	0.99%	0.009956	4	1/17	0.01%	0.000101	0
11/20	0.94%	0.009453	4	1/18	0.01%	0.000101	0
11/21	0.89%	0.008950	4				
11/22	0.84%	0.008447	4				
11/23	0.79%	0.007944	4				
11/24	0.74%	0.007442	3	Totals	99.44%	1	

2.4 Chinook Salmon Spawning Spatial Distribution

The spatial weighting coefficients input into the LAR Mortality Model account for the proportion of fall-run Chinook salmon spawning by geographic location (river mile) in the lower American River. The original LAR Mortality Model defined the spawning spatial distribution for fall-run Chinook salmon in the lower American River based on aerial redd survey data collected by the CDFW for the 1991/92, 1992/93, and 1993/94 biological years. Since then, the CDFW has published additional aerial redd survey reports for the 1994/95 and 1995/96 biological years, providing additional data upon which the Chinook salmon spawning spatial distribution for the LAR Mortality Model can be refined.

Refined spatial weighting coefficients were derived from data collected by aerial redd surveys conducted during the 1991/92 through the 1995/96 fall-run Chinook salmon spawning seasons (Snider and McEwan 1992; Snider et al. 1993, 1996; Snider and Vyverberg 1995, 1996). Tables published in the annual Chinook salmon redd survey reports provide the number of newly-built redds by river mile (RM) observed in each annual survey (**Table 5**). A map of the lower American River indicating river miles, as measured from the confluence of the lower American and Sacramento rivers, is presented in **Figure 10** for reference.

Table 5. Number of newly built redds by river mile (RM) observed during the Chinook salmon aerial redd surveys conducted in the lower American River from 1991 through 1995.

Year RM	1991	1992	1993	1994	1995	1991 – 1995 Total Redds	
5-6	0	0	0	6	2	8	0.05%
6-7	12	7	20	18	15	72	0.46%
7-8	0	0	21	14	28	63	0.40%
8-9	0	0	0	1	17	18	0.11%
9-10	32	6	71	12	12	133	0.85%
10-11	6	0	4	61	39	110	0.70%
11-12	0	1	30	0	1	32	0.20%
12-13	30	1	0	15	45	91	0.58%
13-14	20	0	20	59	87	186	1.18%
14-15	33	38	49	56	115	291	1.85%
15-16	11	0	177	58	66	312	1.99%
16-17	86	123	13	83	63	368	2.34%
17-18	189	9	787	424	601	2,010	12.79%
18-19	154	96	164	297	115	826	5.26%
19-20	314	220	663	391	595	2,183	13.90%
20-21	427	266	1,587	572	1,054	3,906	24.86%
21-22	191	2	1,322	280	561	2,356	15.00%
22-23	121	369	1,277	418	560	2,745	17.47%
RM 5 – RM 23 Total Redds	1,626	1,138	6,205	2,765	3,976	15,710	100%

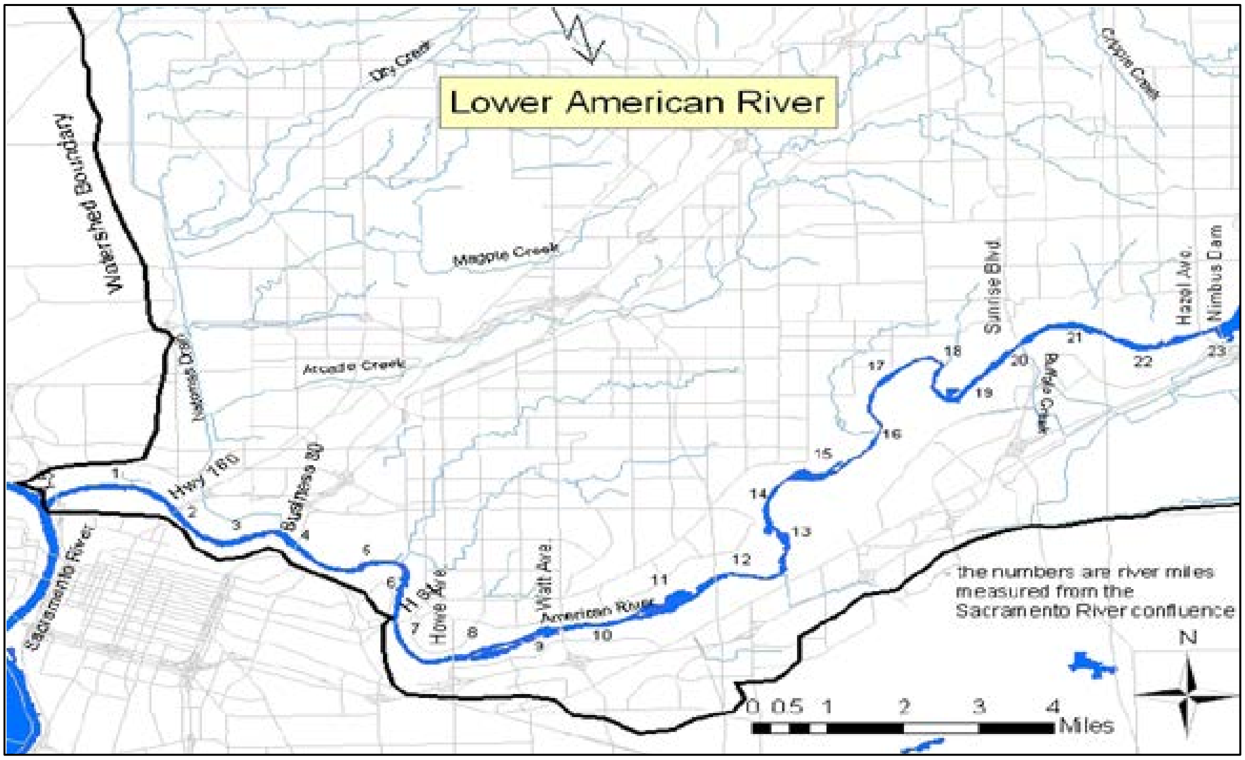


Figure 10. Map of the lower American River indicating river miles, as measured from the confluence of the lower American and Sacramento rivers (Source: Hannon and Deason 2008).

3.0 Thermally-Induced Chinook Salmon Early Lifestage Mortality Rates

3.1 Original Lower American River Mortality Model Rates

The original LAR Mortality Model utilized mortality rates for Chinook salmon fertilized eggs and pre-emergent fry for defined temperature-specific exposure durations that were originally developed by USFWS (1990). At a later date, consultation between the USBR, USFWS, and CDFW resulted in the development of different mortality rates for the pre-spawned egg lifestage (HCI 1996). These mortality rates are shown in

Table 6, **Table 7**, and **Table 8**. The LAR Mortality Model required mortality rates on a daily time-scale, so the cumulative mortality/duration data for the various lifestages were converted into daily mortality rates via Equation 7 (HCI 1996). The daily mortality rates were the rates used by the original LAR Mortality Model.

$$M_i = 1 - (1 - M_n)^{1/n} \tag{7}$$

Where: M_i = daily mortality rate (as a fraction)

M_n = mortality rate after exposure time, n (as a fraction)

n = exposure time in days

Table 6. Temperature and exposure duration-mortality relationships for pre-spawned Chinook salmon eggs (in the adult spawner). Daily mortality rates represent the pre-spawned egg criteria (PSC) used by the original LAR Mortality Model.

Water Temperature (°F)	Mortality Rate at Exposure Time (M_n) (%) [a]	Daily Mortality Rate (M_i) (%)
< 52	Natural Rate	--
52	Natural Rate	--
53	1% @ 30 days	0.034
54	5% @ 30 days	0.171
55	10% @ 30 days	0.351
56	15% @ 30 days	0.540
57	21% @ 30 days	0.783
58	29% @ 30 days	1.135
59	38% @ 30 days	1.581
60	47% @ 30 days	2.094
61	55% @ 30 days	2.627
> 62	64% @ 30 days	3.348

[a] Values listed here were calculated based on daily mortality rates, because in HCI (1996) the listed cumulative mortalities at the 30-day exposure time do not correspond to the listed M_i. The daily pre-spawned egg mortality rates shown here are listed in HCI (1996) and are programmed into the original LAR Mortality Model.

Table 7. Temperature and exposure duration-mortality relationships for fertilized-Chinook salmon eggs (in redds). Daily mortality rates represent the fertilized- egg criteria (EC) used by the original LAR Mortality Model.

Water Temperature (°F)	Mortality Rate at Exposure Time (M_n) (%)	Daily Mortality Rate (M_i) (%)
< 56	Natural Rate	--
57	8% @ 24 days	0.347
58	15% @ 22 days	0.736
59	25% @ 20 days	1.428
60	50% @ 12 days	5.613
61	80% @ 15 days	10.174
62	100% @ 12 days	31.871
63	100% @ 11 days	34.207
64	100% @ 7 days	48.205
> 64	100% @ 7 days	48.205
Source: HCI 1996.		

Table 8. Temperature and exposure duration-mortality relationships for pre-emergent Chinook salmon fry (in gravel). Daily mortality rates represent the pre-emergent fry criteria (FC) used by the original LAR Mortality Model.

Water Temperature (°F)	Mortality Rate at Exposure Time (M_n) (%)	Daily Mortality Rate (M_i) (%)
< 56	Natural Rate	--
57	Natural Rate	--
58	Natural Rate	--
59	10% @ 14 days	0.750
60	25% @ 14 days	2.034
61	50% @ 14 days	4.830
62	75% @ 14 days	9.428
63	100% @ 14 days	28.031
64	100% @ 10 days	36.904
> 64	100% @ 10 days	36.904
Source: HCI 1996.		

3.1.1 Pre-Spawned Egg Mortality Rates

USBR, USFWS, and CDFW collaborated to develop pre-spawned egg mortality rates for use in the LAR Mortality Model and, according to HCI (1996), the agencies assumed the temperature-mortality relationship for unfertilized eggs in the female Chinook salmon spawner to be the same as for fertilized eggs reaching the eyed stage. It is unclear what data the agencies relied upon to develop pre-spawned egg mortality rates, but among the studies referenced by USFWS (1990) for fertilized-egg and pre-emergent fry mortality, Hinze et al. (1956) and Hinze (1959) discussed mortality at the eyed stage for fertilized eggs. Hinze (1959) also was cited by NMFS (1997,

2000) and by USFWS (1995) as showing that the viability of *in vivo* eggs decreases when adult fish are held at temperatures greater than 60°F. These two studies are discussed further below. By convention, *in vivo* mortality is referred to herein as the egg loss due to the physiological effect of water temperature on the ability of the ovum to be fertilized and undergo normal embryo development.

Hinze et al. (1956) discussed operations at Nimbus Hatchery during July 1955 through June 1956. Excessive adult losses were reported at the hatchery in 1956. This report presented data showing the survival of fertilized eggs to the eyed stage compared to the ambient river temperatures at which eggs were harvested from adult spawners (Figure 11). The cumulative mortality (M_n) of fertilized eggs at the eyed stage (Hinze et al. 1956; Figure 11) is comparable with the original LAR Mortality Model pre-spawned egg mortality rates (Table 6). Hinze et al. (1956) discussed a number of factors that influenced egg losses at Nimbus Hatchery that season. Among these factors, high water temperatures occurred during the initial stages of egg incubation, and this alone could have caused much greater mortality than otherwise would have occurred if the same eggs had been spawned and incubated at optimal water temperatures. Furthermore, adult fish collected and held during the early period of spawning were subject not only to high temperatures, but also to low dissolved oxygen and high sulfide concentrations associated with an algal bloom in Lake Natoma the month prior to initial fish take. Therefore, the mortalities reported at Nimbus Hatchery that season cannot be definitively attributed to temperature-induced *in vivo* mortality alone.

Hinze (1959) is a report of the operations at the Nimbus Hatchery for July 1957 through June 1958. Similar to the observations made during the period 1955-56 (Hinze et al. 1956), adult mortality in the lower American River during the 1957 spawning season was high and egg survival was low (**Table 9**). As in Hinze et al. (1956), the water temperature at which eggs were collected from the adult spawners was compared to mortality of fertilized eggs at the eyed stage. Overall, fertilized-egg mortality was relatively high during 1957, even when eggs were collected and incubated at relatively optimal to slightly elevated water temperatures of 50°F to 59°F, possibly indicating that factors beside collection or incubation water temperature may have contributed to fertilized-egg mortality. Mortality data for the 55-59/50-59°F and 60-62/55-56°F egg-take/incubation temperature treatments was cited by Boles et al. (1988) as evidence that eggs exposed to 60 to 62°F water temperature *in vivo* results in lower egg survival at the eyed stage, compared to *in vivo* eggs exposed to 55 to 59°F. While *in vivo* water temperature exposure could have contributed to this mortality, the actual water temperature exposure scenario of adult spawners was not known, and eggs both harvested and incubated at lower water temperatures (50-59°F) also suffered elevated mortality.

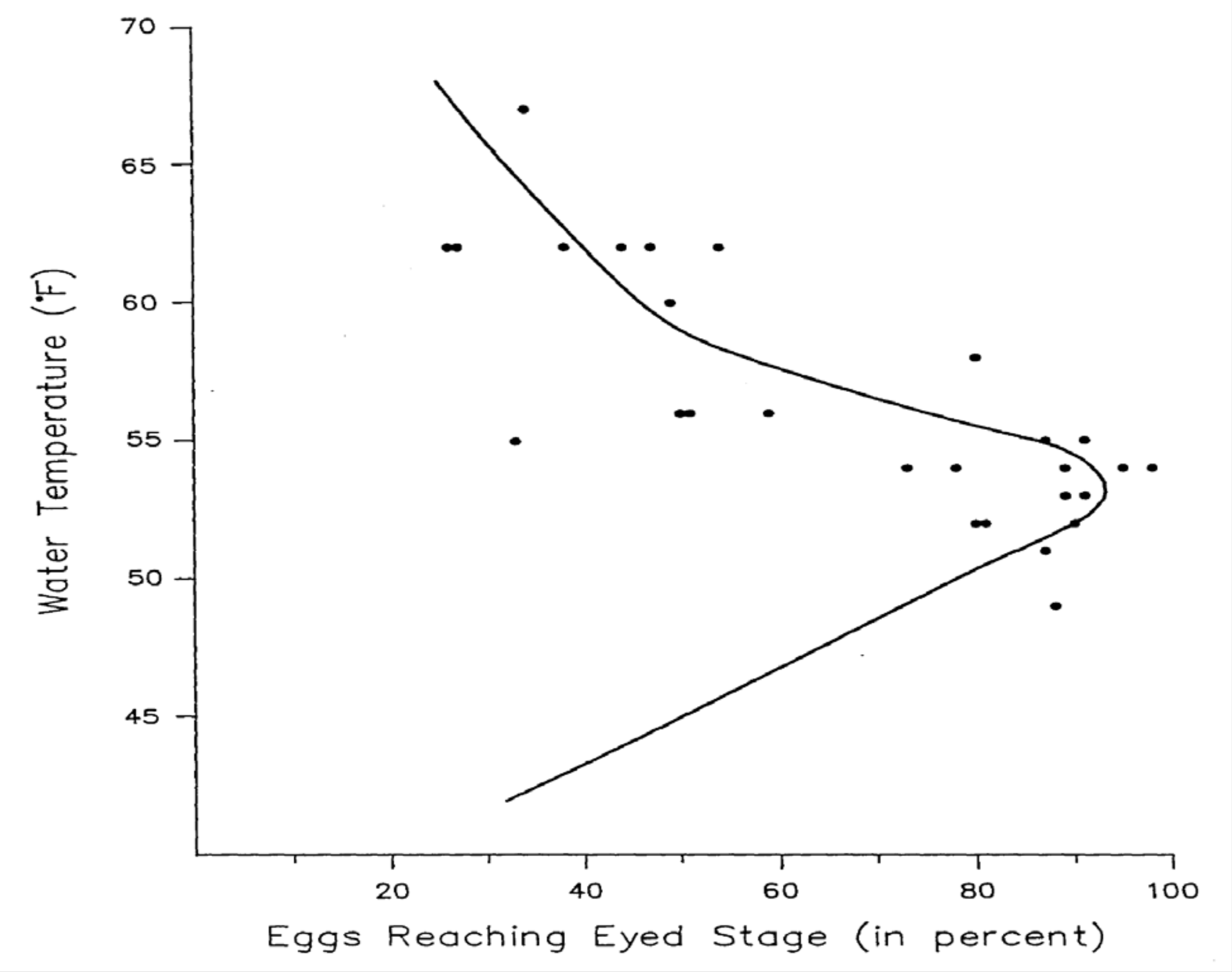


Figure 11. Relationship between water temperature at which adult fish were taken at Nimbus Hatchery during the 1955-1956 spawning season and survival of eggs to the eyed-stage (Data are originally from Hinze et al. (1956), and the figure was reproduced from Boles et al. (1988)).

Table 9. Egg-take water temperature, egg-incubation temperature, and associated mortality for Chinook salmon eggs taken from adult fish at Nimbus Hatchery during the 1957-1958 spawning season, as reported in Hinze (1959).

Egg-Take Temperature (°F)	**Egg-Incubation Temperature (°F)**	**Mortality[a] (%)**
>62	>62	100
60-62	60-62	50
55-59	50-59	20
60-62[b]	55-56	30

[a] Mortality at the eyed stage.
[b] Eggs were transferred to Moccasin Creek Hatchery, Moccasin, CA, following egg-take for cold-water incubation.

Hinze (1959) indicated that eggs collected from fish at Nimbus Hatchery when water temperatures were 60 to 62°F had been transferred to Moccasin Creek Hatchery for incubation at 55 to 56°F, but a description of egg handling and holding prior to transfer to Moccasin Creek Hatchery was not provided. If the fertilized eggs were held for any length of time at 60°F to 62°F prior to their transfer to Moccasin Creek Hatchery, this exposure could have caused water temperature-induced mortality. Also, the water temperature at which egg-take occurred during the 1957 spawning season at Nimbus Hatchery is not necessarily indicative of adult water temperature exposure. Even though the day on which egg take occurred may have had low water temperature (e.g., 50 to 59°F), pre-spawning adults could have held in the lower American River for some length of time, where water temperatures were as high as 67°F during the 1957 pre-spawn period. By contrast, some adults may have held for a minimal length of time in the lower American River prior to capture and egg take.

The early reports from Nimbus Hatchery highlight that the primary factors that influence the survival of Chinook salmon eggs are unrelated to temperature exposure of eggs *in vivo*. Mortality of adult spawners can be high due to disease and prolonged holding at elevated water temperatures, and the associated loss of *in vivo* eggs due to adult mortality can be high. Further, the survival of fertilized eggs to the eyed stage is principally affected by temperature exposure of the eggs post-fertilization. The Nimbus Hatchery reports offer little definitive evidence that survival of fertilized eggs may be affected by the *in vivo* exposure of unfertilized gametes to elevated water temperatures.

3.1.2 Fertilized-Egg Mortality Rates

Although information was limited at the time the fertilized-egg mortality rates were reported, USFWS (1990) developed the mortality rates based upon data from a number of studies including Combs and Burrows (1957), Seymour (1956) and Healey (1979). A personal communication from H. Rectenwald (formerly with CDFW) was also cited, although documentation of this communication could not be found. USFWS (1990) also cited Boles et al. (1988), in which the above referenced studies, as well as Hinze et al. (1956) and Hinze (1959), were reviewed. Another agency document contemporary with USFWS (1990), USFWS (1987), also discussed many of these same studies in the context of early lifestage Chinook salmon mortality in the Sacramento River, providing additional insight into the agency's selection of fertilized-egg mortality rates for the original LAR Mortality Model.

Review of the fertilized-egg mortality rates from the original Mortality Model shows that mortality above the natural rate begins at water temperatures of 57°F, and within 6°F, mortality reaches 100% at 62°F. USFWS (1990) stated that "*56°F is considered to be the upper limit for optimum spawning, egg incubation and sac-fry development in the Sacramento River. Information on specific impacts of temperatures exceeding 56°F on eggs and pre-emergent fry for Sacramento River salmon is limited.*" According to USFWS (1990), thermally induced egg mortality was assumed to initially occur at temperatures greater than 56°F, even though

"*Seymour (1956) observed low egg mortality at a constant temperature of 55°F and 57°F*" (USFWS 1990) and Combs and Burrows (1957) reported an optimal egg incubation temperature range of 42.5°F to 57.5°F. USFWS (1987 and 1990) did not discuss the mortality rates at 57°F, 58°F, and 59°F. However, according to USFWS (1987), 80% mortality occurs when water temperatures during egg incubation are 60°F to 61°F (citing Healey 1979) and 100% mortality occurs at temperatures greater than 62°F (citing Hinze 1959). With regard to exposure duration, USFWS (1990) also claimed that "*at a 12-day exposure to 60°F, egg mortality is 50%, and increases as exposure is prolonged*," and although not referenced, the Nimbus Hatchery 1957/58 fiscal year report appears to have been the source of this information (Hinze 1959).

As discussed further below, data presented in the literature cited by USFWS (1987 and 1990) suggests that the fertilized-egg mortality rates used in the original LAR Mortality Model are higher than that supported by the literature.

- USFWS (1990) stated the fertilized-egg mortality rate at 60°F was 50% for a 12-day exposure. By contrast, for eggs incubated from fertilization to hatch (approximately 33 days), Seymour (1956) and Combs and Burrows (1957) reported 12-35% mortality at 60°F. Healey (1979) also reported approximately 38% cumulative mortality at hatch for eggs incubated at 60°F to 61°F. Hinze (1959) reported 50% mortality at the eyed stage (not hatch) for eggs incubated at 60°F to 62°F, but as discussed above, this report suggests that other factors affected fertilized-egg viability because eggs incubated at optimal temperatures experienced relatively high mortality (Table 9).
- USFWS (1990) stated the fertilized-egg mortality rate at 61°F was 80% for a 12-day exposure. This may have been a misinterpretation of Healey (1979), who reported 80% cumulative egg mortality through complete fry development for incubations at 60°F to 61°F. Egg-associated mortality was only 38% (Healey 1979).
- USFWs (1990) stated that the fertilized-egg mortality rate at 62°F was 100% for a 12-day exposure. Hinze (1959) reported 100% egg mortality at water temperatures *greater than* 62°F. Indeed, these eggs may have been exposed to water temperatures as high as 67°F because water temperatures in the American River at Nimbus Hatchery, where Hinze (1959) conducted the study, ranged from 63°F to 67°F during October 1957, and ranged from 56°F to 65°F during November 1957. Seymour (1956) reported 78% to 85% mortality of fertilized eggs incubated to hatch (approximately 31 days) at temperatures of 62°F.

In discussing the exposure duration values assigned to the original Mortality Model's fertilized-egg mortality rates with J.G. Smith (Project Leader, USFWS, Red Bluff, CA), who was on staff with the USFWS's Fisheries Assistance Office when the original early lifestage mortality data tables were developed, he stated the following:

> *[Previous] studies did not really develop an exposure time, but … there was a need to develop a table that did have exposure times in order to estimate mortality*

> *with varying water temperatures during incubation. I do recall that this was a weakness of the model that our studies were to address. We ran a variety of controlled temperature experiments on incubating winter-run and fall-run Chinook salmon eggs that would mimic various temperature management options (e.g. 55 degrees for XX days then 58 for XX days) that could verify, or not, the values used in Table 1 [of USFWS 1990].* (pers. comm., January 10, 2013)

The controlled temperature experiments referred to by J.G. Smith were those published in USFWS (1998) which, along with other relevant studies, have been used to revise the early lifestage mortality rates presented in this report.

3.1.3 Pre-Emergent Fry Mortality Rates

At the time the original mortality rates were developed, there was virtually no data available on thermally-induced pre-emergent fry mortality (USFWS 1990). In general, USFWS (1990) cited Combs and Burrows (1957), Seymour (1956), Boles et al. (1988), Healey (1979), and a personal communication from H. Rectenwald (formerly with CDFW) as the basis for fertilized-egg and pre-emergent fry mortality rate development. Of these, however, none contain a rigorous study of pre-emergent fry mortality from which mortality rates could be developed. The work by Seymour (1956) provides some insight into water temperature-induced mortality of pre-emergent fry.

Seymour (1956) is a doctoral dissertation that reported on the effects of elevated water temperature exposure of fertilized-eggs on egg mortality and the physiological development of surviving fry. The results from Seymour (1956) were summarized by Boles et al. (1988): "*Incubation temperatures greater than 60°F produced high mortalities in fry able to develop past the egg stage …Though producing low egg mortality in fish from the Sacramento River, constant water temperatures in the range of 55°F to 57.5°F produced sac-fry mortalities in excess of 50 percent*." While Seymour (1956) had reported high mortality of sac-fry which had been hatched and incubated as pre-emergent fry at water temperatures from 55°F to 62°F, the 50% mortality at 55°F and 57.5°F reported by this study was not incorporated into the original pre-emergent fry mortality rates. USFWS (1990) determined that thermally-induced pre-emergent fry mortality did not initially occur until 59°F (Table 8).

Short-comings in the early lifestage mortality rates were generally recognized, as indicated by HCI (1996) and J.G. Smith (USFWS, pers. comm., January 10, 2013), including pre-emergent fry mortality data. Publication of relevant studies since the original mortality rates were developed now allows for the reliable development of pre-emergent fry mortality rates.

3.2 Refinements to Lower American River Mortality Model Rates

3.2.1 Refinements to Pre-Spawned Egg Mortality Rates

Pre-Spawned Egg Mortality Studies

A review of the available literature has shown that to date, few experiments have been published which specifically address *in vivo* egg mortality. Because pre-spawned egg losses are also incurred due to pre-spawn adult mortality, the water temperature-exposure-mortality relationship for adult Chinook salmon also is reviewed. A number of qualitative conclusions can be drawn from the available studies and reports.

Berman (1990) published results of an experiment that measured Chinook salmon *in vivo* egg mortality due to elevated water temperature. Adult spring-run Chinook salmon from the Yakima River, Washington, were initially subject to prolonged holding in hatchery ponds at 66.2°F. At this water temperature, no eggs were obtained due to heavy adult losses after 38 days of exposure (88% adult mortality). Because *F. columnaris* caused excessive disease-related adult mortality at 66.2°F, one-half of the fish from the control-temperature ponds (57°F) were transferred to and held in the elevated-temperature ponds (66.2°F). Adult fish held in the control-temperature ponds (52 days at 57°F) and those held at elevated water temperatures (14 days at 66.2°F) were spawned, and fertilized eggs were incubated until hatch at 49.1°F. Average mortality of eggs from the elevated water temperature treatments was 0.85%, while mortality of eggs from the control treatment was 0.10%. Egg and alevin size were also slightly lower for the elevated water temperature treatment, but fertilization rate and number of eggs produced were similar between treatment and control. Berman (1990) could not properly analyze the experimental results with statistics due to the low number of fish surviving the initial exposure at 66.2°F.

In a similar unpublished experiment, North State Resources (NSR) held spring-run Chinook salmon at constant water temperatures ranging from 55.4°F to 69.8°F (K. Marine, Principal Scientist at NSR, pers. comm., April 23, 2013). Adult fish held at 69.8°F suffered complete mortality, and few adults survived for 30 days at 61°F to 66°F. Adult mortalities were a result of bacterial infection, and most occurred within the first 12 days of exposure. The few fish that survived 30 days at temperatures of 61°F to 66°F, and those surviving at lower temperatures were spawned, and eggs were incubated at optimal temperatures. Egg survival to hatch was high among all temperature treatments, and no differences in mortality could be discerned between the eggs from females exposed to the elevated and low temperature treatments.

Jenson et al. (2006) held adult summer-run Chinook salmon from the Puntledge River, British Columbia in Puntledge Hatchery tanks with elevated daily water temperatures ranging from 66°F to 72°F. The complete mortality of adult fish held for up to six weeks at these temperatures was attributed to a number of factors, including elevated total gas pressure, abrupt switching of water sources, poor water quality related to elevated algal levels, and elevated water temperatures. Because fish in the experimental treatment ponds did not survive, Jenson et al. (2006) compared survival of fertilized eggs (determined at hatch) from fish held in the hatchery raceways and from fish held at an off-site coldwater hatchery. Daily average water temperatures during the adult holding period in the Puntledge hatchery raceways were greater than 68°F for 30 days. Because fish were not tagged upon their arrival, a definitive accounting of each adult's exposure duration was not available. Nonetheless, adults holding in the raceways were exposed to elevated water temperatures for days to weeks. Adult mortality of fish held in the hatchery raceways was estimated to be greater than 47%, and mortality of fertilized eggs (at hatch) from adult fish surviving the raceways was 11.8% to 13.4%. Mortality of adults held at the cold-water site was 8%, and mortality of fertilized eggs from the coldwater site was 3.1%. Based on these results, the difference in percent mortality of fertilized eggs collected from adults at the cold-water site versus the warm-water hatchery raceways was 8.7–10.3%, while the difference is percent mortality of adults was >39%.

Mann and Peery (2005) fitted adult pre-spawn fall-run Chinook salmon from the Snake River with external temperature loggers, and released them into the river to complete their migration. Of the returning fish that migrated to and were spawned at the time of their natural arrival at one of three hatcheries on the river, twelve had retained their temperature loggers. Eggs from these fish were subject to normal hatchery operations. Mortality for each lot of eggs was assessed at hatch and at complete yolk-sac absorption. Adult temperature exposures were calculated as "degree days greater than 20°C." Adults exposed to daily average water temperatures ≤ 20°C (68°F) were given a value of 0 degree days above 20°C. For fish exposed to daily average temperatures > 20°C, 20 was subtracted from each daily average temperature greater than 20°C, and the sum of all such calculations for a particular fish was the number of degree days above 20°C. For example, an adult exposed to three days of daily average water temperatures of 22°C would have incurred 6 degree days above 20°C.

Mann and Peery (2005) observed high variability in the mortality of fertilized eggs (at hatch) from the returning adults. The fish which yielded the highest fertilized-egg mortality (19%) was exposed to 0 days greater than 20°C. The other five adults yielding the next highest fertilized-egg mortalities (4% to 9%) had been exposed to the greatest number of degree days above 20°C (2 to 7 days). Six fish exposed to < 2 degree days above 20°C yielded fertilized-egg mortalities of 1% to 3%.

In 2003 (July through September), Leaburg Hatchery (Leaburg, OR) observed increased spring-run Chinook salmon adult and egg mortalities related to elevated water temperatures during adult holding and fertilized-egg incubation periods. Construction upstream of the hatchery in 2003 resulted in monthly average water temperatures of approximately 64°F in July and August, approximately 6°F greater than observed during other years (**Figure 12**). Annual adult and fertilized-egg mortalities and monthly temperature statistics were obtained from the hatchery for the years 2003, 2005, 2007, 2008, 2009, and 2011 (K. Kremers, Leaburg Hatchery Manager,

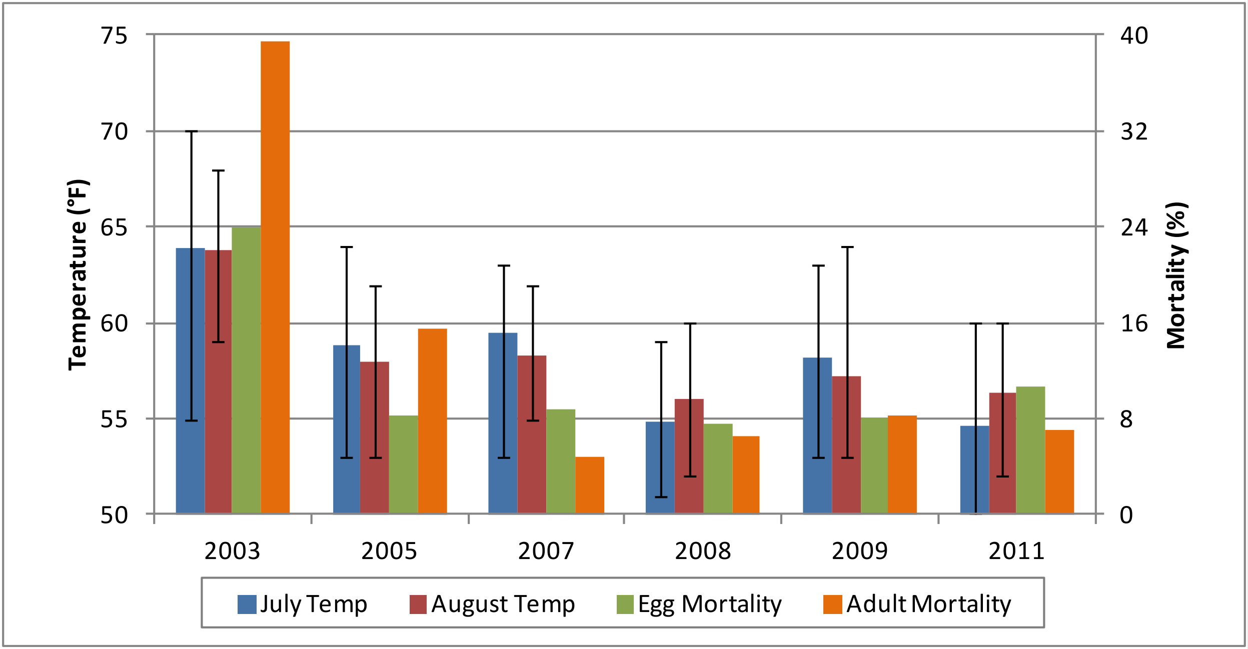


Figure 12. Monthly average water temperatures in hatchery ponds during July and August, and annual spring-run Chinook salmon adult and fertilized-egg mortality at Leaburg Hatchery (Leaburg, OR). Error bars correspond to the daily minimum and maximum temperatures observed during that month.

pers. comm., April 24, 2013). Adult and fertilized-egg mortality in 2003 was 39% and 24%, respectively (Figure 12). Annual average adult and fertilized-egg mortality was 8% and 9%, respectively, for the years 2005, 2007, 2008, 2009, and 2011. Thus, an additional 31% adult mortality and 15% fertilized-egg mortality was observed in 2003. The hatchery attributed the additional 15% fertilized-egg mortality observed in 2003 to prolonged exposure of pre-spawn adults to elevated water temperate because daily average water temperatures during egg incubation were typically well below 60°F.

Temperature-induced adult mortality presents a problem for generating the experimental data needed to address the effects of temperature on *in vivo* egg viability and subsequent survival upon fertilization. Of the studies discussed above, the most pertinent experiments are Berman (1990) and the unpublished work from NSR (K. Marine, pers. comm., April 23, 2013) because these studies held adults for a known duration at constant temperature. Although these studies reported a high proportion of adult mortality due to disease and infection, data from surviving adults indicated that egg survival is undiminished by exposure of pre-spawn adults to water temperatures up to 66°F. Mann and Peery (2005) also showed that there was no relationship between temperature exposure of adult fish and subsequent egg survival. In contrast, observations from Leaburg Hatchery and Puntledge Hatchery suggest that egg mortality could be slightly elevated (by 8–15%) due to prolonged *in vivo* exposures greater than 66–68°F, yet affects on *in vivo* egg viability could also have been related to stress on adult fish from other physical and chemical water characteristics (see discussion of Jensen et al. 2005 above).

Cumulatively, data from these studies are insufficient to determine whether fertilized-egg loss rates are increased (for a given egg incubation temperature) if the adult female (and her *in vivo* eggs) is exposed to temperatures in the mid to upper 60°F range (or even higher) and survives to spawn. However, these studies indicate that pre-spawn adult losses, due to prolonged holding at elevated temperatures or other factors such as disease, result in a much greater proportion of *in vivo* egg loss relative to any decrease in the viability of *in vivo* eggs in surviving adults that spawn, if there is such an effect at all.

Pre-Spawn Adult Mortality Studies

Although the studies and reports reviewed above do not provide sufficient information to determine the temperature-exposure-mortality relationship for *in vivo eggs*, data are available to determine the temperature exposure-survival relationship for adult Chinook salmon (Coutant 1970; Strange 2010; Garman 2014).

Over a 3-year period (1967 to 1969), Coutant (1970) performed experiments that held fall-run Chinook salmon jacks from the Columbia River (Richland, WA) in experimental tanks at constant temperatures ranging from 68°F to 86°F and determined their survival time. Experiments during 1968 utilized 5 to 10 fish per treatment, with fish densities of 6.6 to 13.2 fish/m^3, and incubation temperatures of 78.8°F to 86.0°F. Experiments during 1969 utilized 10 to 15 fish per treatment, with fish densities of 6.6 to 13.2 fish/m^3, and holding temperatures of 71.6°F to 78.8°F. Coutant (1970) reported geometric mean survival time for his experiments. Were the survival times reported as *arithmetic* means, that survival time would correspond to the time when 50% of fish had succumbed to death. Mathematically, however, the *geometric* mean is always less than the *arithmetic* mean. Thus, at the *geometric* mean survival time for a particular incubation temperature more than 50% of the adult fish could have been alive.

The geometric mean survival times for the 1968 and 1969 tests are shown in **Figure 13**. In 1968 the geometric mean survival time for jacks held at 78.8°F was approximately 200 min, compared to approximately 900 min in the 1969 test. Based on the detailed information collected ahead of the tests, Coutant (1970) ruled out differences in acclimation temperatures and fish sizes as explanations of the difference in interannual jack survival times. Coutant (1970) indicated that one possible contributing factor was the use of larger fish tanks in the 1969 test, which would have resulted in lower fish density and lower stress during the high temperature exposures.

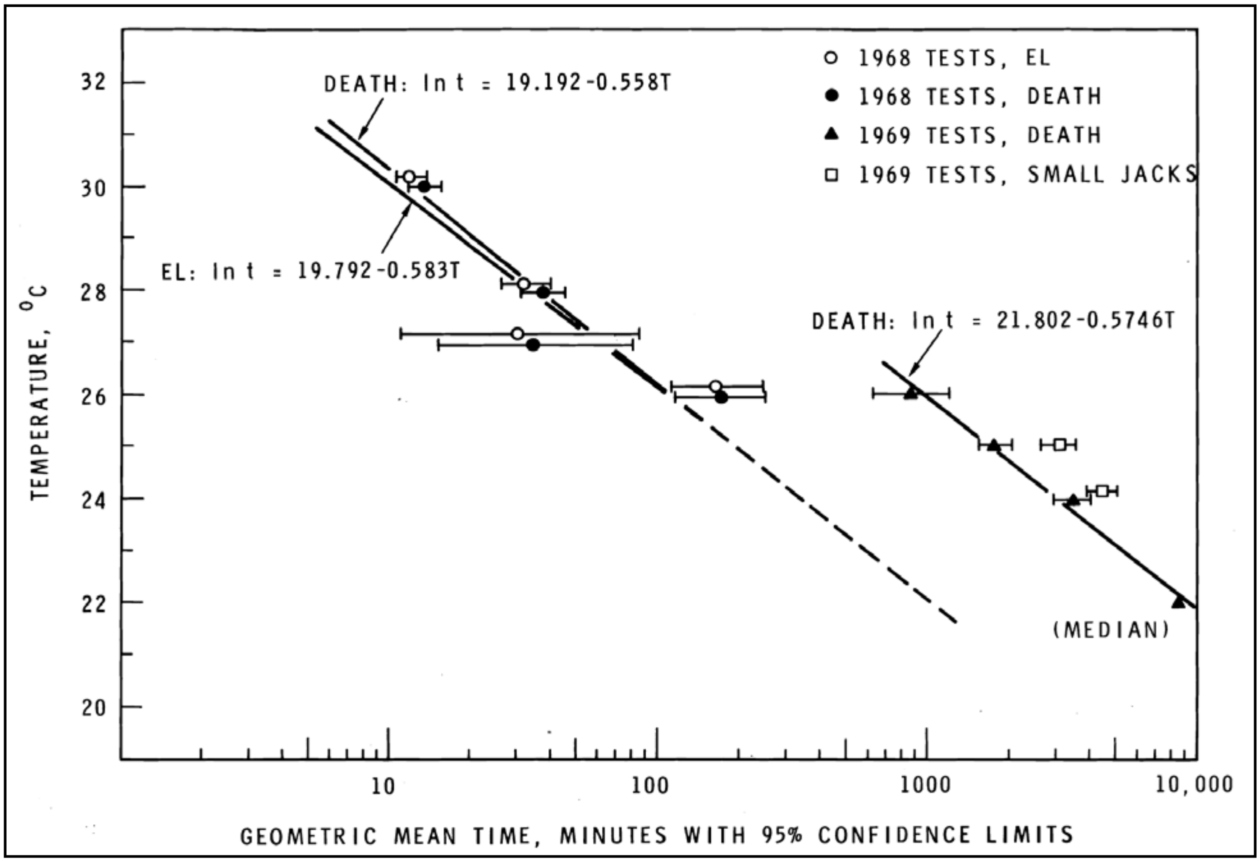


Figure 13. Geometric mean times (t) to equilibrium loss (EL) and death of jack Chinook salmon, 1968 and 1969, with 95% confidence limits. Figure reproduced from Coutant (1970).

Mann and Peery (2005) identified 20°C (68°F) as the upper incipient lethal temperature (UILT) for salmon, although they used a definition of UILT as the water temperature at which theoretically half of the population would survive with permanent exposure. By contrast, the incipient lethal temperature (defined as 50% mortality after 7 days of exposure) of adult Chinook salmon is considered to be approximately 72°F (McCullough 1999), which is in good agreement with the incipient lethal temperature of 71°F to 72°F reported by Coutant (1970) for the tests conducted in 1969.

Strange (2010) reported results of a study in which 16 spring-run and two fall-run Chinook migrating up the Klamath River were tagged with locaters and temperature loggers during the spawning seasons of 2004 and 2005. Of the 18 fish, 16 fish were recovered – four were caught by anglers, ten reached hatcheries or spawned, and two were never recovered. Temperature loggers were recovered from ten fish. Although three fish were caught by anglers early in the migration, data for the other seven fish indicated that mean weekly average body temperature (MWAT) of the fish ranged 70.3–72.7°F during the first week of the migration (weekly average MWAT of 71.4°F) and 62.6–69.4°F during the second week of migration (weekly average MWAT of 66.9°F). Combining data for the first two weeks of the migration, the average MWAT among all fish was 69.2°F. These seven fish survived well past the first two weeks of their migration, eventually reaching spawning areas, showing up in hatcheries, or being caught. Thus, data from Strange (2010) indicate high survival (i.e., 100%) of adult fish migrating during a period in which they were exposed to an average temperature of 69.2°F for 14 days.

Butte Creek, CA, spring-run Chinook pre-spawn holding mortality has been monitored since approximately 2001. Monitoring occurs from early June through spawning in mid-September. Ward et al. (2004c) and Garman (2015) identified an extended period of average daily temperatures above approximately 66-67°F (19–19.4°C), measured at Quartz Bowl (top of the holding reach), as corresponding to the onset of significant pre-spawn mortalities in 2002 and 2003 (21% and 64%, respectively) (note that disease and crowding were also factors) and increased mortality for several weeks in 2014. Temperatures exceeded 67°F a total of 16 days in 2002 and 11 days in 2003. During most other years (2001, 2004–2013), when there was minimal pre-spawn mortality (≤5.4%), daily average water temperature at Quartz Bowl exceeded 67°F only a few days (Ward et al. 2004a; Ward et al. 2006; Ward et al. 2007; McReynolds and Garman 2008; McReynolds and Garman 2010). During 2014, however, water temperature exceeded 67°F a total of 16 days and overall mortality was relatively low (4.4%), but the highest daily mortality rates occurred during and immediately following an 11 day period when temperature each day exceeded 67°F (40 mortalities of 5,083 holding fish, daily mortality rate of 0.072%; Garman 2015). These data from Butte Creek indicate that an index temperature of approximately 66–67°F as measured at Quartz Bowl corresponds to relatively low mortality rate and that temperatures above this correspond to higher mortality.

Because Butte Creek spring-run Chinook salmon hold downstream of Quartz Bowl, the corresponding average daily temperature for the river reach where the largest percentage of fish hold (typically above the Centerville Powerhouse) is actually higher than the Quartz Bowl index temperature (66–67°F). The average temperature of the reach (Quartz Bowl to Pool 4) is 1.4°F higher than the temperature at Quartz Bowl (based on July 2002 and 2003 average Quartz Bowl and Pool 4 temperatures). The reach index temperature, therefore, that corresponds to a relatively low mortality rate is approximately 67.5–68.2°F. An index temperature of 67.5°F and cumulative mortality of 1% after 7 days (0.143% daily mortality) was used as a stringent approach to address this variability.

Revised Pre-Spawned Egg Mortality Rates

As previously discussed in this report (see Section 3.1.1), *in vivo* egg mortality is defined as "*the egg loss due to the physiological effect of water temperature on the ability of the ovum to be fertilized and undergo normal embryo development*." Relevant information related to decreased ovum viability was compiled and reviewed for this report, and the most pertinent experimental information on ovum viability due to adult exposure to high temperature is from Berman (1990) and unpublished work by NSR (K. Marine, pers. comm., April 23, 2013). These sources indicated that decreased ovum viability is minimal compared to adult loss. Although relevant hatchery information also was reviewed, the hatchery studies could not separate pre-spawned egg losses from fertilized-egg losses, because elevated temperatures occurred during both stages, or the studies did not present sufficient data to fully determine if decreased ovum viability was due to factors besides temperature. The same hatchery studies indicated that adult mortality was far greater than decreased ovum viability or fertilized egg mortality that could be attributed to *in vivo* exposure. Therefore, this report relied upon the results from Berman (1990) and NSR as a basis for developing the pre-spawned egg mortality rates on the assumption that adult losses will outweigh any decrease in *in vivo* egg viability.

Temperature-induced pre-spawned adult mortality rates were developed using data from Coutant (1970) to characterize the temperature range that causes elevated mortality of adult Chinook salmon, and using data from Berman (1990), Strange (2010), and Garman (2015) to characterize the range of temperatures and exposure known to be survived by pre-spawn adult salmon (**Table 10**). In using data from Coutant (1970), it was assumed that the temperature-survival time relationship for pre-spawned Chinook salmon in the lower American River is equivalent to the temperature-survival time relationship for jack Chinook salmon derived by Coutant (1970) for the experiments conducted in 1969. The 1969 experimental results were used instead of the 1967 and 1968 results because: (1) Coutant (1970) conjectured that the shorter survival times of the 1967 and 1968 experiments were due to higher fish densities in his experimental tanks relative to 1969; and (2) the lower American River, with adequate flow and space to obviate the influence of confinement, would be better represented by the 1969 results. Berman (1990) reported that healthy adult Chinook salmon survived when held for 14 days at 66.2°F. Data from Garman (2015) indicated high survival of adult Chinook salmon holding 7 days at 67.5°F (daily mortality rate of 0.143%). Strange (2010) reported complete survival of migrating adult Chinook salmon exposed to a weekly average temperature of 69.2°F for 14 days. Because survival to exposures of 66.2–69.2°F was high, a 1% cumulative mortality was assumed for these temperatures (Table 10**)**. A natural background daily mortality rate of 0.003% was also assumed based upon data from Butte Creek (McReynolds and Garman 2012) that shows that mortality is essentially non-existent for healthy adult fish when water temperatures are optimal.

Table 10. Literature-derived Chinook salmon adult mortality data.

Water Temperature (°F)	Cumulative Mortality M_n (%)	Exposure Duration n (days)	Daily Mortality Rate M_i (%)	Reference
66.2	1	14	0.072	Berman 1990
67.5	1	7	0.143	Garman 2015
69.2	1	14	0.072	Strange 2010
71.6	50	5.83	11.218	Coutant 1970
75.2	50	2.36	25.447	Coutant 1970
77.0	50	1.21	43.507	Coutant 1970
78.8	50	0.58	69.799	Coutant 1970

Regression analysis was used to fit a three-parameter exponential function to the daily mortality and temperature exposure data for adult Chinook salmon (Table 10). A three-parameter exponential function was chosen because it facilitates the characterization of the low daily mortality rates that occur below 69°F in comparison to a two parameter exponential function, as was used in the refinement of the fertilized-egg and pre-emergent fry mortality rates. The three-parameter exponential function is shown in Equation 8 and relates average daily temperature in degrees Fahrenheit (T_F) to the daily mortality of adult Chinook salmon as a fraction. Equation 8 is applicable at water temperatures greater than 67.1°F and less than or equal to 80.3°F. At water temperatures less than 67.1°F, Equation 8 produces daily mortality rates less than the natural background mortality rate (0.003%); thus, the daily mortality rate was set at 0.003% for temperatures lower than 67.1°F. At water temperatures greater than 80.3°F, Equation 8 produces daily mortality rates in excess of 100%; thus, the daily mortality rate was set at 100% for temperatures greater than 80.3°F.

$$M_i = -0.042763 + (3.2319 \times 10^{-9}) \times e^{(0.24428 \times T_F)} \tag{8}$$

As previously discussed, Equation 8 also represents the daily pre-spawned egg mortality rate at various temperatures. Daily mortality rates for pre-spawned eggs calculated using Equation 8 are compared (as a percentage) to the original rates in **Figure 14** and **Table 11**. Equation 8 replaces the original LAR Mortality Model's pre-spawned egg criteria (PSC), and is intended to be used to directly calculate the daily pre-spawned egg mortality (PSM) using the average daily water temperature for a given reach.

There were two compelling reasons for extending the range of average daily water temperatures and corresponding daily mortality rates. First, as previously discussed, for the pre-spawned egg lifestage, the 1995 LAR Mortality Model held the daily mortality rate constant for all water temperatures exceeding 62°F. However, examination of available water temperature monitoring data at the Fair Oaks Gage (USGS 11446500) from October 30, 1998 through August 26, 2015 indicate that water temperatures frequently exceed 62°F during the pre-spawned egg lifestage period. The pre-spawned egg lifestage extends from June 1 through mid-January.

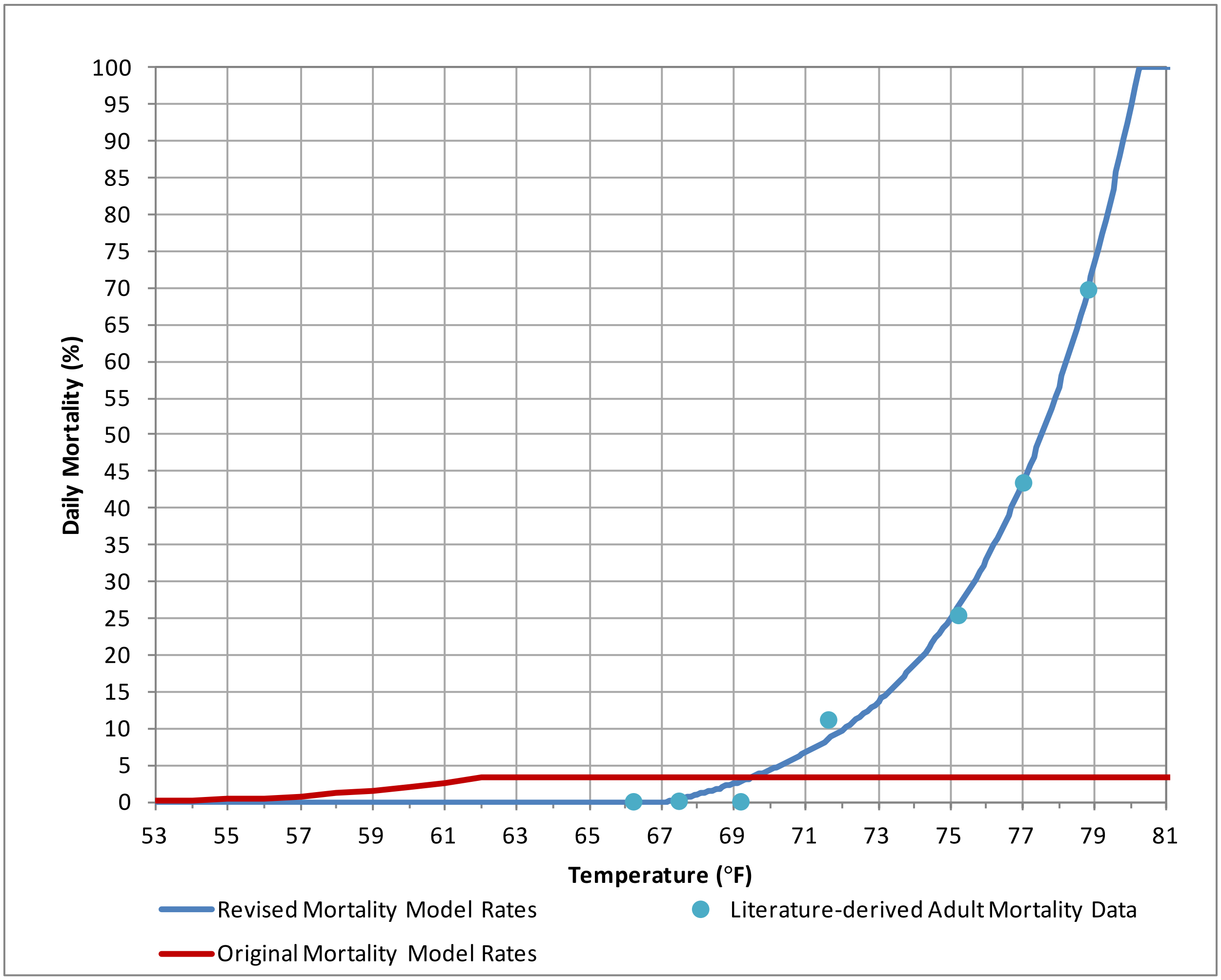


Figure 14. Original 1995 LAR Mortality Model and revised Chinook salmon pre-spawned egg daily mortality rates versus exposure temperature. Revised rates were developed assuming that pre-spawned egg loss is derived solely from temperature-induced mortality of pre-spawned adults.

For the 16 years encompassing this time period, 62°F was exceeded each of those years during the pre-spawned egg lifestage, and typically for much of the duration of the lifestage during most years (**Figure 15**). Considering each of the days corresponding with the pre-spawned egg lifestage for the 16 years during which water temperature monitoring data were available, water temperatures exceeded 62°F 39.9% of the days.

Second, the range of average daily water temperatures and corresponding daily mortality rates was extended in Figure 14 and Table 10 for presentation purposes. The average daily water temperature-daily mortality rate for the pre-spawned egg lifestage is a continuous function, and can be presented for any desired range. In Figure 14 and Table 10 the function was presented such that a daily mortality rate was provided for every corresponding water temperature value until a daily mortality rate approaching 100% was obtained, to illustrate the entire range of the function.

Table 11. Original 1995 LAR Mortality Model and revised Chinook salmon pre-spawned egg daily mortality rates.

Temperature (°F)	Daily Mortality Rate M_i (%)	
	Original Model	**Revised Model**
52	Natural Rate	0.003
53	0.034	0.003
54	0.171	0.003
55	0.351	0.003
56	0.540	0.003
57	0.783	0.003
58	1.135	0.003
59	1.581	0.003
60	2.094	0.003
61	2.627	0.003
62	3.348	0.003
63	3.348	0.003
64	3.348	0.003
65	3.348	0.003
66	3.348	0.003
67	3.348	0.003
68	3.348	1.013
69	3.348	2.477
70	3.348	4.346
71	3.348	6.731
72	3.348	9.777
73	3.348	13.666
74	3.348	18.630
75	3.348	24.968
76	3.348	33.060
77	3.348	43.391
78	3.348	56.580
79	3.348	73.419
80	3.348	94.917
81	3.348	100.000

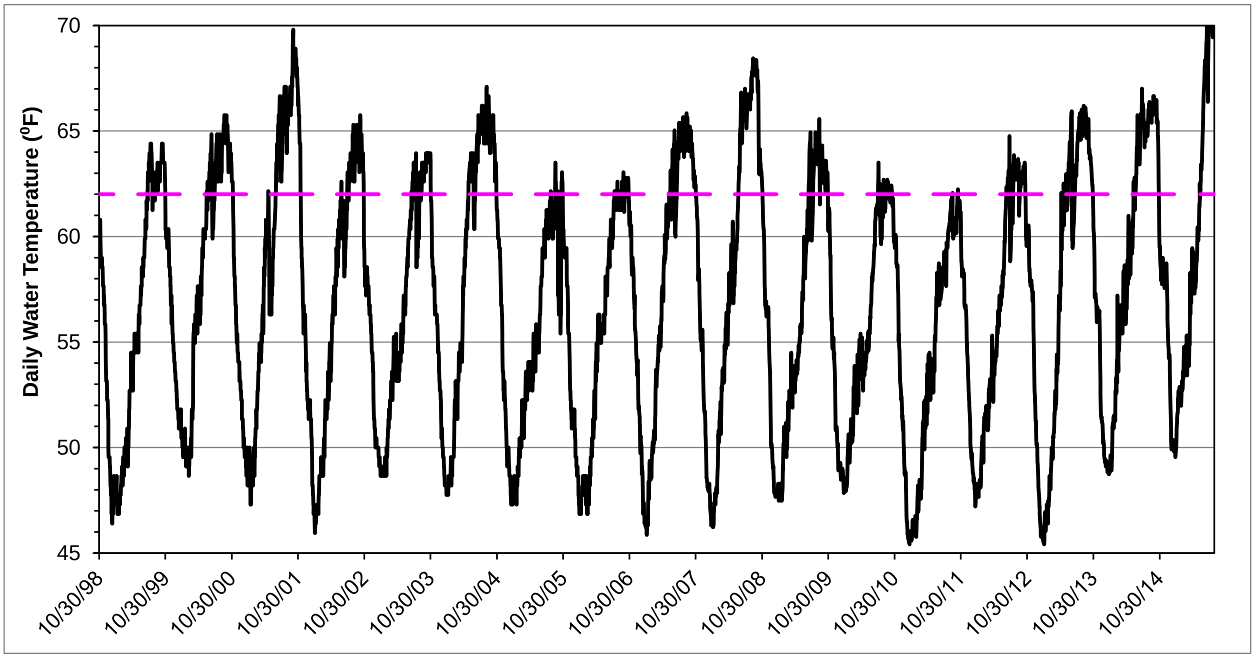


Figure 15. Daily water temperature at the USGS Fair Oaks Gage from October 30, 1998 through August 26, 2015 with the pre-spawned egg period indicated as horizontal lines at 62^{0}F.

3.2.2 Refinements to Fertilized-Egg and Pre-Emergent Fry Mortality Rates

Fertilized Egg and Pre-Emergent Fry Mortality Studies

The fertilized-egg and pre-emergent fry experiments reviewed were those that used constant exposure temperatures, controlled experimental conditions (e.g., replicates, light, water source, dissolved oxygen, etc.), similar experimental methods among studies, and those which had explicitly reported exposure duration.

Seymour (1956) generated data from incubations of Chinook salmon fertilized eggs at constant temperatures between 34°F and 67.5°F, by assessing mortality in weekly intervals through hatch and through yolk-sac absorption. Two experiments were run in consecutive years, each utilizing a single set of parents from the Green River, Washington. Embryos were divided into eight lots and incubated at specified temperatures. The first experiment averaged 547 eggs per lot, while the second averaged 518 eggs per lot. Seymour (1956) reported the duration to 50% hatch, but did not report any exposure durations associated with lots that did not survive to hatch, nor were any exposure durations reported for pre-emergent fry. A fraction of fertilized-eggs survived through 50% hatch at temperatures up to 64.6°F, while complete mortality occurred sometime prior to hatch at temperatures of 64.8°F and 67.5°F. Fertilized-eggs incubated and surviving to hatch at temperatures of 60°F to 62.5°F did not survive further exposures at the same elevated temperatures as pre-emergent fry. Fertilized eggs incubated and surviving to hatch at temperatures of 55°F to 57.5°F produced sac-fry mortalities in excess of 50% upon further exposure to the same temperatures.

Murray and McPhail (1988) conducted constant-temperature incubations of Chinook salmon fertilized-eggs and pre-emergent fry at five different temperatures ranging from 35.6°F to 57.2°F. Adult Chinook salmon were taken from Babine River, British Columbia. Pre-emergent fry were those that survived the constant temperature incubations as eggs, and duration to and mortality at 50% hatch and 50% emergence were reported. Each incubation lot consisted of approximately 240 eggs. At 57.2°F, the mortality of fertilized eggs was 52% and the mortality of pre-emergent fry was 3%.

Beacham and Murray (1989) took Chinook salmon adults from three different salmon stocks in British Columbia and subjected eggs and pre-emergent fry to four constant-temperature treatments ranging from 39°F to 59°F. Incubations of each stock were similar in egg count, which ranged from 750 to 1900 eggs per temperature incubation. Duration to and mortality at 50% hatch and 50% emergence were reported. At 59°F, mortality among the three stocks for fertilized eggs was 4.3% to 8.7% and for pre-emergent fry was 4.8% to 39.4%.

Jensen and Groot (1991) obtained eggs and milt from five female and five male Chinook salmon from Nanaimo, British Columbia. Upon activation of pooled gametes, fertilized eggs were incubated in small groups (approximately 30 per group), with two groups per temperature treatment. Fertilized eggs were incubated at six water temperatures between 50.4°F and 68.4°F. For incubations in which a portion of eggs survived, egg mortalities were monitored until 50% hatch or until complete mortality was observed. Pre-emergent fry mortality was monitored for eggs which had survived incubation at the same treatment temperature. Mortality of pre-emergent fry was monitored until complete emergence, until the yolk-sac was no longer visible, or until complete mortality occurred.

Complete mortality of fertilized eggs occurred prior to hatch in the 64.4°F and 68.4°F constant temperature treatments, while complete mortality of pre-emergent fry occurred prior to yolk-sac absorption in the 61.5°F constant temperature treatment. Although Jensen and Groot (1991) reported the time to the end of the temperature exposure treatments, there was insufficient information presented in the study to verify that the time to the end of the experiment corresponded to the actual date that complete egg mortality occurred. Data for pre-emergent fry from the 61.5°F treatment were considered suspect for the following reason. The exposure duration of pre-emergent fry in the 61.5°F treatment (31 days), calculated as the difference between the time of the end of the experiment less the time to 50% hatch, was longer than the duration to complete emergence or yolk sac absorption at temperatures of 53.0–57.2°F (27 days). These results are counterintuitive from a developmental perspective, as the time to yolk sac absorption decreases with increasing temperature (see Section 4).

USFWS (1998) reported results from a study of thermally-induced, winter and fall-run Chinook salmon egg and pre-emergent fry mortality. Fall-run Chinook salmon eggs and pre-emergent fry from the Sacramento River were incubated at seven constant temperatures ranging from 50°F to

62°F, while winter-run eggs and pre-emergent fry were subject to five temperature treatments in the range of 56°F to 64°F. Five replicates of fall-run and three replicates of winter-run eggs and pre-emergent fry were utilized for each incubation temperature. Each replicate consisted of 80–100 eggs. Mortality was measured at the end of four development stages as determined by the number of ATUs: cleavage eggs (450 ATU), embryo (900 ATU), eleutheroembryo (1350 ATU) and pre-emergent alevin (1800 ATU). The USFWS (1998) embryo threshold of 900 ATU agrees reasonably well with the average 936 ATUs required for fertilized eggs to reach 50% hatch. However, an average 713 ATUs are additionally required for pre-emergent fry to reach emergence, and this developmental threshold is nearly mid-way between the USFWS (1998) eleutheroembryo and pre-emergent alevin end-points. Incubations of both winter- and fall-run showed that a fraction of eggs and pre-emergent fry survived through all developmental stages at temperatures of 50°F to 62°F, and complete mortality occurred sometime within the first 450 ATUs (14.1 days) exposure of winter-run pre-emergent fry to 64°F.

Additional incubations were performed by USFWS (1998) to determine the influence of egg incubation temperature on pre-emergent fry mortality. Fall- and winter-run eggs incubated for the first 900 ATUs at a control temperature of 56°F, were then incubated through the next 900 ATUs as pre-emergent fry at temperatures of 60°F or 62°F. In comparison to mortality when both fertilized-eggs and pre-emergent fry were incubated at the elevated temperature, pre-emergent fry survival was significantly greater when eggs had been incubated at 56°F. These results show that pre-emergent fry mortality is greater when, as eggs, they were exposed to elevated temperatures. This would often be the situation in the lower American River and other spawning reaches of Central Valley rivers, where river temperatures are warmer during fertilized-egg incubation periods and cooler during the pre-emergent fry lifestage.

Revised Fertilized-Egg Mortality Rates

Calculation of daily mortality rates requires cumulative mortality data and the exposure duration associated with mortality. From the studies described above (Seymour 1956; Murray and McPhail 1988; Beacham and Murray 1989; Jensen and Groot 1991; and USFWS 1998), cumulative mortality and days to 50% hatch or days to 900 ATUs (USFWS 1998) were compiled where data was available. These conditions were met for eggs incubated within the temperature range of 35°F to 64.6°F. Using data from treatments in which a fraction of eggs survived to hatch integrated the effects of the temperature exposure over the entire lifestage. Duration for USFWS (1998) cumulative mortality was calculated as the number of degree days required to achieve 900 ATUs at the specified incubation temperature. These duration estimates were verified using the weekly ATU summaries for incubating eggs provided in Appendix 1 and Appendix 2 of USFWS (1998). Data for temperature treatments of 64.4°F and 68.4°F in Jenson and Groot (1991) and 67.5°F in Seymour (1956) were not used because the exact duration that resulted in complete mortality in these treatments was uncertain.

Cumulative mortality and exposure duration were used to calculate daily mortality rate for fertilized eggs. Literature-derived cumulative mortality, exposure duration, and daily mortality rates for fertilized eggs are given in **Table 12**.

Regression analysis was used to fit a two-parameter exponential function to the fertilized-egg daily mortality and temperature exposure data (Table 12). This function is shown in Equation 9 and relates average daily temperature in degrees Fahrenheit (T_F) to the daily mortality of Chinook salmon fertilized eggs as a fraction. Equation 9 is applicable at water temperatures less than or equal to 67.9°F. At water temperatures greater than 67.9°F, Equation 9 produces daily mortality rates in excess of 100%, thus it is assumed that the daily mortality rate is 100% at temperatures greater than this threshold.

$$M_i = 6.451 \times 10^{-19} e^{(0.61669 \times T_F)} \quad \textbf{(9)}$$

Equation 9 is plotted (as a percentage) along with the literature-derived, fertilized-egg mortality data and the original Mortality Model rates in **Figure 16**. **Table 13** also shows the daily mortality rates for fertilized eggs estimated with Equation 9. Equation 9 replaces the original model's fertilized egg criteria (EC) at water temperatures less than or equal to 67.9°F, and at water temperatures greater than this threshold EC is assumed to be 100%. The refined EC values are intended to be used to directly calculate the daily fertilized-egg mortality (EM) using the average daily water temperature for a given reach.

As with the pre-spawned egg lifestage, there were two compelling reasons for extending the range of average daily water temperatures and corresponding daily mortality rates for the fertilized egg lifestage. The 1995 LAR Mortality Model held the daily mortality rate constant for all water temperatures exceeding 64°F for the fertilized egg lifestage. Examination of available water temperature monitoring data at the Fair Oaks Gage (USGS 11446500) from October 30, 1998 through August 26, 2015 indicate that water temperatures exceed 64°F during half (8) of the years encompassing the fertilized egg lifestage (mid-October through mid-March), although not for many days each year **(Figure 17**). Considering each of the days corresponding with the fertilized egg lifestage for the 16 years during which water temperature monitoring data were available, water temperatures exceeded 64°F 2.5% of the days.

Second, the average daily water temperature-daily mortality rate for the fertilized egg lifestage is a continuous function, and can be presented for any desired range. In Figure 16 and Table 13 the function was presented such that a daily mortality rate was provided for every corresponding water temperature value until a daily mortality rate approaching 100% was obtained, to illustrate the entire range of the function.

Table 12. Literature-derived Chinook salmon fertilized-egg mortality data.

Water Temperature (°F)	Cumulative Mortality M_n (%)	Exposure Duration n (days)	Daily Mortality Rate M_i (%)	Reference
38.8	2.1	125.6	0.017	Beacham & Murray 1989
39	30.3	132.5	0.272	Beacham & Murray 1989
39	4.1	128.5	0.033	Beacham & Murray 1989
46.2	0.4	71.1	0.006	Beacham & Murray 1989
46.2	1.1	68.9	0.016	Beacham & Murray 1989
46.4	0.3	70.6	0.004	Beacham & Murray 1989
53.6	0.8	44.1	0.018	Beacham & Murray 1989
53.6	2.2	44.1	0.05	Beacham & Murray 1989
53.8	0.6	42.2	0.014	Beacham & Murray 1989
59	6.9	36.1	0.198	Beacham & Murray 1989
59	4.3	34.1	0.129	Beacham & Murray 1989
59.4	8.7	34.3	0.265	Beacham & Murray 1989
50.4	21.3	51.2	0.467	Jensen & Groot 1991
53.1	28.7	43.1	0.782	Jensen & Groot 1991
57.2	21.3	35.7	0.669	Jensen & Groot 1991
61.5	64.3	32.1	3.158	Jensen & Groot 1991
35.6	86	202	0.969	Murray & McPhail 1988
41	17	101.5	0.183	Murray & McPhail 1988
46.4	6	67.1	0.092	Murray & McPhail 1988
51.8	10	46.9	0.224	Murray & McPhail 1988
57.2	52	38.4	1.893	Murray & McPhail 1988
39.8	6	128.6	0.048	Seymour 1956
44.7	6	79.1	0.078	Seymour 1956
45.2	1	73.4	0.014	Seymour 1956
50.2	2	50.9	0.04	Seymour 1956
50.6	13	50.2	0.277	Seymour 1956
54.6	2	38.8	0.052	Seymour 1956
55.1	5	40	0.128	Seymour 1956
57.8	2	34	0.059	Seymour 1956
59.8	35	32.1	1.333	Seymour 1956
60.2	22	34	0.728	Seymour 1956
62	85	30.7	5.992	Seymour 1956
62.4	78	31.4	4.708	Seymour 1956
64.6	99	28	15.166	Seymour 1956
50	6	50	0.124	USFWS 1998
52	8	45	0.185	USFWS 1998
54	11	40.9	0.284	USFWS 1998
56	10	37.5	0.281	USFWS 1998
56	14	37.5	0.401	USFWS 1998
58	16	34.6	0.502	USFWS 1998
58	14	34.6	0.435	USFWS 1998

Table 12 (continued)				
60	15	32.1	0.504	USFWS 1998
60	14	32.1	0.468	USFWS 1998
62	37	30	1.528	USFWS 1998
62	22	30	0.825	USFWS 1998
64	74	28.1	4.677	USFWS 1998

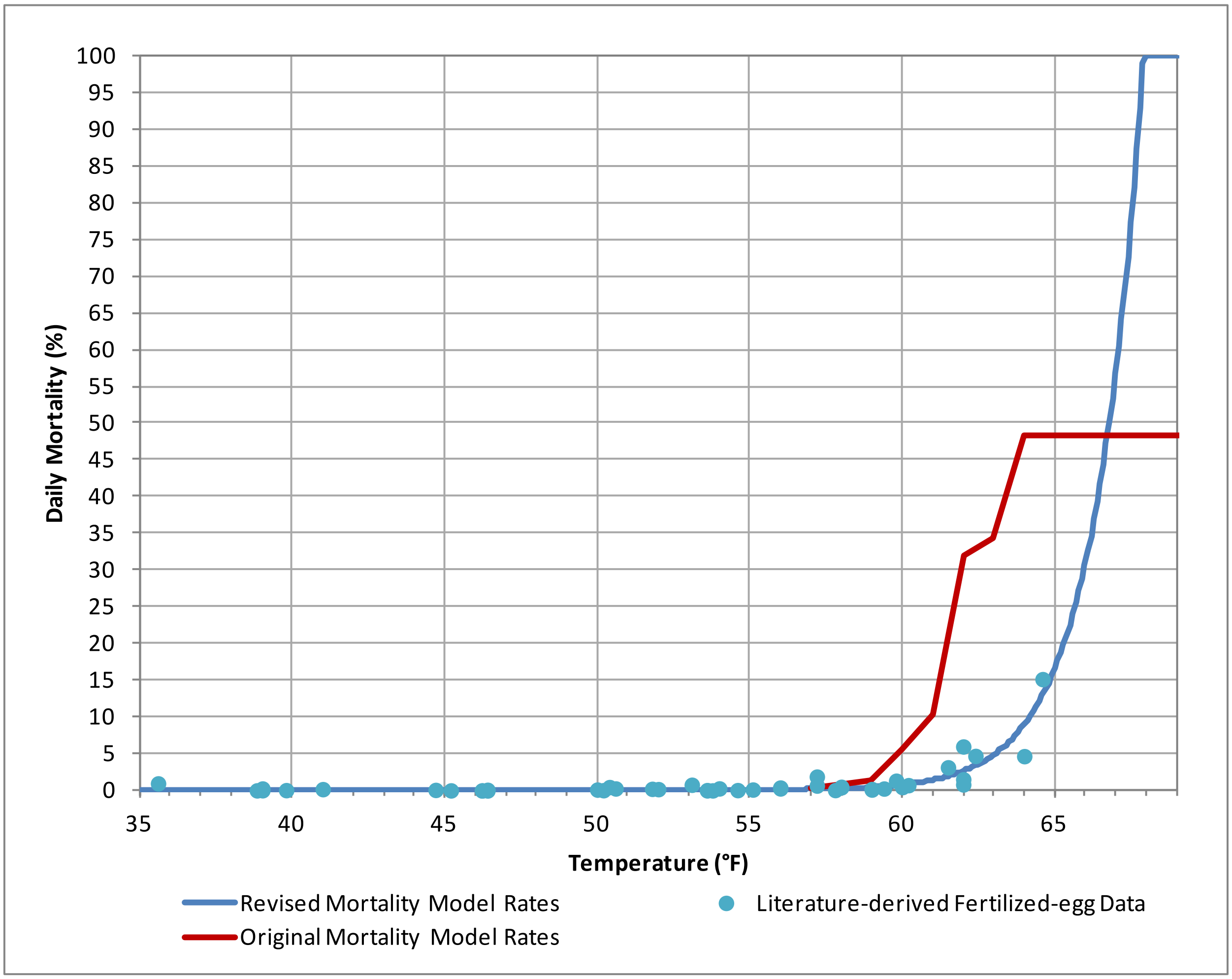


Figure 16. Original 1995 LAR Mortality Model and revised Chinook salmon fertilized-egg daily mortality rates versus exposure temperature. Data used for non-linear regression modeling for the revised Chinook salmon fertilized-egg daily mortality rates are presented for comparison.

Revised Pre-Emergent Fry Mortality Rates

Revised pre-emergent fry mortality rates were derived using data from Murray and McPhail (1988), Beacham and Murray (1989), Jensen and Groot (1991), and USFWS (1998). From these studies, the cumulative mortality and exposure duration data was compiled for pre-emergent fry that had survived the same incubating temperature as eggs. Overall, pre-emergent fry mortality and duration data were available for water temperatures from 35°F to 62°F.

Table 13. Original 1995 LAR Mortality Model and revised Chinook salmon fertilized-egg daily mortality rates.

Water Temperature (°F)	Daily Mortality Rate M_i (%)	
	Original Model	**Revised Model**
56	Natural Rate	0.064
57	0.347	0.119
58	0.736	0.221
59	1.428	0.409
60	5.613	0.757
61	10.174	1.403
62	31.871	2.599
63	34.207	4.815
64	48.205	8.922
65	48.205	16.530
66	48.205	30.627
67	48.205	56.746
68	48.205	100.00
≥69	48.205	100.00

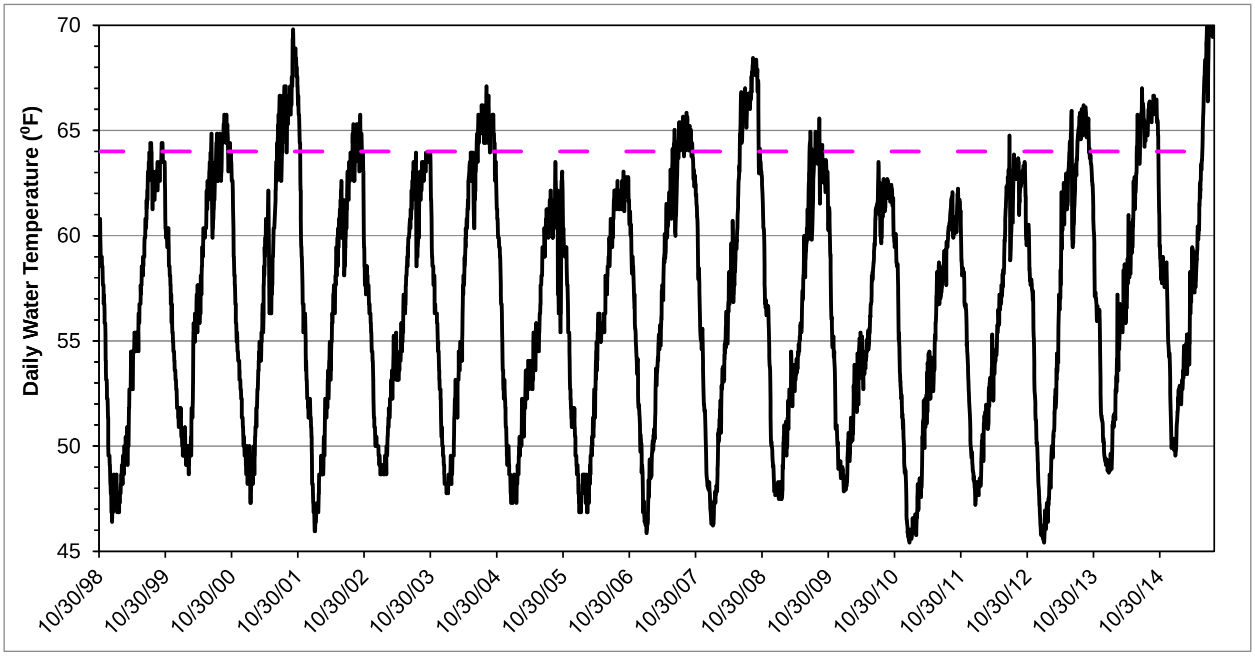


Figure 17. Daily water temperature at the Fair Oaks Gage from October 30, 1998 through August 26, 2015 with the fertilized egg period (mid-October through mid-March) indicated as horizontal lines at 64^{0}F.

The duration of exposure used to calculate daily mortality rates was slightly different depending on the study. Duration of exposure was equivalent to: (1) the duration required to accrue 900 ATUs in USFWS (1998); (2) the duration associated with emergence and/or yolk-sac absorption in Jensen and Groot (1991); and (3) the duration between 50% hatch and 50% emergence in Murray and McPhail (1988) and Beacham and Murray (1989). Data derived from USFWS (1998) was for cumulative mortality through what the study called the "pre-emergent alevin" lifestage, which ended 900 ATUs after the fertilized-egg lifestage (i.e., the cleavage embryo and embryo stages). USFWS (1998) reported cumulative egg mortality at the end of each lifestage, which required calculation of the mortality that occurred specifically during the pre-emergent fry lifestage. To do so, cumulative egg mortality was subtracted from the combined egg and pre-emergent fry mortality, and the resulting difference was divided by the fraction of eggs which survived the egg lifestage. In the case of the 64°F incubation in USFWS (1998), complete mortality occurred sometime within 450 ATU (14.1 days). Because the precise duration of exposure at which complete mortality occurred in the 64°F treatment was not reported, data from this incubation was not used. For the same reasons, data for temperature treatments of 64.4°F and 68.4°F in Jenson and Groot (1991) were not used because the exact duration that resulted in complete mortality in these treatments was uncertain.

Cumulative mortality and exposure duration were used to calculate daily mortality rate. Literature-derived cumulative mortality, exposure duration, and the associated daily mortality rates for pre-emergent fry are given in **Table 14**. Regression analysis was used to fit a two-parameter exponential function to the pre-emergent fry daily mortality and temperature exposure data. The function is shown in Equation 10 and relates average daily temperature in degrees Fahrenheit (T_F) to the daily mortality of Chinook salmon pre-emergent fry as a fraction. Equation 10 is applicable at water temperatures less than or equal to 66.1°F. At water temperatures greater than 66.1°F, Equation 10 produces daily mortality rates in excess of 100%, thus it is assumed that the daily mortality rate is 100% at temperatures greater than this threshold.

$$M_i = 3.268 \times 10^{-19} e^{(0.64334 \times T_F)} \tag{10}$$

Equation 10 is plotted (as a percentage) along with the literature-derived pre-emergent fry mortality data and the original 1995 LAR Mortality Model rates in **Figure 18**. **Table 15** also shows the daily mortality rates for pre-emergent fry calculated with Equation 10. Equation 10 replaces the original 1995 LAR Mortality Model's pre-emergent fry criteria (FC) at water temperatures less than or equal to 66.1°F, and at water temperatures greater than this threshold, FC is assumed to be 100%. The refined FC values are intended to be used to directly calculate the daily pre-emergent fry mortality (FM) using the average daily water temperature for a given reach.

Table 14. Literature-derived Chinook salmon pre-emergent fry mortality data.

Water Temperature (°F)	Cumulative Mortality M_n (%)	Exposure Duration (days)	Daily Mortality Rate M_i (%)	Reference
38.8	0.8	85.7	0.009	Beacham & Murray 1989
39.0	0.0	87.5	0.000	Beacham & Murray 1989
39.0	2.2	82.9	0.027	Beacham & Murray 1989
46.2	0.8	45.0	0.018	Beacham & Murray 1989
46.2	0.0	46.4	0.000	Beacham & Murray 1989
46.4	0.1	56.1	0.002	Beacham & Murray 1989
53.6	0.7	34.1	0.021	Beacham & Murray 1989
53.6	2.3	32.7	0.071	Beacham & Murray 1989
53.8	0.3	33.9	0.009	Beacham & Murray 1989
59.0	39.4	26.7	1.858	Beacham & Murray 1989
59.0	6.3	27.6	0.235	Beacham & Murray 1989
59.4	4.8	27.6	0.178	Beacham & Murray 1989
50.4	0.0	35.5	0.000	Jensen & Groot 1991
53.1	0.0	27.4	0.000	Jensen & Groot 1991
57.2	3.8	27.1	0.143	Jensen & Groot 1991
35.6	0.0	114.0	0.000	Murray & McPhail 1988
41.0	0.0	89.5	0.000	Murray & McPhail 1988
46.4	5.0	47.9	0.107	Murray & McPhail 1988
51.8	4.0	37.1	0.110	Murray & McPhail 1988
57.2	3.0	24.6	0.124	Murray & McPhail 1988
52.0	5.4	45.0	0.123	USFWS 1998
54.0	5.6	40.9	0.141	USFWS 1998
56.0	5.6	37.5	0.154	USFWS 1998
56.0	3.5	37.5	0.095	USFWS 1998
58.0	19.0	34.6	0.607	USFWS 1998
58.0	14.0	34.6	0.433	USFWS 1998
60.0	20.0	32.1	0.692	USFWS 1998
60.0	74.4	32.1	4.153	USFWS 1998
62.0	84.1	30.0	5.945	USFWS 1998
62.0	91.0	30.0	7.723	USFWS 1998

In comparison to the revised LAR Mortality Model fertilized-egg mortality rates (Table 13), the revised pre-emergent fry mortality rates are slightly greater. This may result from the physiological sensitivity of pre-emergent fry which have had a history of high incubation temperatures as eggs (USFWS 1998), or it may truly reflect a greater susceptibility of pre-emergent fry to extreme temperatures, as shown by short-duration (1-8 hour) experiments at temperature greater than 71.5°F (Neitzel and Becker 1985).

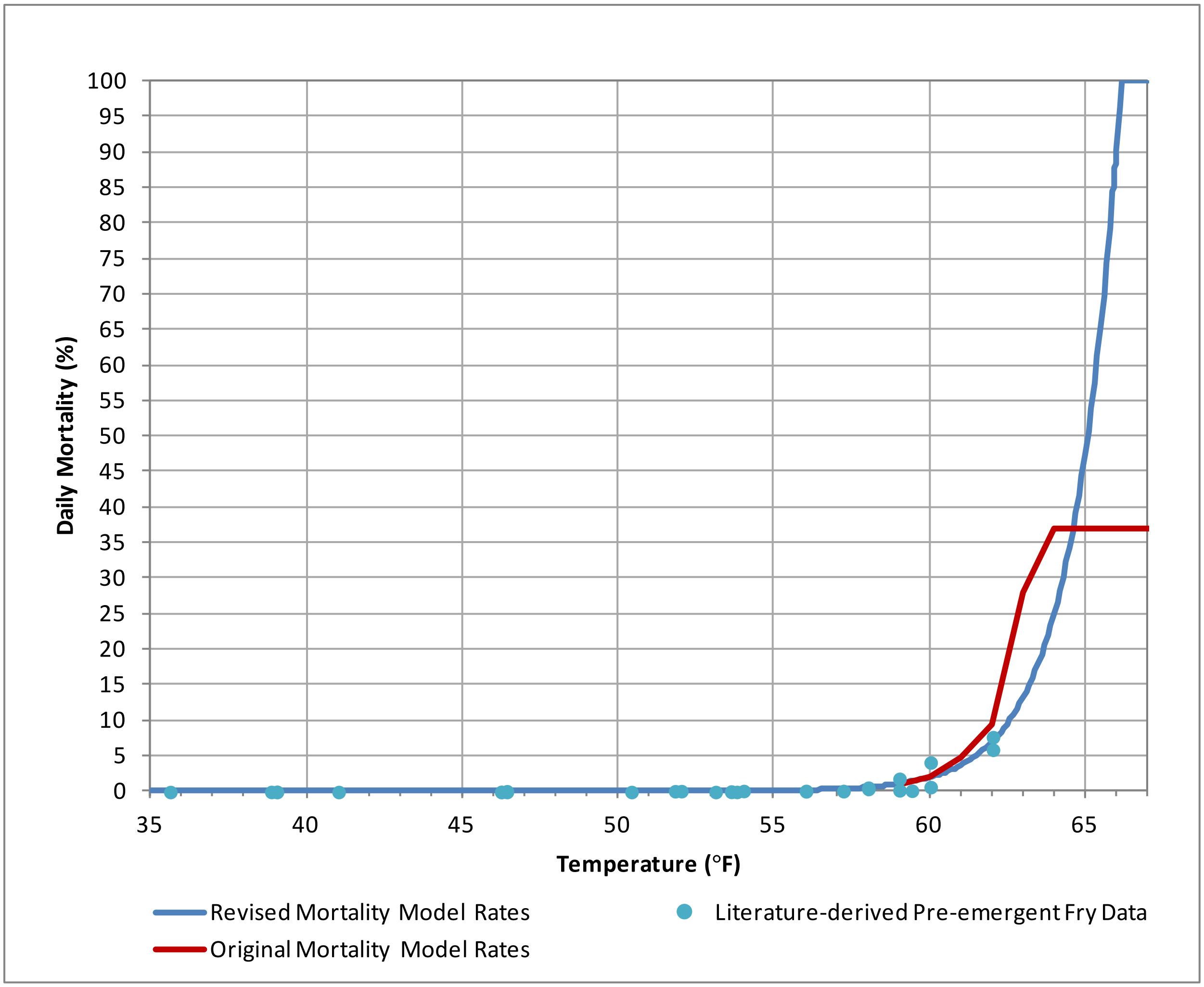


Figure 18. Revised Chinook salmon pre-emergent fry daily mortality rates versus incubation temperature. Data used for non-linear regression modeling and the original Lower American River Mortality Model rates are presented for comparison.

By contrast with the pre-spawned egg and fertilized egg lifestages, examination of average daily water temperatures monitored at the Fair Oaks Gage (USGS 11446500) from October 30, 1998 through August 26, 2015 indicate that water temperatures during the pre-emergent fry lifestage (mid-November through mid-April) did not exceed 64^{o}F (**Figure 19**). The revised pre-emergent fry water temperature-daily mortality rate function approached 100% at 67^{o}F, which represented the upper range depicted in Figure 18 and Table 14.

Table 15. Original and revised Chinook salmon pre-emergent fry daily mortality rates.

Water Temperature (°F)	Daily Mortality Rate M_i (%)	
	Original Model	**Revised Model**
56	Natural rate	0.145
57	Natural rate	0.275
58	Natural rate	0.524
59	0.750	0.997
60	2.034	1.898
61	4.830	3.612
62	9.428	6.872
63	28.031	13.077
64	36.904	24.883
65	36.904	47.348
66	36.904	90.095
≥67	36.904	100.00

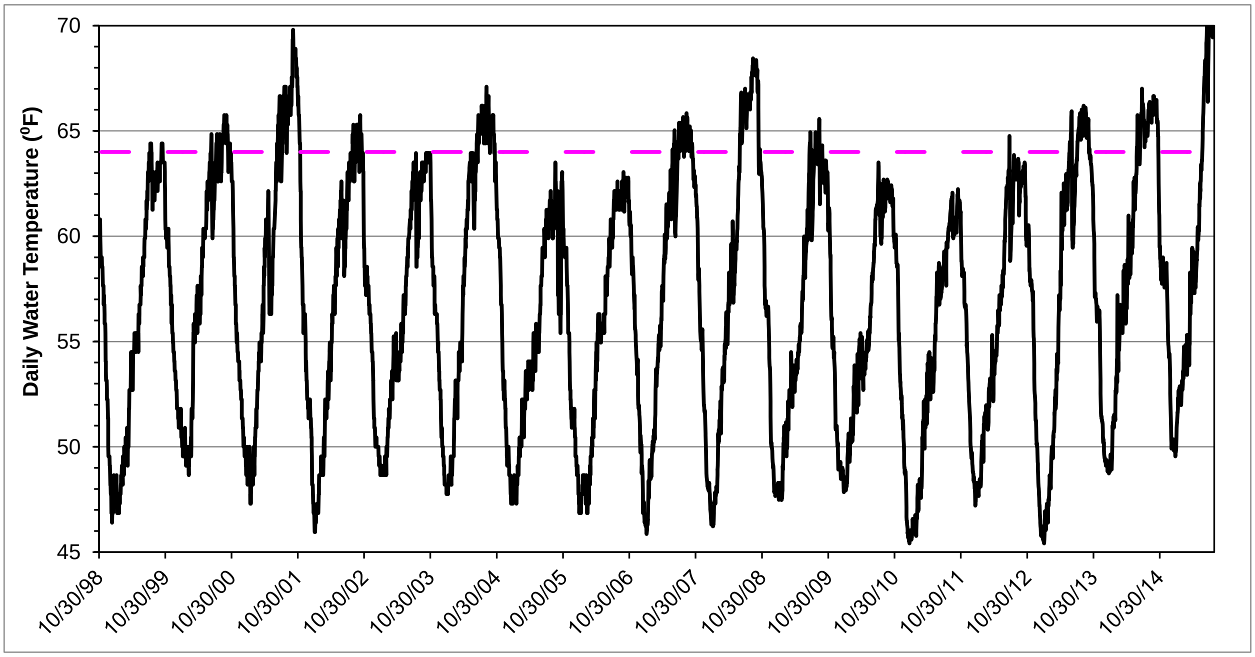


Figure 19. Daily water temperature at the Fair Oaks Gage from October 30, 1998 through August 26, 2015 with the pre-emergent fry period (mid-November through mid-April) indicated as horizontal lines at 64^{0}F.

4.0 Chinook Salmon Early Lifestage Developmental Thresholds

HCI (1996) stated that a key model assumption is "*Development from fertilized egg to hatching requires 750 (°F) temperature units, and another 750 (°F) temperature units from hatching to emergent fry (32mm), for a total of 1500 (°F) temperature units from egg to emergent fry*". An ATU is defined as degrees Fahrenheit above 32°F, accumulated during a 24-hour period (CDFG 1998). CDFG (1998) states "*From the time of egg fertilization a cumulative total of 1550 temperature units …are required for an egg to hatch and fry to emerge (Armour 1991)*". Additionally, Armour (1991) states that… "*Development from fertilization to hatching requires 850 daily temperature units (DTU's), and an additional 700 units are required from hatching to beginning of emergence.*" Because citations for the original 1995 LAR Mortality Model assumption were not provided, the use of the thermal units approach was further examined.

As shown in **Figure 20** and **Figure 21**, the ATUs corresponding to median hatch (50% hatch) and to median emergence (50% emergence) were calculated for fertilized eggs and pre-emergent fry data from studies used in the revision of early lifestage mortality rates (Seymour 1956; Beacham and Murray 1989; and Murray and McPhail 1988; Jensen and Groot 1991). A non-linear relationship between developmental rate, as shown by ATUs to reach the end of the lifestage, and temperature is evident by the downward trend in the ATUs associated with 50% hatch or 50% emergence at temperatures less than 40°F. As discussed by Alderdice and Velsen (1978), the deviation of this relationship from linearity restricts the use of the ATU approach as a satisfactory estimate of the length of the egg incubation period to temperatures greater than 40°F. A similar observation can be made for pre-emergent fry (Figure 21).

The available data from the USGS Fair Oaks Gage (USGS 11446500) presented in Figure 17 and Figure 19, spanning the period from October 30, 1998 through August 26, 2015, show that water temperatures in the lower American River are never below 45.5°F during the fertilized egg lifestage (mid-October through mid-March), and never below 45.4°F during the pre-emergent fry lifestage (mid-November through mid-April). Based upon the foregoing discussing, the thermal units approach will produce satisfactory estimates of the length of the incubation period for fertilized eggs and pre-emergent fry at temperatures relevant to the lower American River. Thus, the use of an average ATU threshold to mark the transition between the egg/pre-emergent fry and pre-emergent fry/post-emergent fry lifestages has been retained in the LAR Mortality Model. The average ATU thresholds used in this update of the LAR Mortality Model are as follows. For fertilized eggs, the average ATUs to 50% hatch is 936, which was calculated using data at temperatures greater than 45.5°F shown in Figure 20. For pre-emergent fry, the average ATUs to 50% emergence is 713, which was calculated using data at temperatures greater than 45.4°F shown in Figure 21.

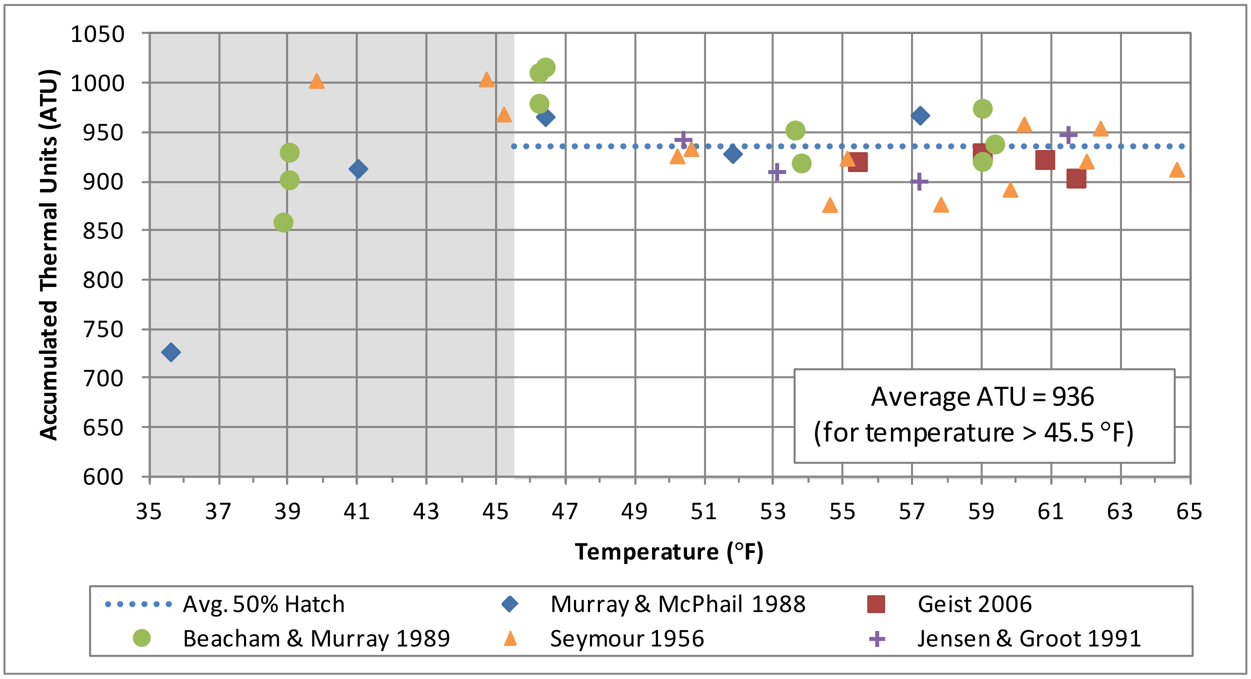


Figure 20. Literature-derived accumulated thermal units (ATUs) required for fertilized eggs to reach 50% hatch at various temperatures. Average ATUs to reach 50% hatch was calculated for temperatures greater than 45.5°F, the minimum temperature that has historically occurred in the lower American River during the egg incubation period of the year.

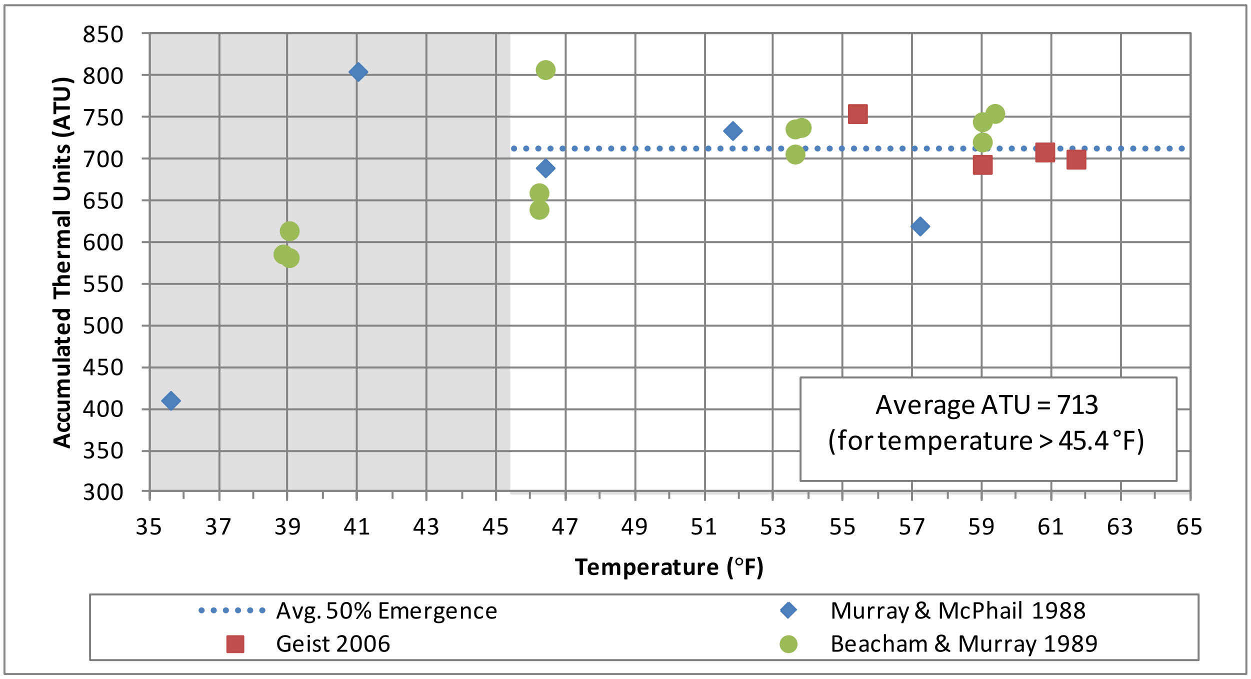


Figure 21. Literature-derived accumulated thermal units (ATUs) required for pre-emergent fry to reach 50% emergence at various temperatures. Average ATUs to reach 50% emergence was calculated for temperatures greater than 45.4°F, the minimum temperature that has historically occurred in the lower American River during the pre-emergent fry development period of the year.

5.0 Model Code Corrections, Programming Language Conversion, and Update

The following sections of this Memorandum describe changes and updates that were made to the original 1995 LAR Mortality Model associated with: (1) identified errors in the coding of the original model; and (2) updated biological and physiological information related to fall-run Chinook salmon in the lower American River.

Before any coding updates were made to the original 1995 model, the coding of the original model in FORTRAN was converted to Visual Basic for Applications (VBA) / Microsoft Excel. After the original FORTRAN model was converted to VBA and it was confirmed that the VBA version produced the same results as the FORTRAN version, the VBA version was then corrected for model coding errors and updated to reflect updated biological and physiological information for fall-run Chinook salmon in the lower American River.

5.1 FORTRAN Code Corrections

Review of the original 1995 Lower American River Salmon Mortality Model resulted in the identification of errors related to five primary components of the original model, including: (1) temporal arrival distribution; (2) the methodology applied to interpolate daily water temperatures based on average monthly water temperatures; (3) calculation of pre-spawned egg mortalities at particular water temperatures; (4) calculation of early year (January and February) early lifestage mortalities; (5) pre-spawn and spawning distributions; and (6) front loading of mortality in each lifestage.

In the process of updating the LAR Mortality Model, the original FORTRAN model was reviewed for errors or inconsistencies. Beyond the updates discussed in previous sections, six areas of concern with the original FORTRAN model were identified: (1) temporal arrival distribution; (2) temperature interpolation; (3) calculation of pre-spawn mortalities; (4) calculation of early year (January and February) mortalities; (5) pre-spawn and spawning temporal distributions; and (6) front loading of mortality in each lifestage.

5.1.1 Temporal Arrival Distribution

In reviewing the FORTRAN code of the original 1995 salmon mortality model and the 1996 *Water Forum Issue Paper* (HCI 1996), it became apparent that the temporal arrival distribution (i.e., weekly mean percentages of the annual fall-run Chinook salmon run arriving in the lower American River) used in the original 1995 FORTRAN model were not consistent with the reported values in the 1996 *Water Forum Issue Paper* (HCI 1996). After converting the 1995 FORTRAN model to VBA, the weekly mean percentages of the annual fall-run Chinook salmon run arriving in the lower American River from the original 1995 FORTRAN model were used.

While converting the model to a different programming language, Visual Basic for Applications (VBA), it was identified that the temporal arrival distribution (also termed: mean percentage of run arriving) used in the original FORTRAN model did not agree with the values provided in the *Water Forum Issue Paper* (Table 4 of HCI 1996) as shown in **Table 16**. When conducting the sensitivity analysis the values from the original FORTRAN model were used, however as the model was updated, the new temporal arrival distribution was used.

Table 16. Temporal arrival distribution from the FORTRAN model and the Water Forum Issue Paper.

Week	Days	Mean Percentage of Run Arriving	
		FORTRAN Model Values	Water Forum Issue Paper Values
Sept (wk 1)	7	2.9%	3.0%
2	8	2.9%	3.0%
3	7	4.3%	4.2%
4	8	2.2%	2.2%
Oct (wk 1)	7	5.4%	5.6%
2	8	5.0%	5.0%
3	8	4.9%	5.0%
4	8	8.4%	8.4%
Nov (wk 1)	7	8.3%	8.4%
2	8	18.8%	19.0%
3	7	16.3%	16.3%
4	8	12.4%	12.4%
Dec (wk 1)	7	2.0%	2.0%
2	8	2.7%	2.4%
3	8	1.0%	1.0%
4	8	2.5%	2.2%

5.1.2 Temperature Interpolation

The original 1995 LAR Mortality Model used average monthly water temperatures to calculate daily mortality rates for fall-run Chinook salmon. In the original model, monthly water temperatures were converted to a daily format by linearly interpolating from the middle of one month (i.e., the 15th of the month) to the middle of the next month. Two problems were identified related to interpolating water temperatures using this method. First, there is no interpolation for the first 15 days of the year (i.e., 1/1 – 1/15) or for the last 16 days (i.e., 12/15 – 12/31) of the year (**Figure 18**). Instead of interpolating water temperatures based on the month before the first month of the year and based on the month after the last month of the year, the original model used the monthly average. Second, when the model's interpolated water temperature values are converted back to a monthly average there could be more than a one degree (°F) of difference between the monthly average water temperatures based on the interpolation method and the actual monthly average water temperatures (**Figure 22** – see comparison of the dashed red line (i.e., monthly average water temperatures derived from interpolation) and the solid green line (i.e., actual average monthly water temperatures). By converting the original model to utilize average daily water temperatures, this problem associated with interpolation of water temperatures was eliminated.

The original FORTRAN model used average monthly temperatures and interpolated these monthly values to daily temperature in order to calculate daily mortality for each lifestage. Monthly temperatures were converted to a daily timestep by linearly interpolating from the middle of one month (the 15th) to the middle of the next month. There were two problems with interpolating the temperatures in this manner. First, there was no interpolation performed for the first 15 days (1/1 – 1/15) and the last 16 days (12/15 – 12/31) of the calendar year (Figure 22). Instead of interpolating with the month before and after the year being run, the model simply used the monthly average. Second, when model interpolated values were converted back to a monthly average value, there could be more than a degree of difference from the initial or actual monthly averages (Figure 22 – comparison of the dashed red and solid green lines). In other words, the FORTRAN model was not maintaining thermal mass through the interpolation process it was using. By converting the model to read average daily temperatures this problem was eliminated.

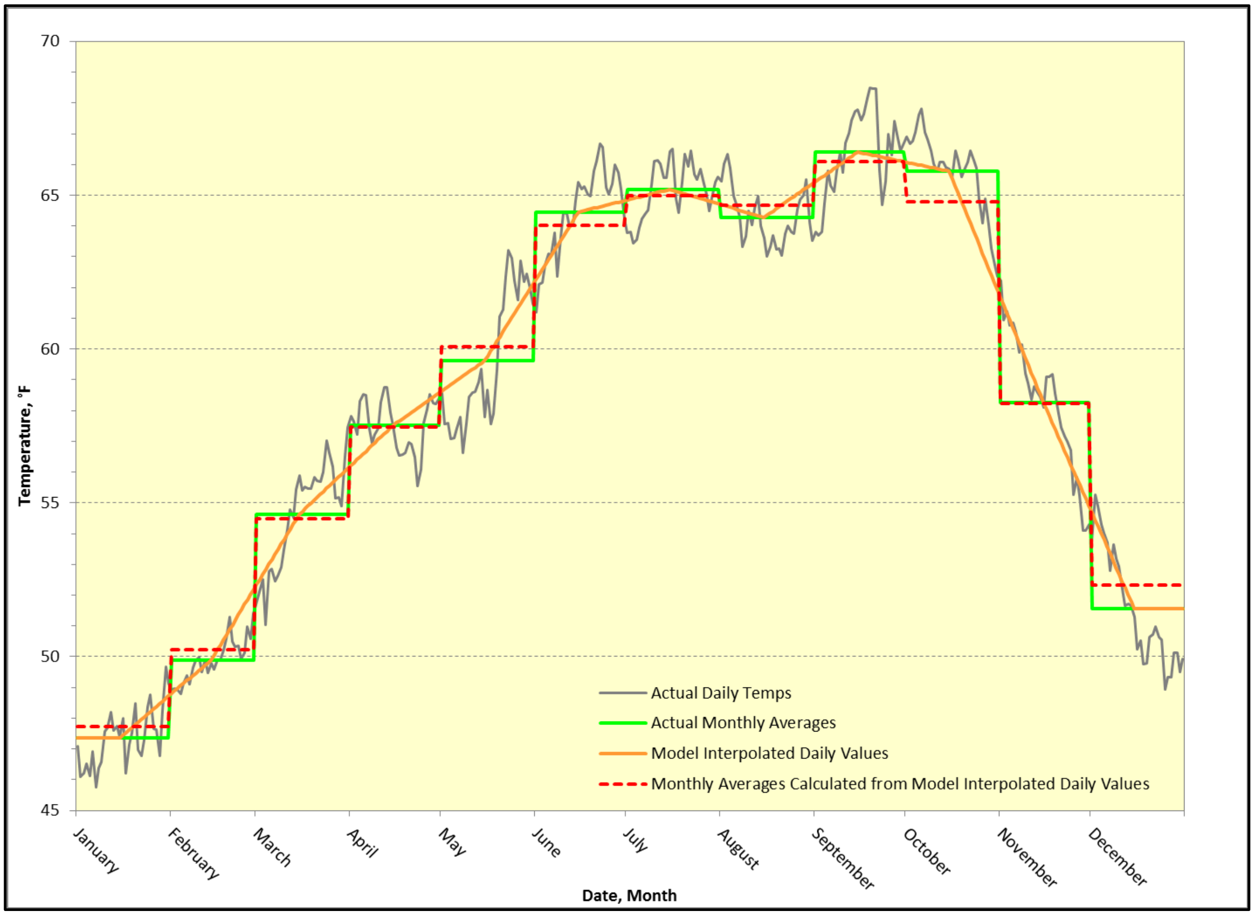


Figure 22. Graph showing problem with FORTRAN model interpolation from monthly to daily temperatures.

5.1.3 Pre-Spawned Mortalities

The original 1995 FORTRAN mortality model "reads" Table 1 from the 1996 Water Forum Issue Paper (i.e., water temperature and exposure duration-mortality rates for pre-spawned Chinook salmon eggs), and uses the mortality rates to interpolate daily mortality rates between whole degrees Fahrenheit. However, manual calculations performed to review the model's performance of interpolating daily mortality rates between whole degrees indicated that the original 1995 model was improperly interpolating daily mortality rates when the daily water temperature was between 60 and 61°F. The original 1995 model was improperly referring to the wrong line of code to calculate the daily pre-spawn mortality rate. The coding error occurred on line 147 (numeric label 97) and was referring to numeric label 95 instead of 99. Once this coding error was corrected, the original 1995 model appeared to run properly. The resultant modeled annual mortalities associated with this code correction were slightly different from the results produced from the original model.

The mortality model used the pre-spawn mortality rates shown in Tables 6-8, and used those values to interpolate daily rates between the integer values provided. However, after hand calculations were performed, it was found that the model was improperly interpolating daily mortality rates when the daily temperature was between 60 and 61°F. The model was incorrectly referencing the wrong line of code to calculate the pre-spawn mortality rate. The error was on line 147 (numeric label 97) and was pointing to numeric label 95 instead of 99. Once fixed, the model ran properly and the yearly losses were slightly different than the original FORTRAN model.

5.1.4 Calculation of Early Year Mortalities

Review of the coding employed in the original 1995 salmon mortality model to calculate daily early lifestage mortality during January and February indicated a potential error in the water temperatures used to calculate early lifestage mortality during January and February.

The original 1995 FORTRAN model “looped back” on itself within the same year to calculate early year (i.e., January and February) Chinook salmon early lifestage mortality. The original 1995 model would store daily water temperatures for one calendar year at a time and then calculate mortalities for that year before deleting the water temperatures and storing the water temperatures for the next year. The original 1995 model would start the annual mortality calculation process on September 1st (day 244). When the original 1995 model steps to day 366 it loops back to January 1st (day 1) of the same year and calculates mortalities using January 1 water temperatures and December 31 inputs. Therefore, the original mortality model may potentially have been applying water temperatures from January and February of the year prior to the year that it was supposed to be calculating early lifestage mortalities for (e.g., calculating early lifestage mortalities for January and February 1923 using water temperatures for January and February 1922). However, it is possible that the water temperatures input to the original 1995 model were formatted in such a way that this methodology was correct (e.g., water temperature data sequenced as Jan 1923, Feb 1923,…Aug 1923, Sep 1922, Oct 1922, Nov 1922, Dec 1922). Regardless, because the original mortality model was updated to calculate annual early lifestage mortality over a “spawning year” (i.e., June 1 – May 31), the potential errors associated with calculating annual early lifestage mortality over a calendar year are removed from the updated mortality model.

The original FORTRAN model used incorrect monthly temperature inputs to calculate daily temperatures in the early part of the calendar year (i.e., January and February). The model would create and store daily temperatures one calendar year at a time and then calculate mortalities for that year before deleting the temperature values and storing the temperature values for the following calendar year. The model would start the mortality calculation process on September 1st (day 244). When the model steps to day 366 (January 1 of the next calendar year) it would loop back to January 1 (day 1) of the same year and calculate mortalities using January 1 temperatures and December 31 inputs.

The only way this was not a mistake was if the input monthly temperature file was created with modified water year temperatures in a calendar year format (i.e., Jan 1923, Feb, 1923, ..., Aug

1923, Sept 1922, Oct 1922, Nov 1922, Dec 1922) which is not the way temperature inputs are typically provided to the original FORTRAN model. It was more likely that the original author of the model used this logic as a work around to use calendar years but still calculate mortalities for a whole spawning season. Examination of the results showed that although there was some issue to be taken with this logic, it likely had little effect on the final result. Temperatures are typically cold enough in January and February that there is very little mortality. If, however, higher temperatures were inputted into the model then losses could be recorded in the early year. Converting the model to use a spawning year format (i.e., June 1 - May 31) eliminated this problem.

5.1.5 Pre-Spawning Adult and Spawning Temporal Distributions

The original 1995 FORTRAN model had some apparent problems with regards to how it handled the pre-spawning and spawning distributions. Specifically, the original model had an accounting error with respect to the total pre-spawn distribution. After the 60°F spawning threshold was passed and spawning was initiated in the original model, the pre-spawn population quickly drops to zero even, despite the fact there were still fall-run Chinook salmon arriving to spawn in the lower American River. As documented below, the 60°F spawning threshold was removed from the updated mortality model, and pre-spawning and spawning temporal distributions were applied in order to define the number of days to spawning for pre-spawning adults that arrived in the lower American River on any given day, removing the error associated with the accounting of the pre-spawning adult and spawning distributions in the original mortality model. The problem was that the model was adjusting the pre-spawn distribution with population losses (both pre-spawn mortality and transition to the egg lifestage), but was not adjusting the spawning distribution (i.e., the percent of the population on a given day transitioning from the pre-spawn lifestage to the egg lifestage) in the same manner. Thus the model was accounting for a larger spawning population which caused the pre-spawn population to drop to zero. As an example, on a given day the spawning distribution specifies 8% should transition from pre-spawning to egg; however, between arrival and spawning the pre-spawn population incurred 2% mortality. Therefore only 6% of the spawning distribution on that day (a fraction of the total pre-spawn population on that day) would transition to the egg lifestage.

The original FORTRAN model had some problems with regards to how it handled the pre-spawn and spawning temporal distributions. The model had an accounting error with respect to the total pre-spawn distribution. After the 60°F spawning threshold was reached, and spawning was allowed to begin, the pre-spawn population would quickly drop to zero even though there were still arrivals. The problem was that the model was adjusting the pre-spawn distribution with population losses (both pre-spawn mortality and transition to the egg lifestage), but was not adjusting the spawning distribution (i.e., the percent of the population on a given day transitioning from the pre-spawn lifestage to the egg lifestage) in the same manner. Thus the model was accounting for a larger spawning population which caused the pre-spawn population to drop to zero. As an example, on a given day the spawning distribution specifies 8% should transition from pre-spawning to egg; however, between arrival and spawning the pre-spawn population incurred 2% mortality. Therefore only 6% of the spawning distribution on that day (a fraction of the total pre-spawn population on that day) would transition to the egg lifestage.

5.1.6 Mortality Frontloading and Daily Cohort Tracking

For each lifestage in the model there were periods where one lifestage and the subsequent lifestage did and did not overlap. Mortalities incurred in the FORTRAN model during periods of no overlap were translated to the beginning of the subsequent lifestage. This is referred to as a “frontloading” of mortalities. For example, if mortalities were incurred two weeks after the initial arrival of pre-spawned adults and before the initiation of any spawning, then it should be assumed that all two weeks’ worth of the population that were present in the river would incur some level of loss proportional to the arrival distribution. However, the FORTRAN model was assuming that the fish holding the longest (i.e., the first arrivals) would incur all of the mortality. Thus, the front end of the subsequent lifestage (for this example it would be the egg distribution) would experience all of the loss incurred prior to the initiation of spawning. This issue was resolved when the model was converted to track daily cohorts, and then mortality was distributed across all preceding days of a particular lifestage, not just isolated to the front end of that lifestage.

To overcome issues with mortality frontloading and to accommodate earlier run arrivals, the model was converted to track each individual daily cohort through each of the three lifestages with a spawning year format, starting on June 1. Originally, the FORTRAN model would compute mortality one lifestage at a time. This model framework led to the mortality frontloading issue. Instead, the updated model tracks each daily cohort individually which allows for properly distributed mortalities. Furthermore, this update eliminates the issues concerning early year mortalities (see Section 5.1.4) since model calculations begin on June 1st and carry through consecutively (on a daily basis) through the end of each spawning year.

5.2 Model Conversion to VBA/Excel

As previously mentioned, before any updates were made the original 1995 model, the 1995 model was converted to VBA/Excel in order to operate the model in the same way as the original FORTRAN model was operated. During the conversion process any errors discovered in the FORTRAN code were either fixed or documented. The original 1995 FORTRAN model was converted to VBA/Excel for several reasons. First, Excel is widely used and accessible to potential users. It provides the user with a familiar and user-friendly environment for changing variables and examining results. Secondly, VBA is a more modern language and easier to write than FORTRAN. Furthermore, de-bugging and testing the model is easier with VBA than FORTRAN, reducing the risk of programming errors. The drawbacks of using VBA/Excel are that the file sizes are larger and run times are longer than in FORTRAN. However, the additional increase in file sizes and run times are generally negligible with modern computers.

Extensive testing was performed for all stages of early lifestage mortality modeling to ensure that the VBA/Excel model and FORTRAN models were calculating the same resultant mortality values. Additionally, all input variables were adjusted for both models and tested for congruity. FORTRAN and VBA/Excel models both calculated the same total annual early lifestage Chinook salmon losses when provided the same inputs.

Before any updates were made, the model was converted to VBA/Excel to operate the same as the original FORTRAN model. During the conversion process any errors discovered in the FORTRAN code were either fixed or documented. The choice to convert the model to VBA/Excel was made for several reasons. First, Excel is widely used and accessible, and provides the user with a familiar and user-friendly environment for changing variables and examining results. Second, VBA is a more modern language that code is easier to write, de-bug and test, as compared to FORTRAN, which reduced the risk of programming errors. The drawbacks of using VBA/Excel are that the file sizes are larger and model run times are longer. However, with modern computing systems these differences are negligible.

Extensive testing was performed for all stages of mortality prediction to ensure that the VBA/Excel model and FORTRAN models were calculating the same values. In addition, all input variables were adjusted for both models and tested for agreement. FORTRAN and base VBA/Excel models both calculated the same total yearly salmon losses when given the same inputs.

5.3 Model Update

After initial review of the original 1995 FORTRAN model, it became apparent that certain aspects of the original model needed to be updated in order to better reflect an updated understanding of biological and physiological characteristics of fall-run Chinook salmon in the lower American River. Updated biological and physiological information used to update the original mortality model related to: (1) fall-run Chinook salmon pre-spawning arrival and spawning spatial and temporal distributions in the lower American River; (2) the physiological spawning response to water temperature in the lower American River; (3) the ATUs associated with the end of the fertilized-egg and pre-emergent fry lifestages; and (4) pre-spawned egg, fertilized egg, and pre-emergent fry mortality-water temperature relationships.

In addition to updating the original mortality model to reflect updated biological and physiological information, the model also was updated to reflect a more accurate application of water temperature-mortality relationships for the three early lifestages of fall-run Chinook salmon, and include modeling of early lifestage mortality in 18 reaches within the lower American River instead of 9 reaches in the original mortality model.

The updates described in this section refer to version 2.5 of the updated Lower American River Salmon Mortality Model. In addition to the correction of coding errors previously described, there were seven key updates made to the original 1995 model: (1) allow the model to compute annual early lifestage mortalities based on the spawning year (i.e., starting on June 1) instead of the calendar year; (2) convert the model to track individual daily cohorts; (3) update the fall-run Chinook salmon spawning spatial distribution and water temperatures with an 18 reach distribution; (4) update the fall-run Chinook salmon run arriving to the lower American River from weekly values starting in September to daily values starting in June with associated holding times until spawning; (5) replace the 60°F spawning distribution threshold with calculated days from arrival to the lower American River until spawning (based on fall-run Chinook salmon pre-spawning and spawning temporal distributions); (6) replace interpolated lifestage-specific mortality values with continuous mortality equations; and (7) change the ATUs associated with the end of the fertilized-egg and pre-emergent fry lifestages. Most of these revisions are justified and discussed in earlier sections of this technical memorandum.

5.4 Summary of Model Updates

After initial review, it was decided that certain aspects of the model needed to be updated. There were eight key updates made to the model:

1.) Correct coding errors as needed.

2.) Convert model from a calendar year format to a spawning year (i.e., 6/1 - 5/30) format.

3.) Convert the model to track individual daily cohorts (revised code provided in Appendix A).

4.) Expand from 9 reaches to 18 reaches and update spatial spawning distribution.

5.) Update temporal arrival distribution from weekly values starting in September to daily arrivals starting in June.

6.) Replace 60°F spawning initiation threshold with a specified days till spawning independent of water temperature.

7.) Replace interpolated life-stage mortality values with continuous mortality equations.

8.) Change life-stage accumulated temperature unit (ATU) values.

6.0 Effect of Model Refinements

The effect of the various model refinements upon predicted mortalities for each lifestage were evaluated with a progressive sensitivity analysis. Refinements were implemented stepwise, one piece at a time, where each refinement built upon the earlier refinements. The evaluation was carried out over 15 spawning years. To provide input data for the evaluation of the model refinements, mean daily water temperatures for each of 18 reaches were computed using the HEC-RAS water quality model for the lower American River developed for the Water Forum.

6.1 Water Temperature Modeling

The lower American River HEC-RAS water quality model was used to simulate water temperature in each of the 18 reaches for the period of record where input data were available (i.e., June 1999 – May 2014). River flow (i.e., Nimbus Dam release), upstream water temperature, diversions, and downstream stage data at the confluence with the Sacramento River were acquired from CDEC, USGS, Carmichael Water District, and the City of Sacramento. Meteorological conditions were acquired from CIMIS gage #131 in Fair Oaks.

The HEC-RAS model was executed with a sub-hourly time step and the results averaged to produce mean daily water temperatures. Water temperatures were extracted from river segments that spanned the half river-miles (i.e., RM 5.5, RM 6.5,…, RM 21.5, RM 22.5) and were used to represent water temperatures in the 18 reaches of the Mortality Model. The locations of the half river miles used are based upon the river mile locations specified by the USGS.

6.2 Progressive Model Sensitivity Analysis

The following components were progressively implemented (i.e., in a stepwise manner) in the order listed to demonstrate the effects of each major refinement on the final results:

1.) Correct coding errors, include daily cohort tracking, and increase the number of reaches to 18

2.) Use average daily water temperatures

3.) Update adult arrival temporal distribution, implement number of days until spawning and remove 60°F spawning threshold

4.) Add new pre-spawn mortality rate equation

5.) Add new egg mortality rate equation

6.) Add new fry mortality rate equation

7.) Use new egg ATU threshold

8.) Use new fry ATU threshold yielding the New Model

Each sensitivity item on the list includes the updates from all previous items. For example, the results for Adjustment 4 (adding the new pre-spawn mortality rate equation) included the model updates listed in Adjustments 1, 2, and 3.

6.3 Progressive Sensitivity Analysis Results

Total annual mortalities for each lifestage (i.e., pre-spawn, egg, and pre-emergent fry) are the primary output of the LAR Chinook Salmon Early Lifestage Mortality Model. Annual mortalities of each lifestage were averaged across the 15 years simulated to demonstrate the effect each revision had on the model results (**Table 16** and **Figure 23**). The new model showed an 11.49% decrease in total average annual mortality compared to the FORTRAN model. The difference results from a large decrease in pre-spawn losses and a smaller increase in egg losses.

The progressive sensitivity analysis showed that Adjustments 1 through 5 had the largest impacts on model results. Adjustment 1 resulted in increased average mortalities, mostly in the pre-spawn lifestage, due largely to the corrected calculation of the pre-spawn and spawning temporal distributions, as described earlier. Adjustment 2, the utilization of average daily water temperatures, also showed an increase in mortalities, mostly due to increased egg mortality. Daily averaged water temperatures had individual days with water temperatures in excess of the monthly interpolated averages where the population experienced higher mortality rates.

Adjustment 3, updated arrival distribution with days until spawning and removal of the 60°F spawning threshold, showed a dramatic increase in pre-spawn mortalities due to significantly earlier arrivals (June 1 vs. September 1) and longer adult holding times. Additionally, without the 60°F spawning threshold, spawning generally occurred earlier in the season when water temperatures were higher. Earlier spawning in turn led to an increase in egg mortalities as well as this lifestage was generally present earlier in the season and subject to higher water temperatures.

Adjustment 4, incorporation of the new pre-spawn mortality rate equation, led to a very large reduction in pre-spawn mortalities compared to the results of Adjustment 3. New pre-spawn mortality rates essentially eliminated pre-spawn losses for water temperatures less than 67.5°F. In many years (12 of the 15 used in the sensitivity analysis), water temperatures rarely exceeded 67.5°F during adult holding periods and pre-spawn losses were therefore negligible. Decreased pre-spawn mortality resulted in a larger egg population (i.e., fewer pre-spawn losses left a larger number of fertilized eggs). A larger egg population, that was present earlier in the season when temperatures were warmer, led to a large increase in egg mortalities.

Adjustment 5, incorporation of the new egg mortality equation, led to a large decrease in egg mortality when compared to the results of Adjustment 4. For water temperatures between 58°F and 66°F, the new egg mortality rates were up to 35% lower than the mortality rates in the FORTRAN model. This decrease in mortality rates is why there was a decrease in average egg mortality from Adjustment 4 to 5. Conversely, Adjustment 5 has more egg mortality than the FORTRAN model, due to the elimination of the 60°F spawning threshold and decreased pre-spawn losses. These differences resulted in earlier spawning in larger quantities, which led to an increase in egg mortality over the FORTRAN model. Although there was a very small increase in fry mortalities, generally, the model showed very low sensitivity to Adjustments 6 through 8.

In addition to total mortality and mortality for each lifestage, the model provides cumulative daily survival plots for each lifestage as well as for the timing of spawning. Three representative spawning years were selected to demonstrate the differences in predictions between the FORTRAN model and the new model. The three years serve to represent an average mortality year (2004-2005, **Figure 24**), a low mortality year (2011-2012, **Figure 25**), and a high mortality year (2001-2002, **Figure 26**). Daily average water temperatures for both the FORTRAN model and the new model are provided as grey lines in all plots. The FORTRAN interpolated, monthly average temperatures were reasonably correlated with the new model's daily average water temperatures from June until December 15. After December 15, the FORTRAN model's interpolation issues and calendar year framework caused the interpolated, average water temperatures to diverge from the intended values.

The new model's tendency to have lower pre-spawn mortalities is apparent in the top-left plot (blue lines in **Figure 24, Figure 25** and **Figure 26**). Even in high mortality years (2001-2002) the new model's pre-spawn cumulative survival was markedly higher than the FORTRAN model (new – 88% vs. FORTRAN – 67%). A sharp increase at the front end of the FORTRAN model's spawning distribution in the top-right plots was caused by the 60°F spawning threshold. Egg mortality can be interpreted by differencing the final value of the green line in the bottom-left plot with the final value of the blue line in the top-left plot. The difference for the new model (dashed line) is greater than the difference of the FORTRAN model (solid line). The model's insensitivity to fry mortality rates (i.e., the survival rate for the fry lifestage is roughly equal to the survival rate for the egg lifestage) was due primarily to cold water temperatures and was apparent when comparing the final egg survival (green line in the bottom-left plot) with the fry survival (purple line in the bottom-right plot).

Overall, low and average mortality years saw an increase in survival (i.e., a decrease in mortality) with the new model compared to the FORTRAN model. High mortality years, on the other hand, saw a decrease in survival with the new model compared to the FORTRAN model. These differences were due in part to how the new pre-spawn mortality rate equation behaved at low and high temperatures in addition to increased egg mortalities. At lower water temperatures, the new pre-spawn mortality equation is relatively insensitive. Water temperatures in critical reaches (i.e., the reaches where a majority of the spawning is predicted) in most years were below the 67.5°F threshold, yielding virtually no mortality for the pre-spawn lifestage. Alternatively, in years with high water temperatures, the new pre-spawn mortality rate is higher than the original pre-spawn mortality rate and therefore higher pre-spawn losses were predicted. This tendency of the new pre-spawn mortality equation means that only in years with high water temperatures will pre-spawn mortality be noticeable. Moderate pre-spawn losses and increased egg losses in high water temperature years combined and led to total annual mortalities in excess of FORTRAN model predictions.

Table 17. Progressive sensitivity analysis results - average annual mortality for each lifestage, total, and difference from original FORTRAN model.

Adjustment Number	Model Adjustment	Average Annual Mortality				
		Pre-Spawn	Egg	Fry	Total	Difference from FORTRAN Model
-	**Original FORTRAN Model**	20.41%	3.33%	0.00%	**23.74%**	-
1	Correct coding errors, daily cohort tracking, increase to 18 reaches	23.34%	3.37%	0.00%	**26.71%**	2.97%
2	Use average daily water temperatures	24.09%	7.25%	0.01%	**31.34%**	7.61%
3	Update arrival distribution and used new days till spawning metric	38.87%	11.89%	0.00%	**50.76%**	27.02%
4	Add new pre-spawn mortality rate equation	1.34%	33.13%	0.00%	**34.47%**	10.73%
5	Add new egg mortality rate equation	1.34%	10.41%	0.04%	**11.79%**	-11.95%
6	Add new fry mortality rate equation	1.34%	10.41%	0.71%	**12.46%**	-11.28%
7	Use new egg ATU threshold	1.34%	10.60%	0.31%	**12.25%**	-11.49%
8	Use new fry ATU threshold - **New Model**	1.34%	10.60%	0.30%	**12.25%**	-11.49%

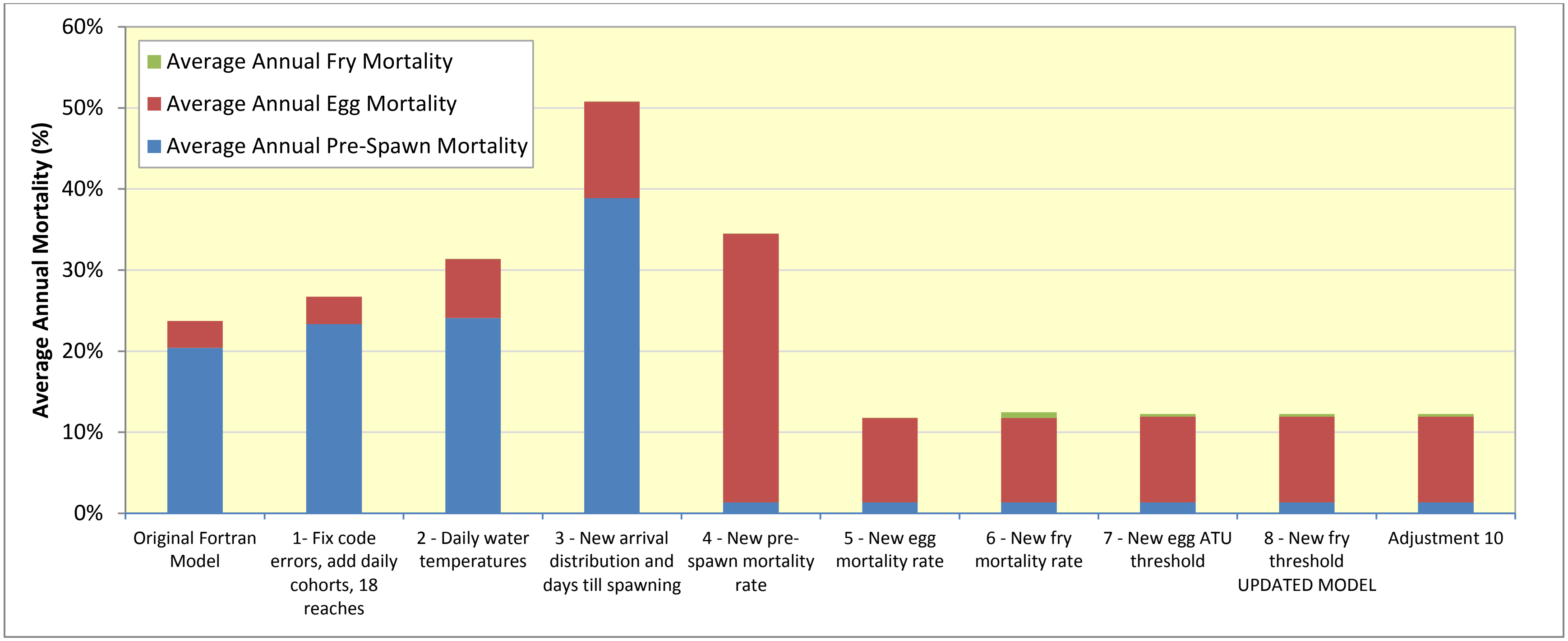


Figure 23. Plot of progressive sensitivity results showing total average annual mortality for each model adjustment.

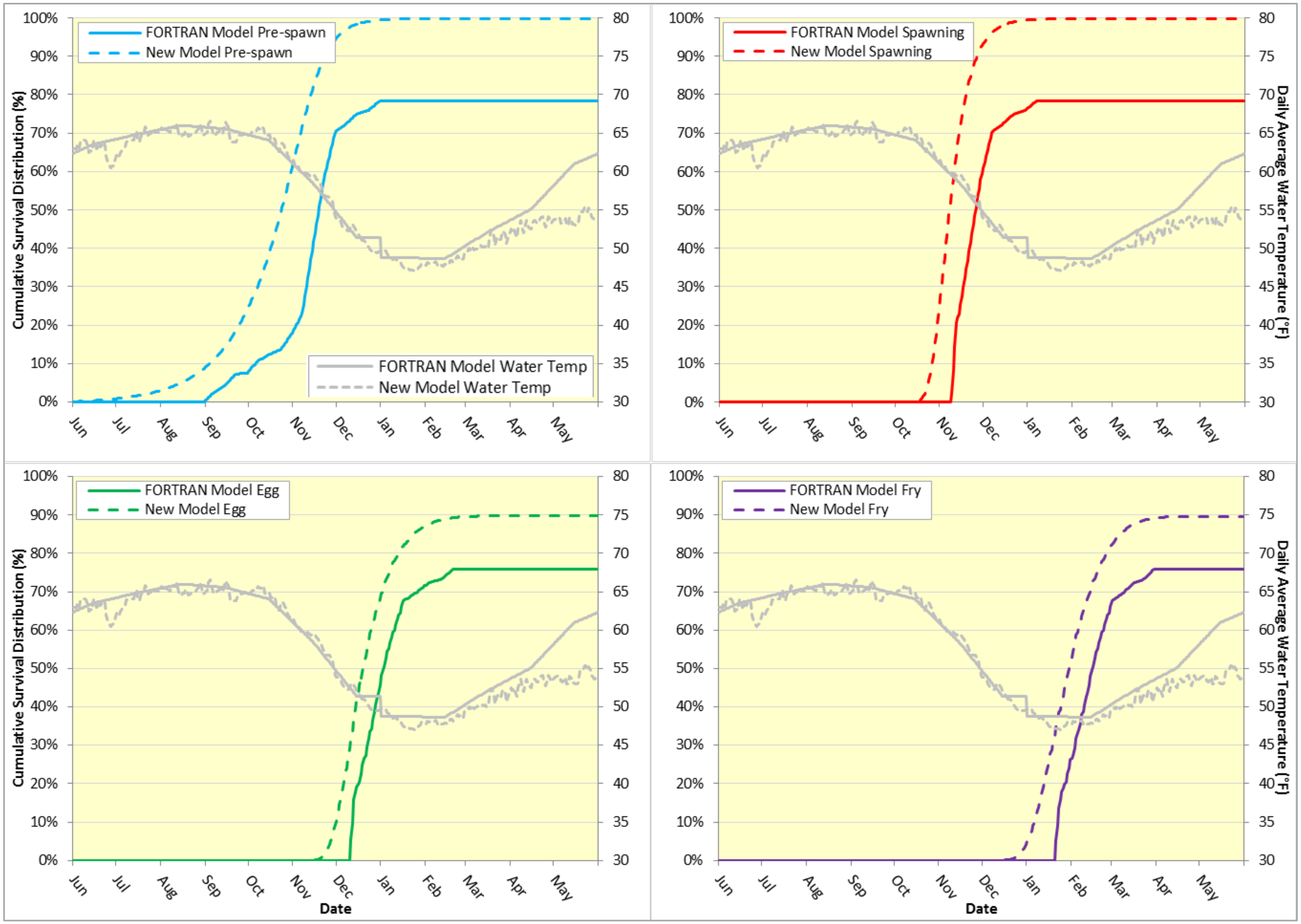


Figure 24. Total annual mortality for an average mortality year (spawning year 2004-2005) – Total Mortality: FORTRAN Model = 24.2%, New Model = 10.4%.

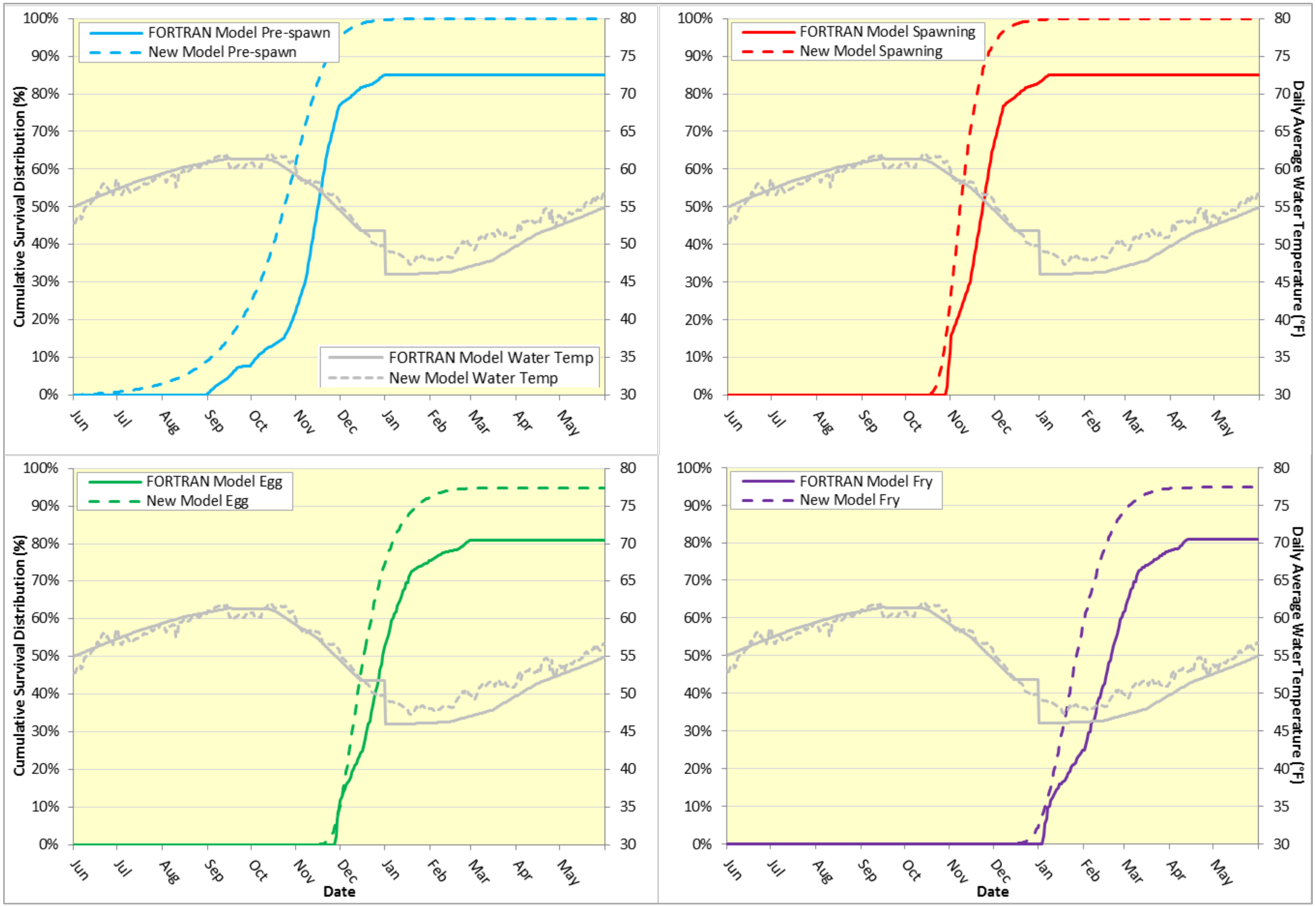


Figure 25. Total annual mortality for a low mortality year (spawning year 2011-2012) – Total Mortality: FORTRAN Model = 19.0%, New Model = 5.3%.

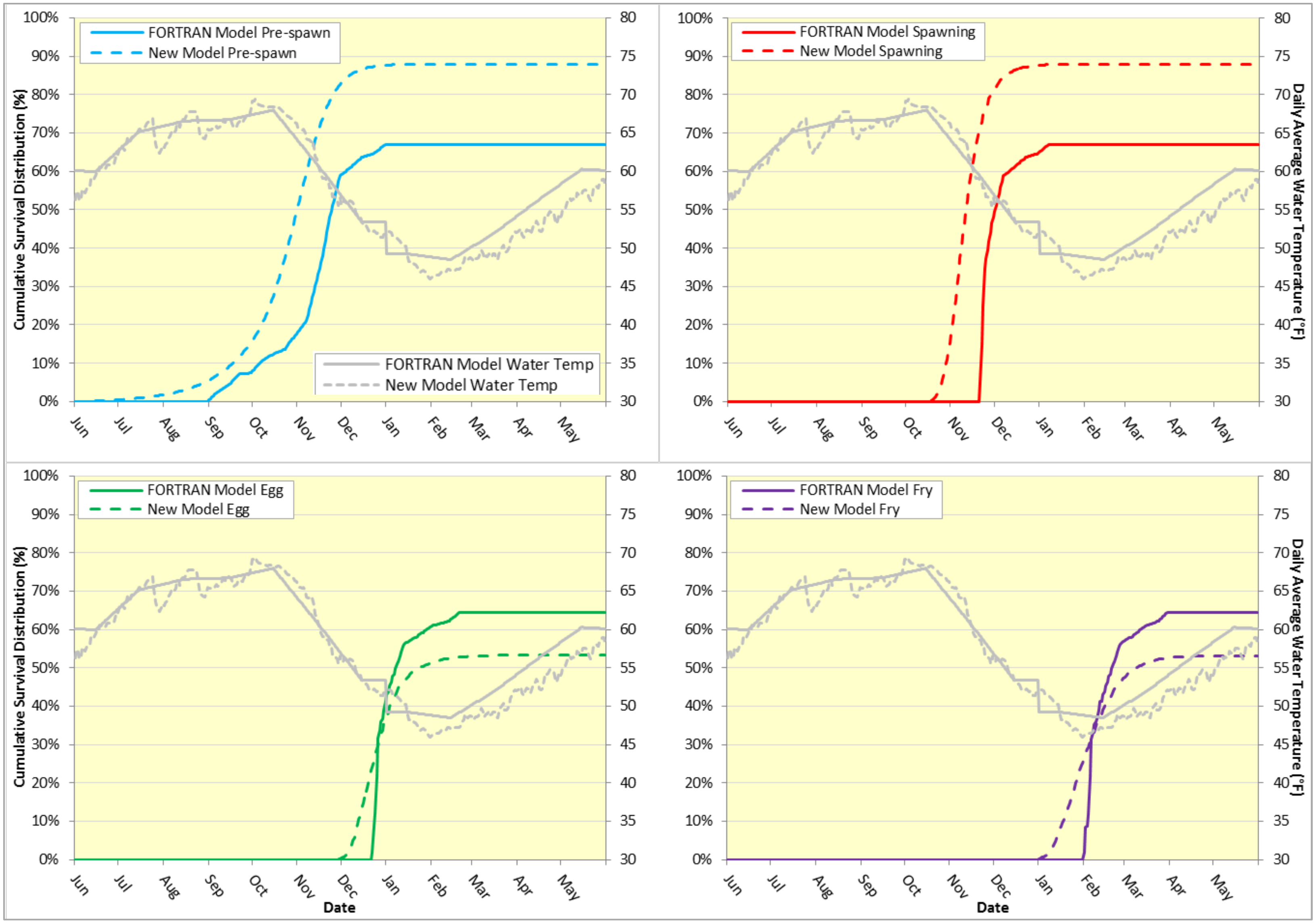


Figure 26. Total annual mortality for a high mortality year (spawning year 2001-2002) – Total Mortality: FORTRAN Model = 35.6%, New Model = 46.9%.

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APPENDIX A

REVISED MORTALITY MODEL VBA CODE

```
Sub RunMortality()
'prespawn and spawn variables
    Dim i As Long
    Dim J As Long
    Dim PreSpwnStartDay(1 To 82) As Integer
    Dim PreSpwnEndDay(1 To 82) As Integer
    Dim SpwnStartDay(1 To 82) As Integer
    Dim SpwnEndDay(1 To 82) As Integer
    Dim PreSpwnDist(2 To 34000, 19) As Double
    Dim PreSpwnMort(2 To 34000, 18) As Double
    Dim PreSpwnMortC(2 To 34000, 18) As Double
    Dim PreSpwnMortCumul(2 To 34000, 19) As Double
    Dim PreSpwnMortTime(2 To 34000, 19) As Double
    Dim SpwnDist(2 To 34000, 19) As Double
    Dim spwnday(2 To 34000) As Double


'egg variables
    Dim EggMort(2 To 34000, 18) As Double
    Dim EggMortC(2 To 34000, 18) As Double
    Dim EggMortCumul(2 To 34000, 19) As Double
    Dim EggMortTime(2 To 34000, 19) As Double
    Dim EggDist(2 To 34000, 18, 2) As Double
    Dim EggDistCumul(2 To 34000, 19) As Double
    Dim DegDay(2 To 34000) As Double
    Dim TemperatureF(2 To 34000, 18) As Double
    Dim Eggstart(2 To 34000) As Long
    Dim Eggend(2 To 34000) As Long

'fry variables
    Dim FryMort(2 To 34000, 18) As Double
    Dim FryMortC(2 To 34000, 18) As Double
    Dim FryMortCumul(2 To 34000, 19) As Double
    Dim FryMortTime(2 To 34000, 19) As Double
    Dim FryDist(2 To 34000, 18, 2) As Double
    Dim FryDistCumul(2 To 34000, 19) As Double
    Dim DegDayf(2 To 34000) As Double

'temporary variable
    Dim TempVar As Double
'    Dim TempVar2(2 To 34000, 18) As Double
```

```
'reach variables
   Dim Rch As Integer
   Dim Rchs As Integer
   Dim RchPerct(1 To 18) As Double
   Dim RchFlag As Integer

'year variables
   Dim Yr As Integer
   Dim FirstYr As Integer

'prespawn and spawn settings
   PreSpwnStartDay(1) = 79
   PreSpwnEndDay(1) = 288 '444
   SpwnStartDay(1) = 233
   SpwnEndDay(1) = 295

'egg settings
   EggDegDayConst = 931

'fry settings
   FDegDayconst = 686

'reach setting
   Rchs = 18
   RchFlag = 1     '1 turns the reach weighting on and zero turns it off

'*********************************************
'         Set Calculation and Updating off
'*********************************************
Application.Calculation = xlCalculationManual
Application.ScreenUpdating = False
'*********************************************
'        Set prespawning and spawning start and end dates (rows)
'*********************************************
Application.StatusBar = "Set prespawn and spawn start and end dates"
'Sheets("StartEndDays").Select
For i = 1 To 81
   PreSpwnStartDay(i) = Sheets("StartEndDays").Cells(i + 2, 9).Value
   PreSpwnEndDay(i) = Sheets("StartEndDays").Cells(i + 2, 10).Value
   SpwnStartDay(i) = Sheets("StartEndDays").Cells(i + 2, 11).Value
   SpwnEndDay(i) = Sheets("StartEndDays").Cells(i + 2, 12).Value
Next
```

```
For Rch = 1 To Rchs
    RchPerct(Rch) = Sheets("StartEndDays").Cells(Rch + 9, 3).Value
Next

'********************************************
'          Read in the Data
'********************************************
Application.StatusBar = "reading data"
'Sheets("Fishdata").Select

For Yr = 1 To 81
      FirstYr = (PreSpwnStartDay(Yr) - PreSpwnStartDay(1))
    If Yr = 1 Then
      For i = PreSpwnStartDay(1) To PreSpwnEndDay(1)
        spwnday(i) = Sheets("Fishdata").Cells(i, 6).Value
        PreSpwnDist(i, 0) = Sheets("Fishdata").Cells(i, 3).Value
      Next
    Else
      For i = PreSpwnStartDay(Yr) To PreSpwnEndDay(Yr)
        spwnday(i) = spwnday(i - FirstYr) + FirstYr
        PreSpwnDist(i, 0) = PreSpwnDist(i - FirstYr, 0)
      Next
    End If
Next

For Rch = 1 To Rchs
    For i = 2 To 34000
       PreSpwnDist(i, Rch) = PreSpwnDist(i, 0)
    Next
Next

Sheets("WaterTemperature").Select
For Rch = 1 To Rchs
  For i = 2 To 34000
    TemperatureF(i, Rch) = Cells(i + 25, Rch + 1).Value
    PreSpwnMort(i, Rch) = (1 - 0.5 ^ (1440 / (Exp(21.802 - 0.5746 * (TemperatureF(i, Rch) - 32) / 1.8))))
    EggMort(i, Rch) = 1.404 * (10 ^ -10) * Exp(0.31584 * TemperatureF(i, Rch))
    FryMort(i, Rch) = 6.688 * (10 ^ -17) * Exp(0.56446 * TemperatureF(i, Rch))
  Next
Next
```

```
'**************************************************
'Reach Loop Calculation
'**************************************************
For Rch = 1 To Rchs

    '**********************************************
    '         Adjust Pre Spawning Mortality
    '**********************************************
    Application.StatusBar = "Adjusting PreSpawn Mortality"

    For Yr = 1 To 81
     For J = PreSpwnStartDay(Yr) To PreSpwnEndDay(Yr)                              'Loop through PreSpawn Temporal Distribution
        For i = J To PreSpwnStartDay(Yr) Step -1                                    'Step back through to calculate mortality on fish already in the river
            If (spwnday(i) >= J) Then                                               'Only calculate mortality on fish that have not already spawned
              TempVar = PreSpwnDist(i, Rch) * PreSpwnMort(J, Rch)
              If TempVar > PreSpwnDist(i, Rch) Then TempVar = PreSpwnDist(i, Rch)
              PreSpwnDist(i, Rch) = PreSpwnDist(i, Rch) - TempVar
              PreSpwnMortCumul(i, Rch) = PreSpwnMortCumul(i, Rch) + TempVar
              PreSpwnMortTime(J, Rch) = PreSpwnMortTime(J, Rch) + TempVar
                'Range("l" & i).Value = PreSpwnDist(i)
            End If
        Next
     Next
    Next

    '**********************************************
    '         Calculate the Spawning Distribution
    '**********************************************
    Application.StatusBar = "Calculating the Spawning Distribution"

    For Yr = 1 To 81
     For J = SpwnStartDay(Yr) To SpwnEndDay(Yr)                                    'Loop through Spawning Temporal Distribution
        For i = J To PreSpwnStartDay(Yr) Step -1                                    'Step back through PreSpawn Fish to accumulate the number of fish that will spawn on each day
          If (spwnday(i) = J) Then                                                  'Only accumulate spawning for day J
            SpwnDist(J, Rch) = SpwnDist(J, Rch) + PreSpwnDist(i, Rch)
            'Range("m" & J).Value = SpwnDist(J)
          End If
        Next
     Next
    Next

    '***********************************************
```

```
'         Calculate the Egg and Fry Distributions
'*********************************************
For Yr = 1 To 81
  Application.StatusBar = "Calculating the Egg and Fry Distributions " & Yr
 For J = SpwnStartDay(Yr) To SpwnEndDay(Yr)                              'Track Spawning Cohorts through egg and fry emergence
  EggDist(J, Rch, 1) = SpwnDist(J, Rch)                                  'Transfer Spawning Distribution (after mortality) to Egg Distribution
  i = J                                                                  'Increment Counter to start on day J (spawning cohort j)
  DegDay(J) = TemperatureF(J, Rch) - 32#                                 'Initiate Degree Day calculation

  '*******************************************
  '       Egg Distribution
  '*******************************************
  Do While DegDay(J) < EggDegDayConst                                    'For each egg cohort loop through each day until the day before hatching
    TempVar = EggDist(J, Rch, 1) * EggMort(i, Rch)
    If TempVar > EggDist(J, Rch, 1) Then TempVar = EggDist(J, Rch, 1)    'If the egg distribution goes negative set to "zero"
    EggDist(J, Rch, 1) = EggDist(J, Rch, 1) - TempVar                    'Adjust the egg distribution for cohort j based on daily temperature mortality
    EggMortC(J, Rch) = EggMortC(J, Rch) + TempVar

    EggMortTime(i, Rch) = EggMortTime(i, Rch) + TempVar

    i = i + 1                                                            'Increment the counter for the next day
    DegDay(J) = DegDay(J) + TemperatureF(i, Rch) - 32#                   'Accumulate degree days for the next day
  Loop

    EggDist(J, Rch, 2) = i - 1                                           'Track the day for the last day of egg cohort j
    EggDistCumul(i - 1, Rch) = EggDistCumul(i - 1, Rch) + EggDist(J, Rch, 1)   'Accumulate egg distributions the final day before hatching
    EggMortCumul(i - 1, Rch) = EggMortCumul(i - 1, Rch) + EggMortC(J, Rch)

  '*******************************************
  '       Fry Distribution
  '*******************************************
  FryDist(J, Rch, 1) = EggDist(J, Rch, 1)                                'Start the fry distribution

  Do While DegDay(J) < (EggDegDayConst + FDegDayconst)                   'For each egg cohort loop through each day until the day before fry emergence
    TempVar = FryDist(J, Rch, 1) * FryMort(i, Rch)
    If TempVar > FryDist(J, Rch, 1) Then TempVar = FryDist(J, Rch, 1)    'If the fry distribution goes negative set to "zero"
    FryDist(J, Rch, 1) = FryDist(J, Rch, 1) - TempVar                    'Adjust the fry distribution for cohort j based on daily temperature mortality
    FryMortC(J, Rch) = FryMortC(J, Rch) + TempVar

    FryMortTime(i, Rch) = FryMortTime(i, Rch) + TempVar

    i = i + 1                                                            'Increment the counter for the next day
```

```
        DegDay(J) = DegDay(J) + TemperatureF(i, Rch) - 32#                    'Accumulate degree days for the next day
      Loop

        FryDist(J, Rch, 2) = i - 1                                    'Track the day for the last day of fry cohort j
        FryDistCumul(i - 1, Rch) = FryDistCumul(i - 1, Rch) + FryDist(J, Rch, 1)    'Accumulate egg distributions the final day before emergence
        FryMortCumul(i - 1, Rch) = FryMortCumul(i - 1, Rch) + FryMortC(J, Rch)

    Next
   Next

Next

'**********************************************
'    Write Out Data With (flag =1) or Without (flag = 0) Reach Weighting
'**********************************************

For Rch = 1 To 18
  If RchFlag <> 1 Then RchPerct(Rch) = 1#

  For i = 2 To 34000
    PreSpwnDist(i, Rch) = PreSpwnDist(i, Rch) * RchPerct(Rch)
      PreSpwnDist(i, 19) = PreSpwnDist(i, 19) + PreSpwnDist(i, Rch)

    SpwnDist(i, Rch) = SpwnDist(i, Rch) * RchPerct(Rch)
      SpwnDist(i, 19) = SpwnDist(i, 19) + SpwnDist(i, Rch)

    EggDistCumul(i, Rch) = EggDistCumul(i, Rch) * RchPerct(Rch)
      EggDistCumul(i, 19) = EggDistCumul(i, 19) + EggDistCumul(i, Rch)

    FryDistCumul(i, Rch) = FryDistCumul(i, Rch) * RchPerct(Rch)
      FryDistCumul(i, 19) = FryDistCumul(i, 19) + FryDistCumul(i, Rch)

    PreSpwnMortCumul(i, Rch) = PreSpwnMortCumul(i, Rch) * RchPerct(Rch)
      PreSpwnMortCumul(i, 19) = PreSpwnMortCumul(i, 19) + PreSpwnMortCumul(i, Rch)

    PreSpwnMortTime(i, Rch) = PreSpwnMortTime(i, Rch) * RchPerct(Rch)
      PreSpwnMortTime(i, 19) = PreSpwnMortTime(i, 19) + PreSpwnMortTime(i, Rch)

    EggMortCumul(i, Rch) = EggMortCumul(i, Rch) * RchPerct(Rch)
      EggMortCumul(i, 19) = EggMortCumul(i, 19) + EggMortCumul(i, Rch)

    EggMortTime(i, Rch) = EggMortTime(i, Rch) * RchPerct(Rch)
```

```
      EggMortTime(i, 19) = EggMortTime(i, 19) + EggMortTime(i, Rch)

    FryMortCumul(i, Rch) = FryMortCumul(i, Rch) * RchPerct(Rch)
      FryMortCumul(i, 19) = FryMortCumul(i, 19) + FryMortCumul(i, Rch)

    FryMortTime(i, Rch) = FryMortTime(i, Rch) * RchPerct(Rch)
      FryMortTime(i, 19) = FryMortTime(i, 19) + FryMortTime(i, Rch)

  Next
Next

'Sheets("PreSpwnDist").Select
Sheets("PreSpwnDist").Range("b2:u34000").Value = PreSpwnDist
'Sheets("SpwnDist").Select
Sheets("SpwnDist").Range("b2:u34000").Value = SpwnDist
'Sheets("EggDist").Select
Sheets("EggDist").Range("b2:u34000").Value = EggDistCumul
'Sheets("FryDist").Select
Sheets("FryDist").Range("b2:u34000").Value = FryDistCumul
'Sheets("PreSpwnMort").Select
Sheets("PreSpwnMort").Range("b2:u34000").Value = PreSpwnMortCumul
'Sheets("PreSpwnMortTime").Select
Sheets("PreSpwnMortTime").Range("b2:u34000").Value = PreSpwnMortTime
'Sheets("EggMort").Select
Sheets("EggMort").Range("b2:u34000").Value = EggMortCumul
'Sheets("EggMortTime").Select
Sheets("EggMortTime").Range("b2:u34000").Value = EggMortTime
'Sheets("FryMort").Select
Sheets("FryMort").Range("b2:u34000").Value = FryMortCumul
'Sheets("FryMortTIme").Select
Sheets("FryMortTIme").Range("b2:u34000").Value = FryMortTime
Sheets("PS_Mort_Rate").Range("b2:t34000").Value = PreSpwnMort
Sheets("Egg_Mort_Rate").Range("b2:t34000").Value = EggMort
Sheets("Fry_Mort_Rate").Range("b2:t34000").Value = FryMort
'temp write out for testing
'Sheets("junktest").Select
'Range("b2:t34000").Value = TempVar2
Sheets("Model Results").Select
Application.ScreenUpdating = True
Application.Calculation = xlCalculationAutomatic
Application.StatusBar = "Model Execution Complete"
End Sub
```

Appendix E: Water Supply and Delivery, Part 1

Note: Appendix E, Part 2 includes monthly date products

1. Water Supply

1.1 Background

The U.S. Army Corps of Engineers (USACE) has embarked on a study to define how Folsom Reservoir would be operated upon completion of the new spillway and dam raise authorized by Public Law 106-53, 1999 Water Resources Development Act. The completed spillway carries with it the potential for added reservoir operations flexibility. Evaluating the effects that the modified Folsom Reservoir flood protection operations could have on the supply of water for project uses is an integral part of the Folsom Dam Water Control Manual (WCM) Update. These effects include water deliveries for municipal, industrial, and agricultural use; in-stream flows; and reservoir storages.

The Central Valley Project/State Water Project Operations Model (CalSim II) was employed to complete the Manual Update Water Supply effects evaluation. CalSim II is the latest rendition of a long-term hydrologic planning model characterizing the U.S. Bureau of Reclamation’s (Reclamation) Central Valley Project (CVP) and DWR’s State Water Project (SWP). The roots of long-term hydrologic planning models reach back some 40-plus years to a time just after the completion of major facilities of the CVP and SWP and, coincidentally, the availability of operating agency computers capable of solving hydrologic modeling problems.

The earliest CVP/SWP planning tools were spreadsheets; not the personal computer types so common today, but the term’s namesake: a large sheet of paper 2 to 3 feet wide with multiple columns, spread out on a desk. Column entries were entered in pencil, and calculations were performed using calculators. The results of the spreadsheets were no less accurate than those obtained from today’s models, but the time required to calculate even one year’s CVP/SWP operation realistically limited the number of years that could be modeled.

As the integrated water and power operations for both the CVP and SWP took on more complexity with increasing water demands, including the need to coordinate project operations in the Sacramento–San Joaquin Delta (Delta), it was obvious that computer models needed to be developed that could look at longer-term operations. Thus, in the 1970s, both Reclamation and DWR began to build computer models focused on their respective projects but including the other’s project too. Reclamation created the Project Simulation Model (PROSIM), which represented the CVP with good detail but was less capable of modeling SWP operations. The State of California created the DWR planning simulation model (DWRSIM), which understandably represented the SWP with good detail but was less capable of modeling CVP operations.

Both PROSIM and DWRSIM were used for several years to model CVP/SWP operations, the choice of models most often being determined by which project was the subject of the study alternative. It should be noted that the original purpose of these models was to identify the effect of alternative project operations on authorized CVP/SWP functions. Model use for other intents has expanded in subsequent years.

To avoid the duplicitous effort of supporting two models, in the 1980s and 1990s, DWR and Reclamation jointly developed a new computer model called CalSim II that simulates much of the water resources infrastructure in the Central Valley of California and Delta region and that would be used for all studies. CalSim II, therefore, provides quantitative hydrologic-based information to those responsible for the planning, managing, and operating the CVP and SWP. CalSim II is a particular CVP/SWP configuration of software developed primarily by DWR called WRIMS (Water Resources Integrated Modeling System). Presently, CalSim II is being used for all studies affecting CVP/SWP operations.

Strictly speaking, model verification of CalSim II cannot be realized. A CalSim II model simulation has converted land use changes over time to reflect a given level of land use and development. In addition, project operation of today's facilities includes reservoirs and pumping plants different than historical operations and facilities. Concern over the inability to verify and the importance of results obtained from the model that affect California's water supplies and environmental resources gave rise in 2003, to the CALFED Science Program convening an external review panel for the purpose of providing an independent analysis and evaluation of the strengths and weaknesses of WRIMS and CalSim II. Among other questions, the review panel was asked: "Is CALSIM a reasonable modeling approach for current and proposed applications and problems?" In response to this question, the Peer Review Panel found:

> CALSIM II is a simulation model developed as a joint venture between the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) to (i) provide a significant modernization and upgrading of the DWRSIM and PROSIM models developed and used by these organizations, (ii) develop a comprehensive modeling system that simultaneously addresses the current and future needs of both the SWP and CVP systems; and (iii) develop a generalized modeling system that could be applied in any river basin system, in contrast with the previous models that were less generalized and more specifically designed for the existing SWP and CVP systems. In this respect, CALSIM II represents a state-of-the-art modeling system that is similar in general concept, while differing in specific details, to other data-driven river basin modeling systems such as ARSP, MODSIM, OASIS, REALM, RiverWare and WEAP.

For the past 10-plus years, CalSim II has been used for CVP/SWP system-wide studies to the exclusion of PROSIM and DWRSIM. Prominent among these studies are those associated with the CVP/SWP Operations Criteria and Plan, Bay Delta Conservation Plan, Lower Yuba River Accord, and State Water Project Delivery Reliability Reports, to name a few. While some of these projects have been challenged, the disputes relate to input assumptions or interpretation of results, not to the efficacy of the CalSim II tool. Like other complex models, there is room for improvement in methods, data, and scope of CalSim II and WRIMS. Corrections, adjustments, and improvements to CalSim II are an ongoing effort of DWR and Reclamation, with no discernible end. However, CalSim II, with appropriate configuration for the intended study, is the CVP/SWP accepted long-term planning tool.

CalSim II and WRIMS documentation is available on the DWR modeling web site:

http://modeling.water.ca.gov/hydro/model/index.html
http://www.waterplan.water.ca.gov/docs/tools/descriptions/CALSIM-description.pdf

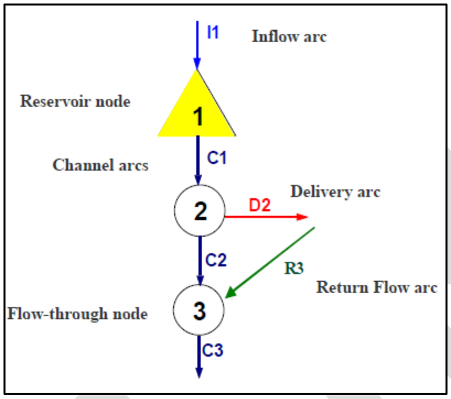
1.2 Analytical Approach

This section describes the models used, their limitations in application to the WCM project, and the model output parameters that were selected for the water supply effects evaluation.

1.2.1 CalSim II Model Description

The CalSim II model simulates operations of the CVP and SWP system as a network of nodes and arcs, comprised of reservoirs and natural and artificial channels. Reservoirs, groundwater basins, the junction points of two or more flows, or a point of interest on a channel are represented by nodes in the network. Arcs represent water flows between nodes, or out of the system, and may be inflows, channel flows, return flows, or diversions. The model then uses a mixed integer linear programming model solver to route water through the network of nodes and arc over time. An example schematic is shown in Figure 1-1.

Figure 1-1. Example Model Schematic Showing Series of Arcs and Nodes.

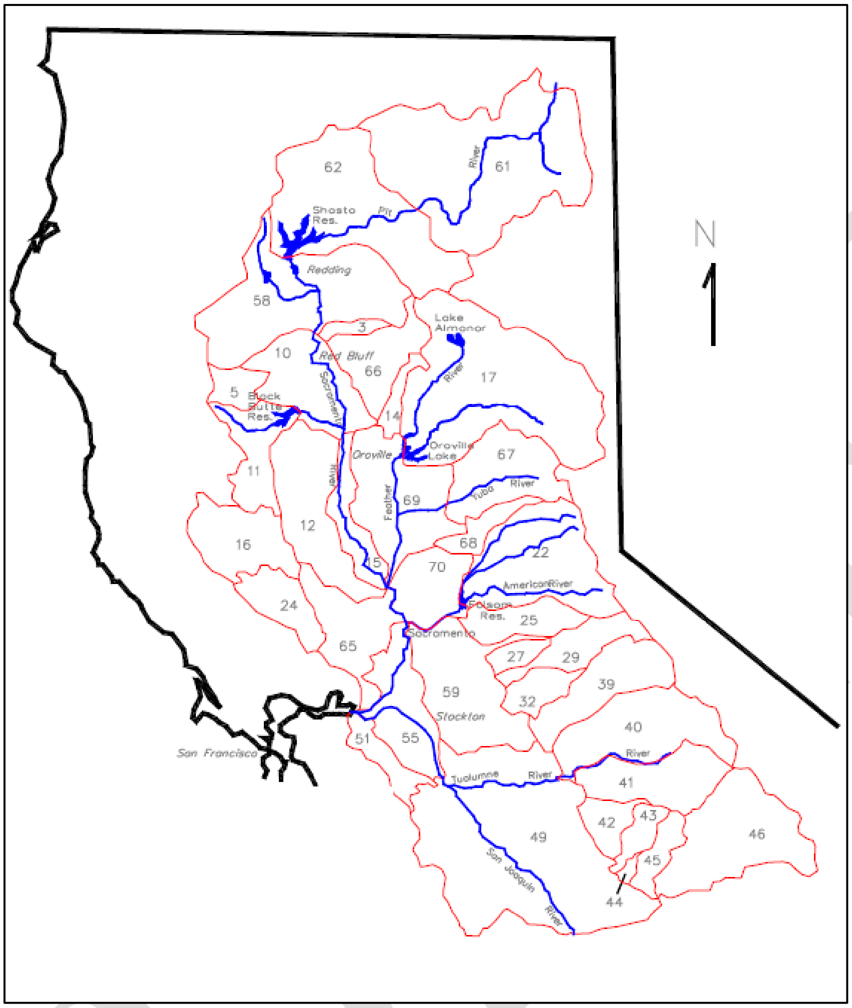


Source: CalSim Water Resources Simulation Model Manual, Draft Documentation (DWR 2002)

CalSim II simulates the entire CVP/SWP system from Lake Shasta to Castaic Lake and Lake Perris at the southern end of the Californian Aqueduct. Demands were derived by DWR using a geographical information system “snapshot” of the crop and urban acreage based on county surveys done in the 1990s. To develop inflow hydrology for CalSim II and its predecessor, DWRSIM, DWR developed a set of hydrologic units (termed detailed study areas) and depletion study areas that divide the Sacramento and San Joaquin Valleys into thirty-seven regions. The inflow hydrology used in the model is based on temporal and spatial distribution of precipitation for the historic 81-year period from 1922 to 2003.

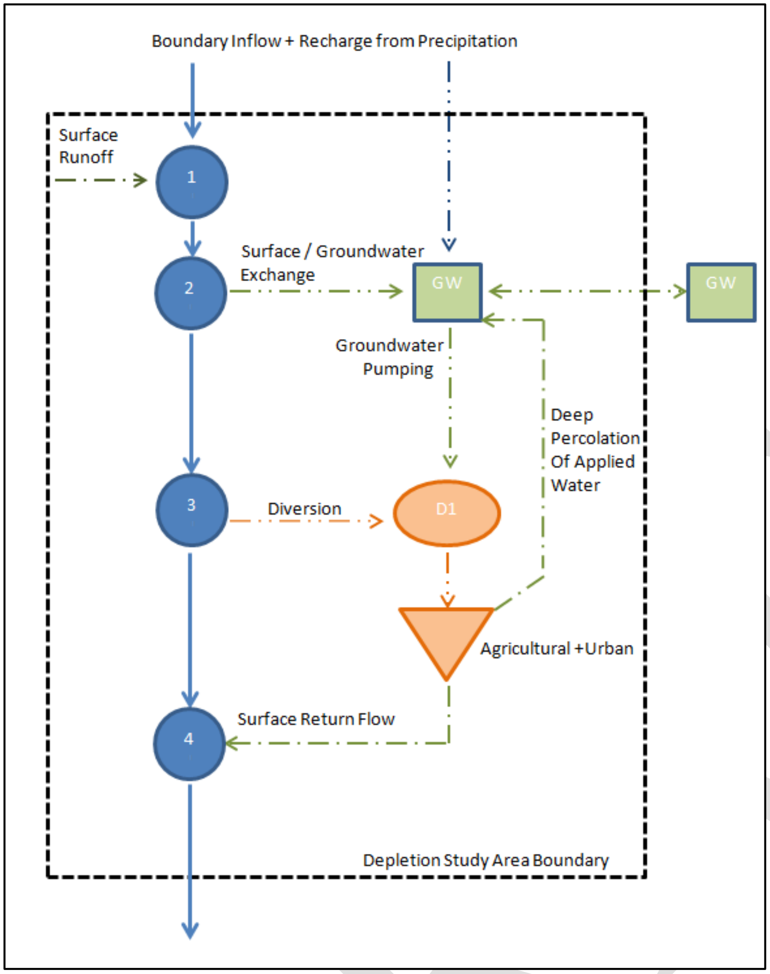
Depletion study areas are categorized as either valley floor areas or rim basin areas. The valley floor areas are represented in CalSim II in much greater detail than rim basins because of their greater complexity, larger demands, and integration with the operation of the CVP/SWP. The extent of the CalSim II model and study areas are shown in Figure 1-2, and a hypothetical depletion study area showing representation of typically defined arcs and nodes is presented in Figure 1-3.

Figure 1-2. CalSim II Model Extents and Study Areas.



Source: CalSim Water Resources Simulation Model Manual, Draft Documentation (DWR 2002)

Figure 1-3. Schematic of Depletion Study Area Representation.



Source: CalSim Water Resources Simulation Model Manual, Draft Documentation (DWR 2002)

The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over this 81-year period, representing a fixed level of development, rather than one that varies in response to hydrologic conditions or changes over time. Model results, therefore, represent a range of possible water supply conditions at a particular snapshot in time.

CalSim II uses the USACE's Hydrologic Engineering Center Data Storage System (HEC-DSSVue) time-series data storage system. Relational data such as index-dependent flow standards and monthly flood-control diagrams are stored in simple, text-based, relational tables.

The model user can describe the physical system in Water Resources Engineering Simulation Language (WRESL) statements characterizing:

- Dams, reservoirs, channels, and pumping plants;
- Basic operational rules such as flood-control diagrams, minimum flows, and delivery requirements;

- Specialized operational rules such as delivery cutbacks, and salinity-flow requirements;
- Priorities for allocating water to different uses;
- Current or future levels of land development; and
- Various regulatory conditions.

The statements are then assembled into WRESL text-based, relational tables and files using a tree-structure for organization of related constraints. The text tables also contain the conductivity matrix for the network and the user-defined weights that are incorporated into the objective function. At model run-time, the WRESL statements and data from the DSS database and the text tables are converted into a matrix or array that is passed to the solver (DWR 2003).

1.2.2 Model Limitations

These CalSim II model limitations were taken directly from the Reclamation's 2008 Operations Criteria and Plan Biological Assessment (USBR 2008).

- *"The main limitation of CalSim-II model is the time step. Mean monthly flows do not define daily variations that could occur in the rivers from dynamic conditions. However, monthly results are still useful for general comparison of scenarios.*

- *The CalSim-II model is not a hydraulic model. CalSim-II does not use channel characteristics, such as channel roughness, cross-sectional geometry, etc., to simulate the routing of water as commonly found in other models simulating rainfall runoff response.*

- *CalSim-II uses simplified rules and guidelines to simulate SWP and CVP delivery allocation. Therefore the results may not reflect how the SWP and CVP would actually operate under extreme hydrologic conditions (very wet or very dry). The allocation process in the modeling is weighted heavily on storage conditions and inflow to the reservoirs that are fed into the curves mentioned previously in the Hydrologic Modeling Methods section and does not project inflow from contributing streams when making an allocation. This curve-based approach does cause some variation in results between studies that would be closer with a more robust approach to the allocation process.*

- *There are a number of rule-curves embedded in CalSim-II and it is these rule-curves that drive the water balance between the reservoirs, determine how much water to carryover until the following year, and allocate the amount of water for delivery. It is difficult to produce a rule-curve in CalSim-II that produces good realistic results in the full spectrum of year types. CalSim-II rule-curves often produce sub-optimal results with respect to Project operations in the driest years. Some results imply that the projects would operate the reservoirs to unrealistically low levels in these dry year outliers. In reality the Projects could and would operate to higher reservoir elevations in these extremely dry years. An examination of modeling output suggests that this would be possible by reducing project releases and exports to minimums rather than the unrealistic rates often assumed by the models in these years."*

CalSim II model results should not be used on an absolute predictive basis since it does not predict how the actual CVP/SWP operations would occur given a set of hydrologic conditions. The model results should be used on a relative basis between two scenarios.

In addition to the inherent limitations to the CalSim II model, another limitation applies specific to this Project. As part of the WCM update, a complex set of Folsom Reservoir operations, including flood protection rules, are modified, but they can only be represented in the CalSim II model by the top-of-conservation-pool volume time series. CalSim II cannot capture the full extent of modifications in Folsom Reservoir operations, as represented in the HEC-ResSim model developed by USACE. Also, the ResSim models are based on a daily time step, while these operations are aggregated to a monthly representation in the CalSim II models.

1.2.3 Model Output Parameters

For the water supply effects evaluation of this report, CalSim II models for all the scenarios were executed for an 81-year period of record (POR) extending from water year 1921 through water year 2003. The model output parameters selected for all of water supply comparative evaluations in this document were based on either their regulatory relevance or their historical importance in characterizing effects to water supply in the CVP/SWP system. A more refined evaluation was completed for the Lower American River (LAR).

1.2.3.1 Parameters Derived from Federal and State Directives

The State Water Resources Control Board has issued several water rights decisions in order to protect Project-beneficial uses like water quality, maintenance of in-stream flows, and fisheries. In a similar fashion, the National Marine Fisheries Service has instituted additional operating requirements through biological opinions. These water rights decisions and biological opinions establish objectives that need to be complied with while operating the system. Modifications to the Folsom Reservoir flood operations could compromise the ability of the CVP and SWP system operators, Reclamation, and DWR to meet these objectives. For this reason, the CalSim II outputs for these parameters need to be compared for the water supply effects evaluation of this study.

Model output parameters deriving from Federal and state directives include:

- Minimum release requirements (MRR) in American River below Nimbus Dam;
- MRR in Sacramento River below Keswick Dam;
- MRR in Sacramento River at Rio Vista; and
- Old and Middle River (OMR) flows.

1.2.3.2 Parameters Important to CVP/SWP System

Model output parameters that did not have direct regulatory constraints were incorporated in this evaluation because of their importance in CVP/SWP system. These parameters are as follows:

- Water delivery to refuges north and south of the Delta;

- Water delivery to settlement and exchange contractors;
- Water delivery to Feather River SWP contractors;
- Water delivery to CVP municipal and industrial (M&I) water service contractors north and south of the Delta;
- Water delivery to CVP agricultural water service contractors north and south of the Delta;
- Delta exports;
- May end-of-month storage in Shasta, Oroville, and Folsom Reservoirs;
- September end-of-month storage in Shasta, Oroville, and Folsom Reservoirs; and
- End-of-month storages in San Luis Reservoir.

The rationale for selection of these parameters is the fact that they are an important part of CVP/SWP system operations; they represent beneficial uses such as M&I, agricultural, and fish and wildlife; and are instructive as to Reclamation and DWR's ability to meet contractual obligations and to satisfy water rights requirements.

Model outputs were tabulated for long-term average and average by 40-30-30 Sacramento Valley Index water year type for CVP/SWP deliveries, Delta exports, OMR flows, and San Luis storages. In addition, exceedance plots were created for selected parameters such as mean monthly flows and Folsom, Shasta, and Oroville storages. These data products can be found in:

- Tables 1–12, 182–184, and 247–248 of each comparison in Monthly Data Products Volume I, at the end of this document.
- Figures 1–15 and 164 of each comparison in Monthly Data Products Volume I, at the end of this document.

1.2.3.3 Refined Level Evaluation Parameters

In addition to the screening level evaluation discussed above, a more refined level evaluation was completed for the LAR. This refined level evaluation addresses specific parameters based on their importance in characterizing effects within the LAR such as:

- Deliveries to American River purveyors; and
- LAR minimum in-stream flow requirements in summer and fall months.

Models output for the water purveyors holding water rights and CVP contracts assigned to the LAR and Folsom Reservoir were reviewed. The evaluation consisted of calculating the monthly average, maximum, and minimum water deliveries for each purveyor from the models. The differences in water delivery volume for each month were then determined. These differences represent a comparison of the absolute maximum and minimum delivery for each month for the total 81-year POR covered by the CalSim II models. The American River water deliveries included in this evaluation are:

- American River Pump Station deliveries - The American River Pump Station serves Placer County Water Agency (PCWA);

- City of Folsom deliveries;
- City of Roseville deliveries;
- San Juan Water District (SJWD) deliveries;
- Sacramento Suburban Water District (SSWD) deliveries from Folsom;
- Folsom Pumping Plant deliveries - The Folsom Pumping Plant serves water for the City of Folsom, PCWA, the City of Roseville, and SJWD;
- E.A. Fairbairn Water Treatment Plant (FWTP) deliveries - The FWTP serves as a diversion point for the City of Sacramento, SSWD, and Carmichael Water District;
- Freeport Regional Water Project deliveries; and
- August 1977 deliveries - A further interrogation of model output was completed to consider the variation shown in the comparison of the 81-year POR deliveries for the City of Roseville, the City of Folsom, and the SJWD. Monthly deliveries were reviewed to identify the specific occurrences of variability between models within a single water year.

In the course of developing the refined evaluation, it was noted that observed variation within the models frequently occurred in water year 1977. The drought that persisted through 1976 and 1977 represents the driest conditions in California's recorded history. The two consecutive years with little precipitation left California with record low storage in its surface reservoirs and required the use of large quantities of groundwater to make up the surface water shortage. Based on the evaluation completed for the current study, the CalSim II model has difficulty resolving water supply allocations during this period and produces ambiguous results, as shown in both the comparison of CalSim II models for the LAR purveyors, and in the comparison of water quality parameters in the Delta (covered in later sections of this report). In the current evaluation of model consistency, specific differences in model output based on month-to-month and year-to-year comparisons are included and considered representative of model capabilities; however, results identifying model inconsistencies occurring in water year 1977 should be carefully reviewed.

Models outputs for LAR MRR for the summer and fall months, June through December, are presented in exceedance plots. Changes in system-wide operations between the CalSim II models affect the indices used to establish the MRR flows. The CalSim II model implements a dynamic procedure to track these indices which, to some degree, is dependent on the water control diagram (WCD) to which the model assumes Folsom Reservoir to be operated; therefore, the computed MRR may never be precisely the same between alternatives for all months because of system-wide operational decisions.

A water delivery formulation was created using the POR model output and model output sorted by water year type, to account for effects that are more pronounced in one water year type versus another. Thresholds were developed to define deviations from the baseline condition. The following 10 metrics were selected for refined level evaluation of water delivery in the LAR.

- Folsom Pumping Plant – April: total occurrences where delivery fell below 95 percent of POR average of all Aprils.

- Folsom Pumping Plant – April: total occurrences for any single-year type where delivery fell below 95 percent of POR average of all Aprils.
- Folsom Pumping Plant – July: total occurrences where delivery fell below 95 percent of POR average of all Julys.
- Folsom Pumping Plant – July: total occurrences for any single-year type where delivery fell below 95 percent of POR average of all Julys.
- FWTP – April: total occurrences where delivery fell below 95 percent of POR average of all Aprils.
- FWTP – April: total occurrences for any single-year type where delivery fell below 95 percent of POR average of all Aprils.
- FWTP – July: total occurrences where delivery fell below 95 percent of POR average of all Julys.
- FWTP – July: total occurrences for any single-year type where delivery fell below 95 percent of POR average of all Julys.
- Folsom Pumping Plant: minimum diversion for any month.
- FWTP: minimum diversion for any month.

A comparison of the alternative was made to the baseline metrics noted above to determine consistency, or lack thereof, with the baseline condition. The following rules are applied to characterizing consistency with the baseline condition:

- All 10 metrics the same as the baseline: ‘Consistent’
- 7–9 metrics the same as the baseline: ‘Moderately Consistent’
- Less than 7 metrics the same as the baseline: ‘Not Consistent’

Data Products for the refined level evaluation of water supply effects are presented in:

- Tables 150–168 of each comparison in Appendix A Monthly Data Products Volume I;
- Figures 142–148 of each comparison in Appendix A Monthly Data Products Volume I.

1.3 J602F3 ELD Model Development

The E504 ELD CalSim II build served as the base model for development of the J602F3 ELD CalSim II build. J602F3 ELD represents inflow-forecast-based operations. The reservoir is operated by rules which compute the required available storage level, or top-of-conservation-pool storage volumes, as a function of forecasted inflow volume. Inflow volumes are computed from runoff forecast data provided by the National Weather Service. These volumes are computed for the 1-day, 1-day, 3-day, and 5-day durations. Each volume is converted into an available storage target, and the lowest target value is adopted as the top-of-conservation-pool storage volume. When a sufficiently large event is captured in the forecast, pre-event releases are made to draw down the reservoir to the forecast-based, computed top-of-conservation-pool. When actual storage levels exceed the top-of-conservation-pool, flood releases are triggered and gradually stepped up and eventually reduced as determined by updated forecast information. The majority of the times, forecast-based releases are not required, and the reservoir is allowed to use the variable flood control pool for the additional purposes of the reservoir (i.e. water and power supply, recreation). Efficient drawdown ensures proper flood risk performance while minimizing impacts to the reservoir's other purposes. Conversely, during times when a storm is not forecast, more water could be stored in the authorized flood space above top-of-conservation-pool for other beneficial uses, but this type of forecast-based operation is not being pursued at Folsom Reservoir during the current study.

In the CalSim II model, the maximum allowable storages in Folsom Reservoir were defined using a combination of USACE’s J602F3 top-of-conservation-pool storage volumes and the E503p ELD top-of-conservation-pool storage volumes. For October through January, top-of-conservation-pool storage volumes from the J602F3 forecasts were used. For the spring months (February through May), basin wetness correction was also applied. If the volume of April through July unimpaired inflow to Folsom Reservoir was less than 1,100 TAF and the February upstream creditable space at Folsom Reservoir with

400-600 WCD was more than 120 TAF, then the year was qualified for the basin wetness correction. Out of the 82 years of the CalSim simulation period, 32 years qualified for the basin wetness correction using this approach. For February through May of a qualified year, the top-of-conservation-pool storage volumes from the J602F3 forecasts were used, while the E503p ELD top-of-conservation-pool storages volumes were used for all other years.

1.4 Comparison of J602F3 ELD and E504 ELD

1.4.1 General Observations

The respective models for the water supply effects evaluation of J602F3 ELD and E504 ELD, as described in previous sections, were executed. Model outputs for storage in Folsom Reservoir for J602F3 ELD are higher than for E504 ELD. Fall flows in the American River below Nimbus Dam are slightly lower than for E504 ELD. Annual CVP and SWP deliveries are similar for the two scenarios. Comparison of flows in the Sacramento River and Shasta and Oroville Reservoirs’ storages shows very little difference between the two scenarios.

Based on the Folsom Pumping plant and FWTP deliveries data for water delivery evaluation, 8 out of the 10 metrics were the same for the two models; therefore, the deliveries produced by J602F3 ELD were determined to be ‘moderately consistent’ with deliveries from E504 ELD.

1.4.2 Detailed Observations

Screening Level Evaluation

Table 1-3. Storages, Flows, and MRR for J602F3 ELD vs. E504 ELD.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Generalized Results
End of Month Storages (May and September)		
Folsom	Monthly exceedance distributions – Folsom storages as noted; Similar storages for others.	May – higher storages. September – higher or same for 400-750 TAF range, lower for the rest.
Shasta		✓
Oroville		✓
Mean Monthly Flows and MRR Compliance (October through December)		
Lower American River below Nimbus Dam	Monthly exceedance distributions – Similar flows; MRR met.	October – very small increases in flows November and December – very small decreases in flows.
Sacramento River below Keswick Dam		✓
Sacramento River at Rio Vista		✓

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

Table 1-4. CVP/SWP Deliveries, Delta Exports, and San Luis Storages for J602F3 ELD vs. E504 ELD.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Generalized Results**					
CVP/SWP Deliveries							
Delivery Type	Long-term and water year type average annual deliveries – Generally similar long-term average annual deliveries and generally similar average annual deliveries most of the time during all water year types, but with some slight increases and/or decreases.	**Long-term and Water Year Type Average Annual Deliveries**					
		Long-term	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
CVP M&I NOD		1 TAF increase	✓	2 TAF increase	✓	✓	✓
CVP agricultural NOD		3 TAF increase	5 TAF increase	8 TAF increase	2 TAF increase	1 TAF increase	1 TAF increase
CVP settlement NOD		✓	✓	✓	✓	✓	✓
CVP refuges NOD		✓	✓	✓	✓	✓	✓
CVP M&I SOD		✓	1 TAF increase	✓	✓	✓	1 TAF decrease
CVP agricultural SOD		5 TAF increase	4 TAF increase	13 TAF increase	4 TAF increase	6 TAF increase	2 TAF increase
CVP exchange contractors		✓	✓	✓	✓	✓	✓
CVP refuges SOD		✓	✓	✓	✓	✓	✓
Total CVP deliveries		8 TAF increase	10 TAF increase	22 TAF increase	6 TAF increase	6 TAF increase	1 TAF increase
SWP contractors		2 TAF decrease	3 TAF decrease	✓	7 TAF decrease	5 TAF increase	5 TAF decrease
Delta Exports and Flows							
Jones exports	Long-term and water year type average monthly exports/flows – Generally similar except as noted.	Long-term: 0–2 TAF ranging from 0% in several months to +1.4% in June. Maximum monthly decrease over the POR: 3 TAF (2.2%) in average of all Julys of critical years.					
Banks exports		Long-term: ±1 TAF ranging from –0.4% in November, January and February to +0.7% in June. Maximum monthly decrease over the POR: 3 TAF (1.4%) in average of all Februarys of below-normal years.					
OMR flows		Long-term: –0.8% in June to +0.3% in January. Negative OMR flows: maximum monthly decrease of 4.3 % in average of all Junes of dry years. Positive OMR flows: no decrease in monthly average by water year.					

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Generalized Results
San Luis Storages		
CVP San Luis	Long-term and water year type average end-of-month storages – Minimal changes as noted.	Long-term: ±2 TAF ranging from –0.9% in July to +0.5% in November. Maximum monthly decrease over the POR: 8 TAF (7.8%) in average of all Augusts of above-normal years.
SWP San Luis		Long-term: –4 TAF (–1.1%) in September to –1 TAF (–0.1%) in April. Maximum monthly decrease over the POR: 8 TAF (2.0%) in average of all Septembers of below-normal years.
Total San Luis		Long-term: –1 TAF (–0.1%) in June and December to –3 TAF in several months. Maximum monthly decrease over the POR: 9 TAF (1.4%) in average of all Septembers of below-normal years.

Note: "✓" refers to the same value of the evaluation metric for both scenarios.
NOD = North of Delta
SOD = South of Delta

Refined Level Evaluation

Table 1-5. American River Purveyors Deliveries for J602F3 ELD vs. E504 ELD.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Results**		
American River Purveyors Deliveries				
Purveyor Delivery Type	Long-term monthly average, maximum and minimum deliveries – Generally similar deliveries with some increases and decreases as noted.	**Monthly Average, Maximum, and Minimum Deliveries**		
		Average	**Maximum**	**Minimum**
American River Pump Station deliveries to PCWA		✓	✓	✓
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 Regional Water Project deliveries		Up to 8 AF decrease in January through July. 53 AF decrease in August. No change in other months.	1 AF decrease in November, 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.

Table 1-6. American River Diversions and Consistency Formulation for J602F3 ELD vs. E504 ELD.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Results**
American River Diversions - Folsom Pumping Plant and E.A. Fairbairn Water Treatment Plant (Consistency formulation)		
Folsom Pumping Plant - April	Total occurrences where delivery fell below 95% of POR average of all Aprils – Same for both scenarios.	✓
Folsom Pumping Plant - April	Maximum number of years for any water year type where delivery fell below 95% of POR average of all Aprils – Same for both scenarios.	✓
Folsom Pumping Plant - July	Total occurrences where delivery fell below 95% of POR average of all Julys – Same for both scenarios.	31 for E504 ELD. 32 for J602F3 ELD.
Folsom Pumping Plant - July	Maximum number of years for any water year type where delivery fell below 95% of POR average of all Julys – Same for both scenarios.	13 for E504 ELD. 14 for J602F3 ELD.
FWTP - April	Total occurrences where delivery fell below 95% of POR average of all Aprils – Same for both scenarios.	✓
FWTP - April	Maximum number of years for any water year type where delivery fell below 95% of POR average of all Aprils – Same for both scenarios.	✓
FWTP - July	Total occurrences where delivery fell below 95% of POR average of all Julys – Same for both scenarios.	✓
FWTP - July	Maximum number of years for any water year type where delivery fell below 95% of POR average of all Julys – Same for both scenarios.	✓
Folsom Pumping Plant	Minimum diversion for any month – Same for both scenarios.	✓
FWTP	Minimum diversion for any month – Same for both scenarios.	✓
Consistency		Moderately Consistent

Note: "✓" refers to the same value of the evaluation metric for both scenarios.

Table 1-7. American River MRR for Summer and Fall Months for J602F3 ELD vs. E504 ELD.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Generalized Results**
American River Minimum Release Requirement in Summer and Fall Months		
June through September	Monthly exceedance distributions – Similar MRR.	✓
October through December	Monthly exceedance distributions.	October - MRR decreases slightly. November and December – MRR increases for higher flow ranges; decrease slightly for lower flow ranges.

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

1.4.3 Evaluation of Effects

CalSim II model outputs for E504 ELD and J602F3 ELD indicate that, overall, J602F3 ELD would be generally similar to or better than E504 ELD. There could be some occurrences of slight increases and decreases in evaluation metrics, as expected with any changes in the CalSim II models.

The top-of-conservation-pool storage volumes computed from inflow-forecast-based operations and selective basin wetness corrections to the spring refill curve for J602F3 ELD prescribe higher maximum allowable storages in November through April months than for E504 ELD. As a result, the model is storing more water in these months and releasing it in summer. Releases in November through February are reduced accordingly. Folsom Reservoir storage is higher in May and similar in September, implying better availability of water to meet summer water delivery obligations and higher Folsom Reservoir releases through the summer.

Mean monthly flows below Nimbus Dam in October are higher by 1 percent, relative to the basis of comparison. Flows in November and December show a decrease of 3–4 percent for the long-term average value. These reduced flows are a result of the higher storages in the Folsom Reservoir for the same months. Sacramento River flows below Keswick Dam and at Rio Vista are similar for the two scenarios and meet the MRR.

As a result of the higher Folsom Reservoir storages and changes in the allocations in the J602F3 ELD CalSim II model, long-term average annual deliveries show a slight increase (8-TAF increase for long-term average of total CVP deliveries and 1-TAF decrease for long-term average of SWP deliveries). It is notable that the dry and critical-years' average annual deliveries show a slight increase of up to 6 TAF.

Deliveries to LAR purveyors are generally similar with some increases and decreases –53 to +31 AF) for the long-term average. Water supply delivery evaluation of the two scenarios indicates that the two scenarios are 'moderately consistent' as defined by the consistency formulation.

Summer months' MRRs in the LAR are similar. October shows a very slight decrease (0.4 percent) in MRR flows. November and December show an increase in higher flow ranges and some slight decreases in MRR in lower flow ranges. As described earlier in the previous comparisons, MRR flows in the American River below Nimbus Dam are based on the regulated hydrology of the respective models. Changes in the Folsom Reservoir storages are causing changes in the Fall MRR.

1.5 References

Water Supply

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Appendix E: Water Supply and Delivery, Part 2

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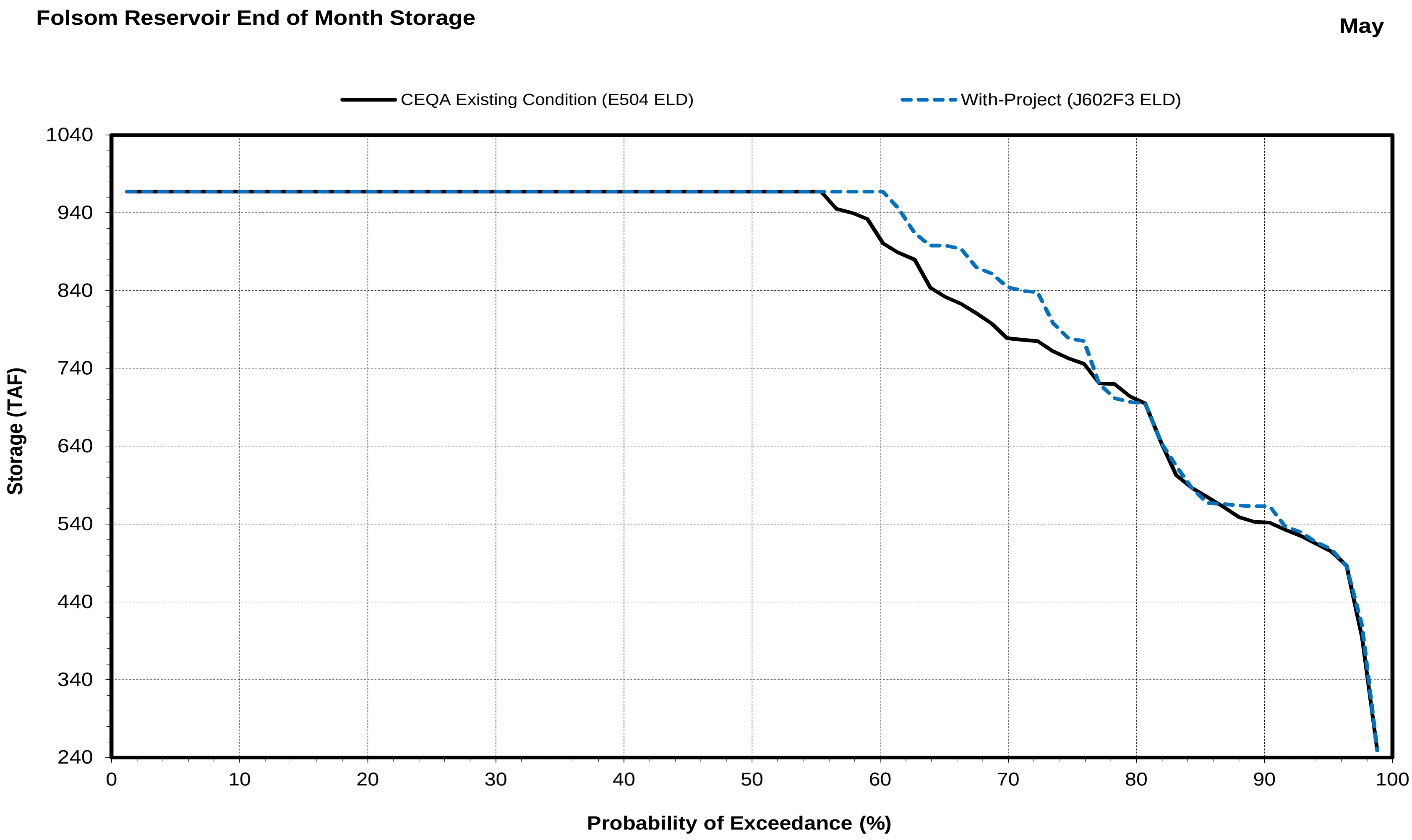
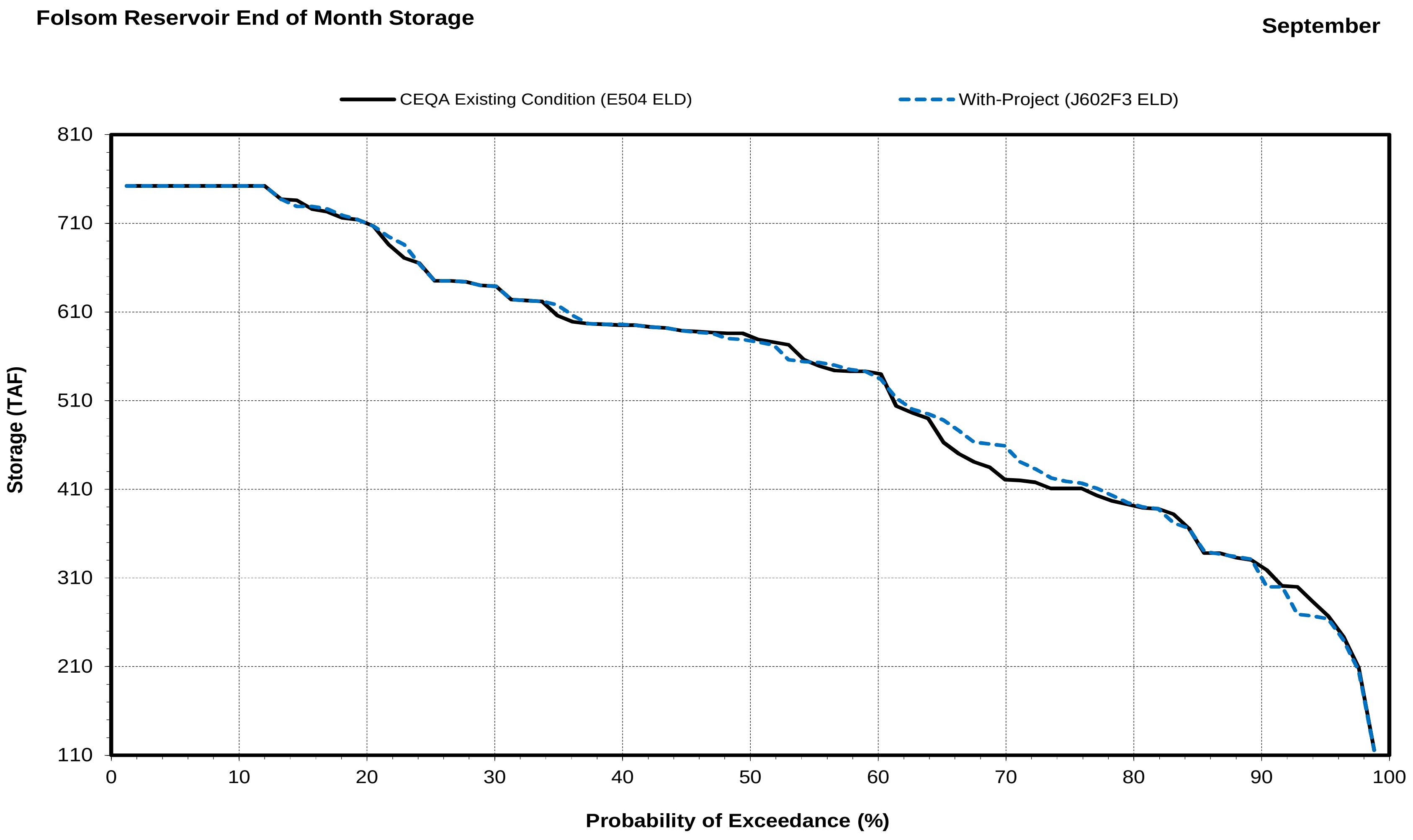
Figure 1 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

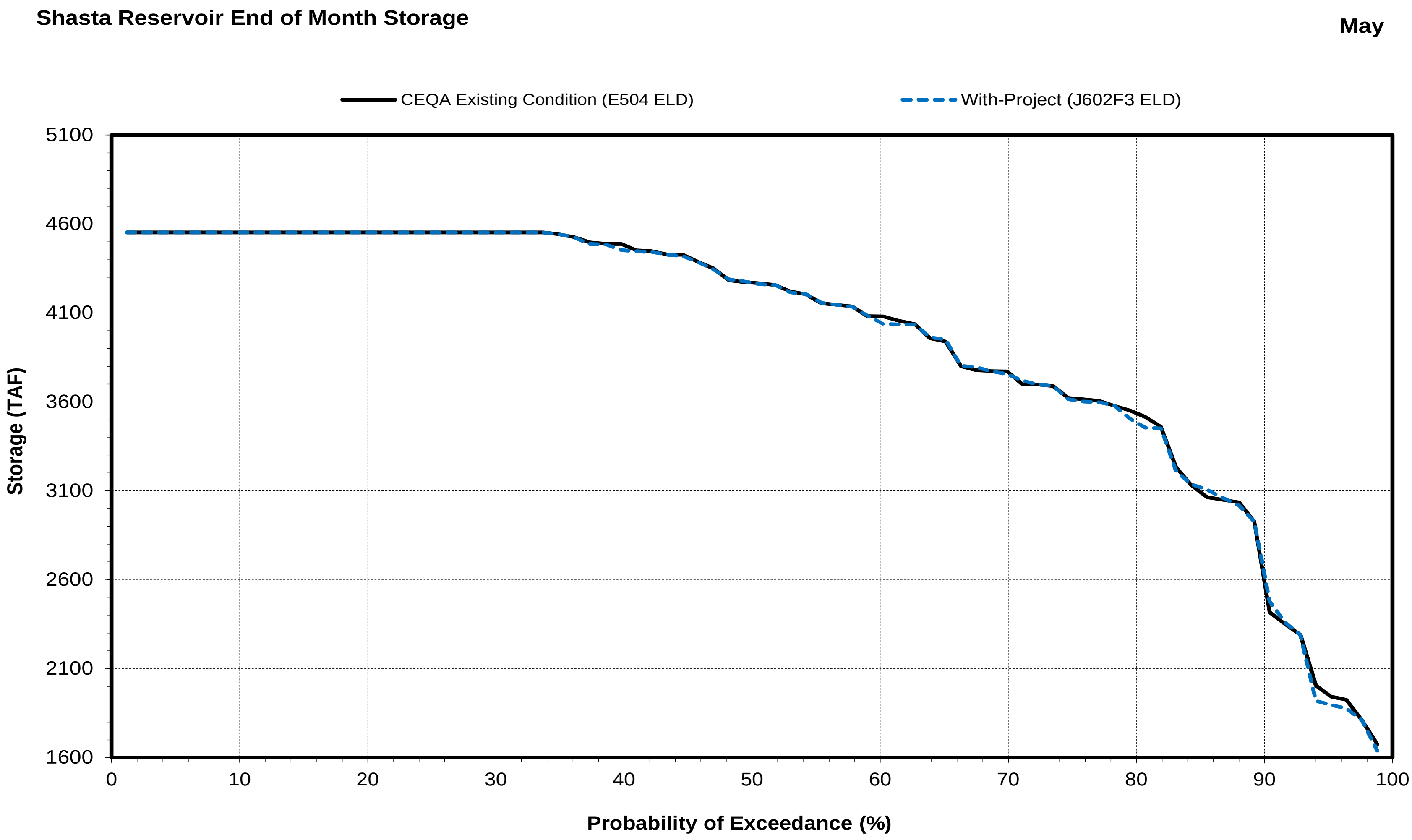
Figure 2 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

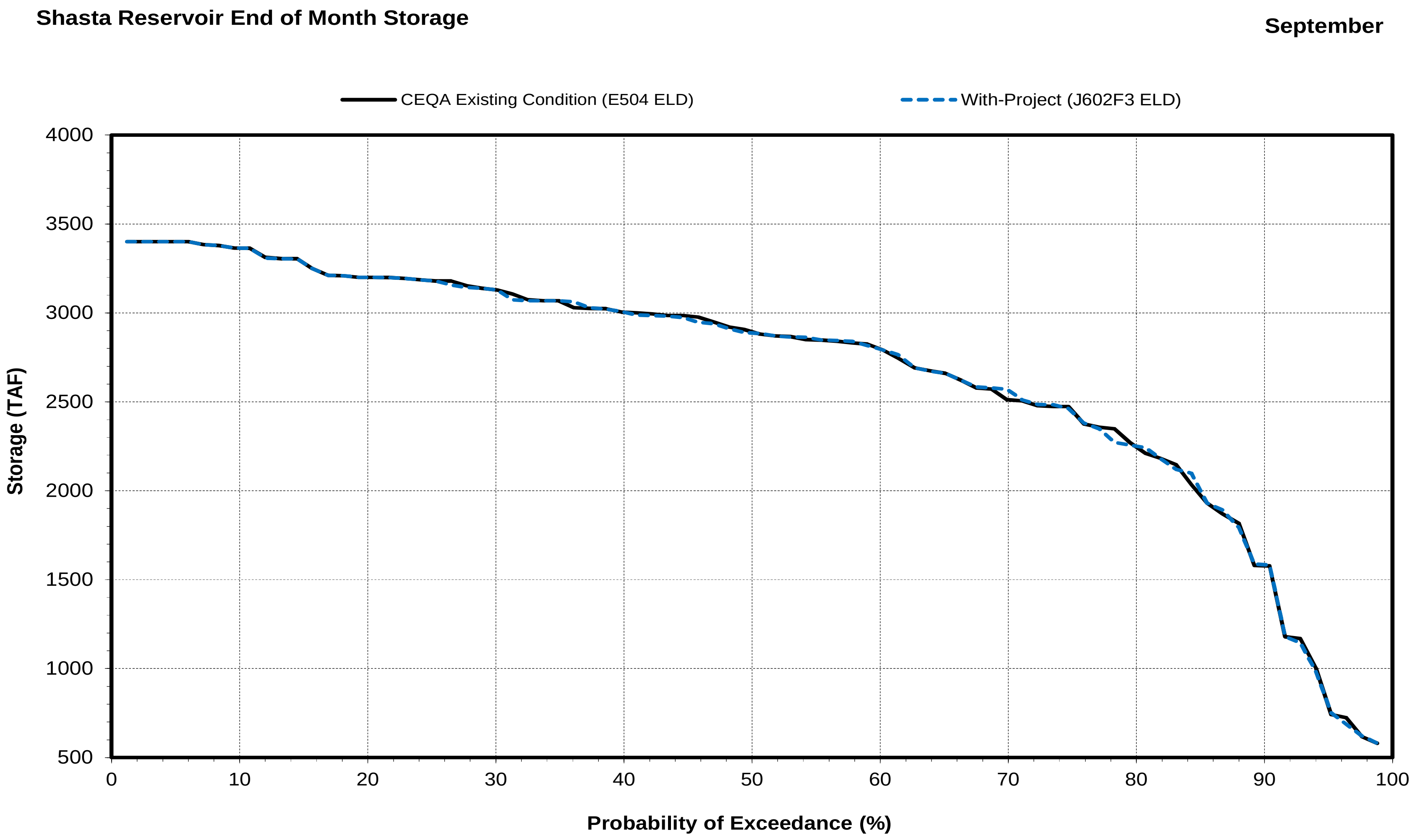
Figure 3 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

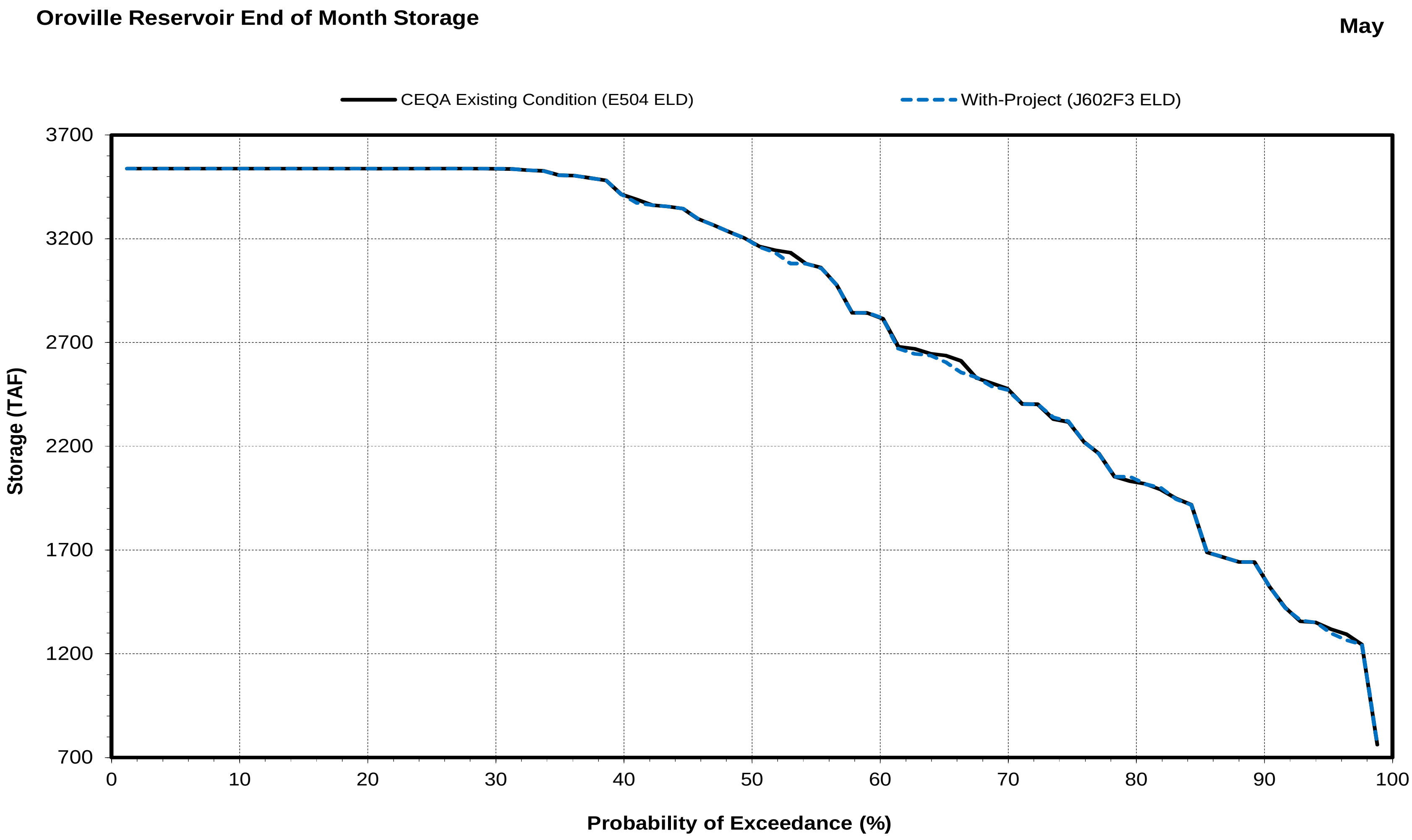
Figure 4 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

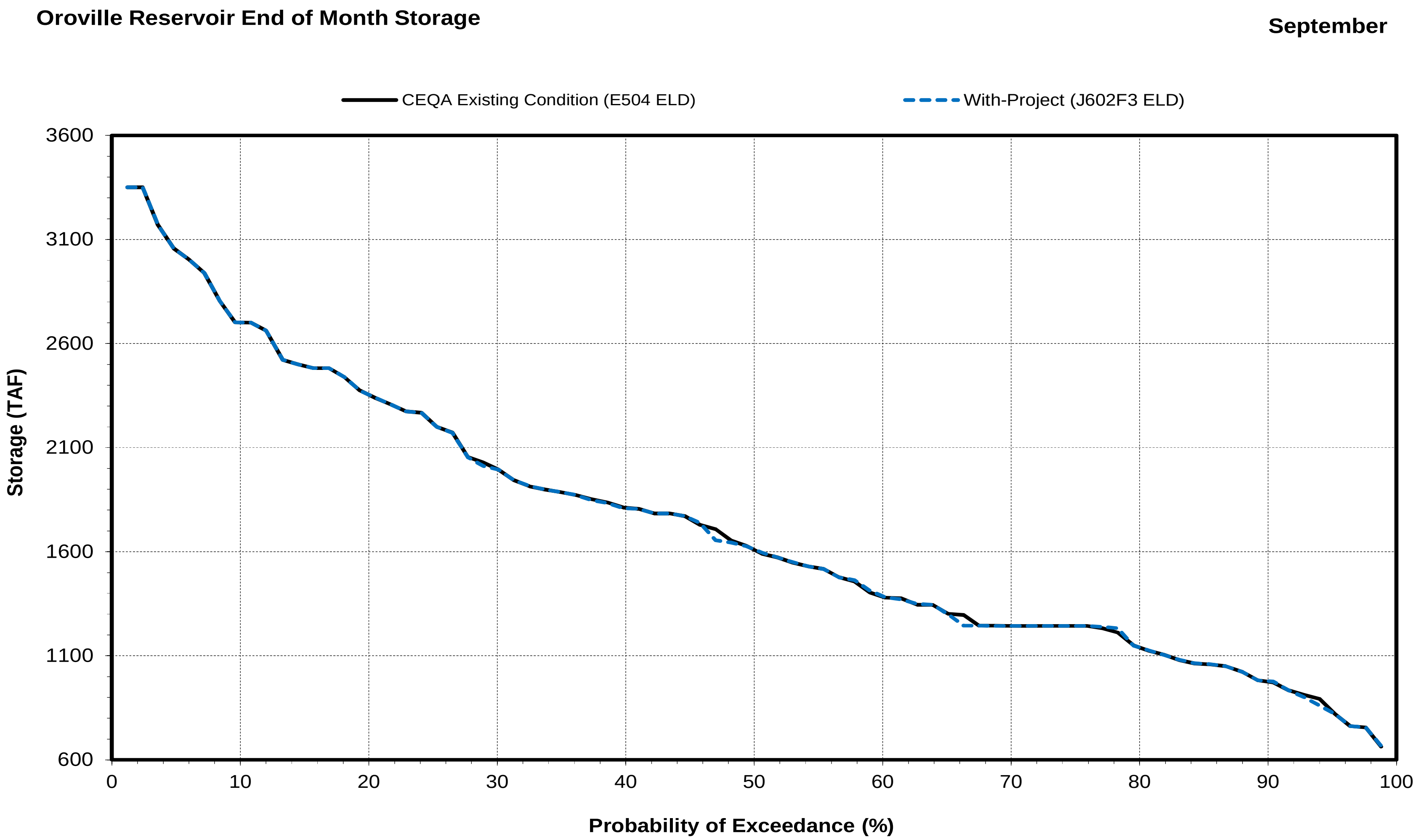
Figure 5 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

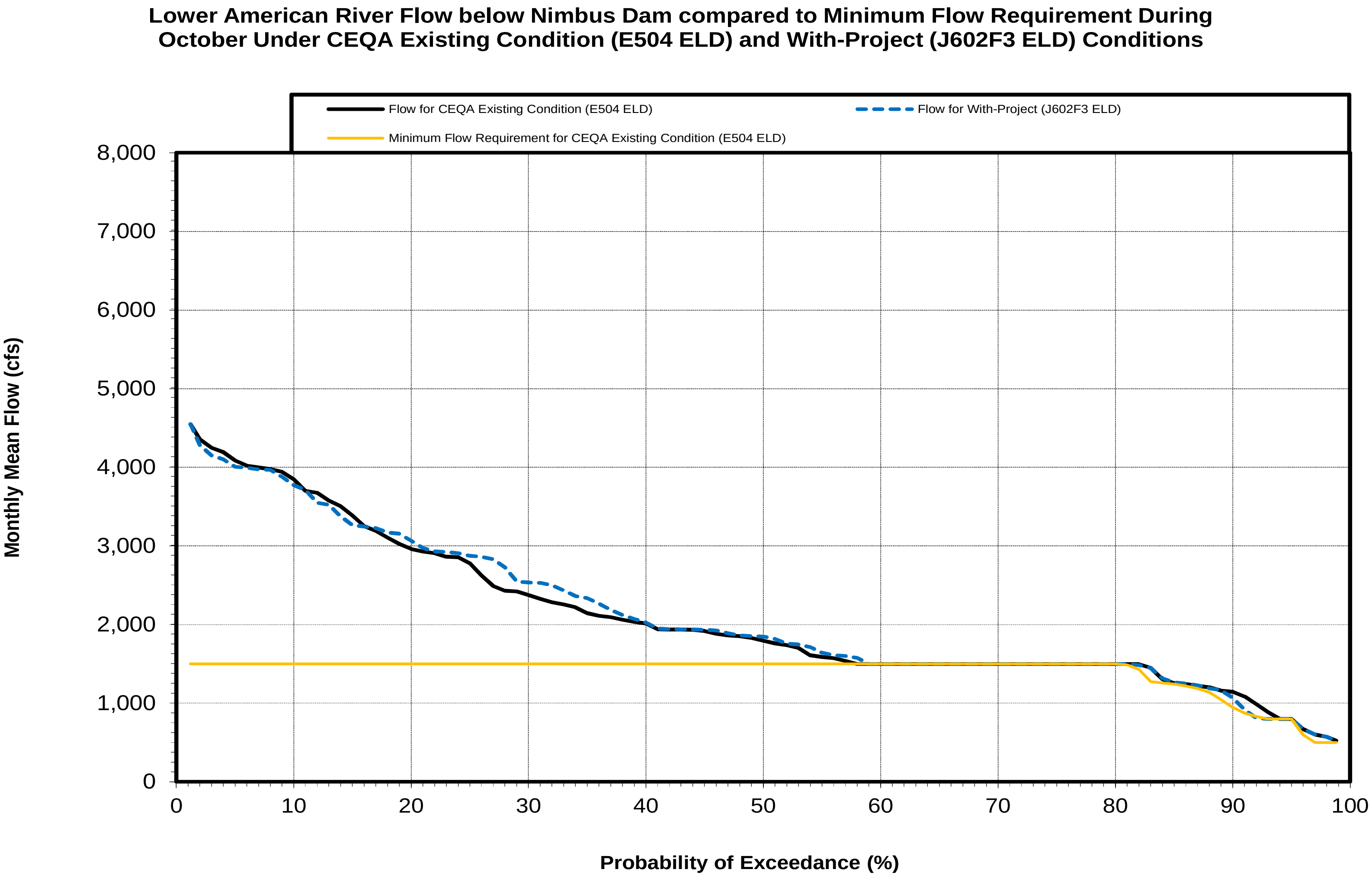
Figure 6 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

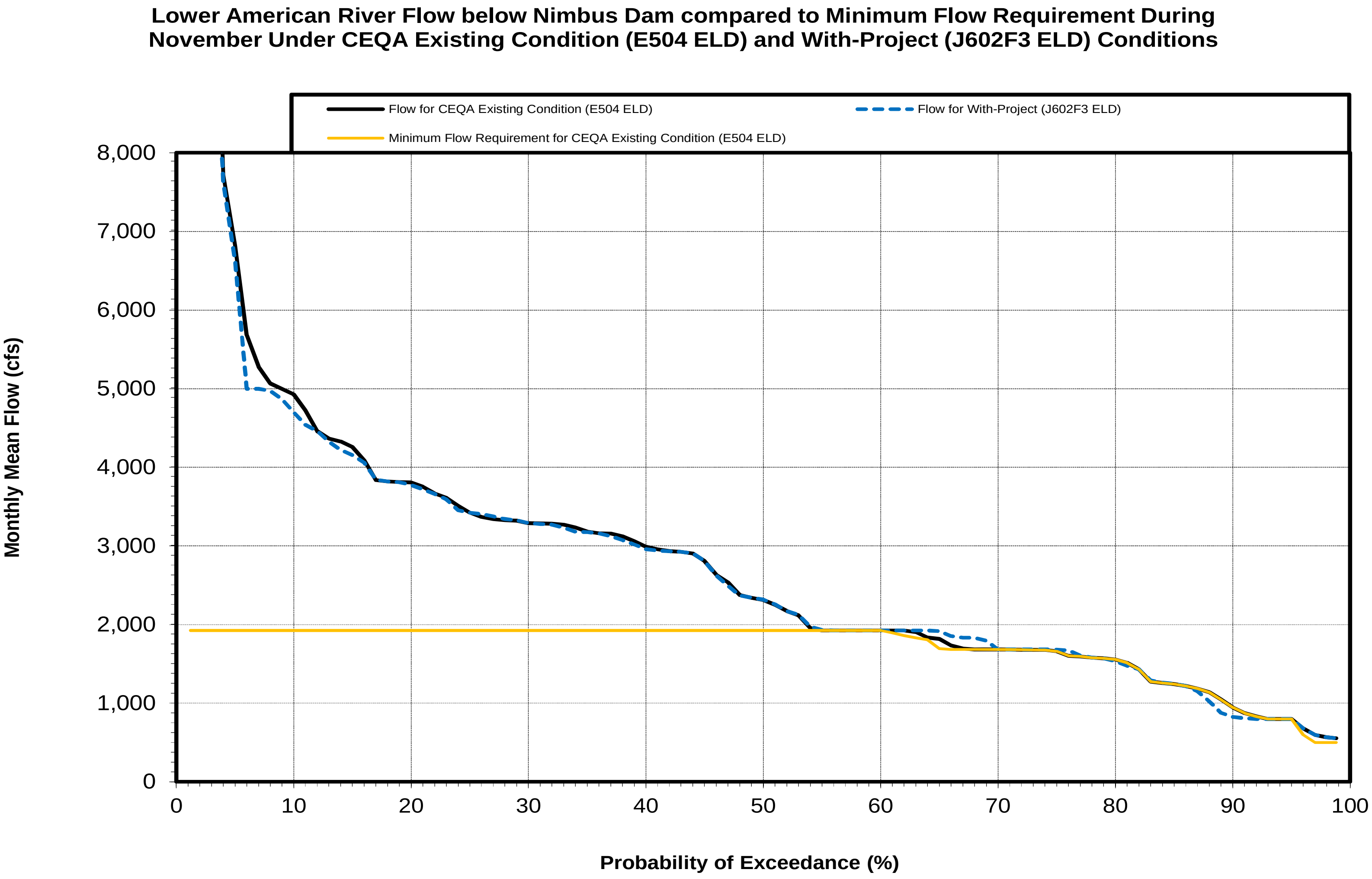
Figure 7 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

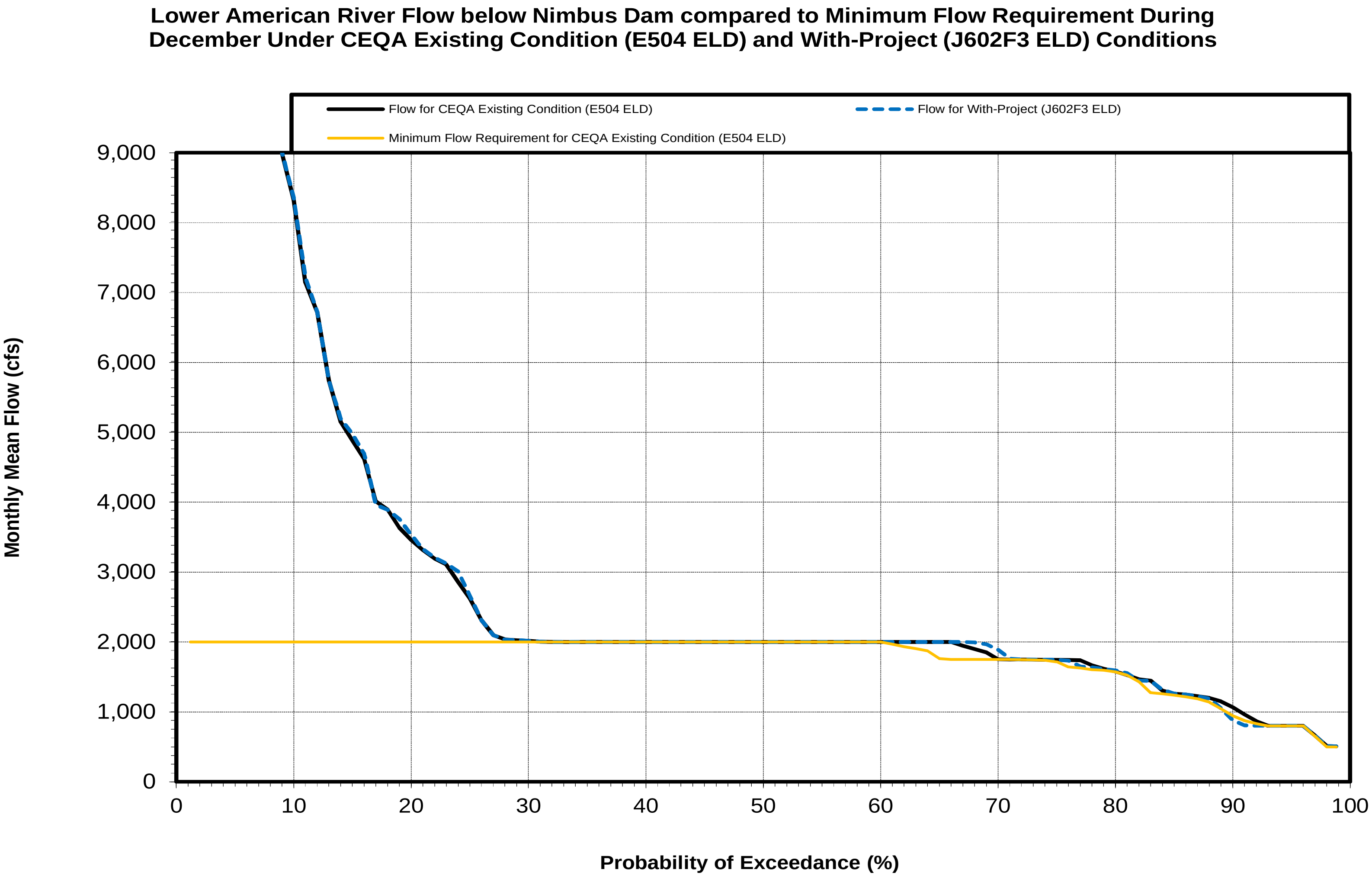
Figure 8 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

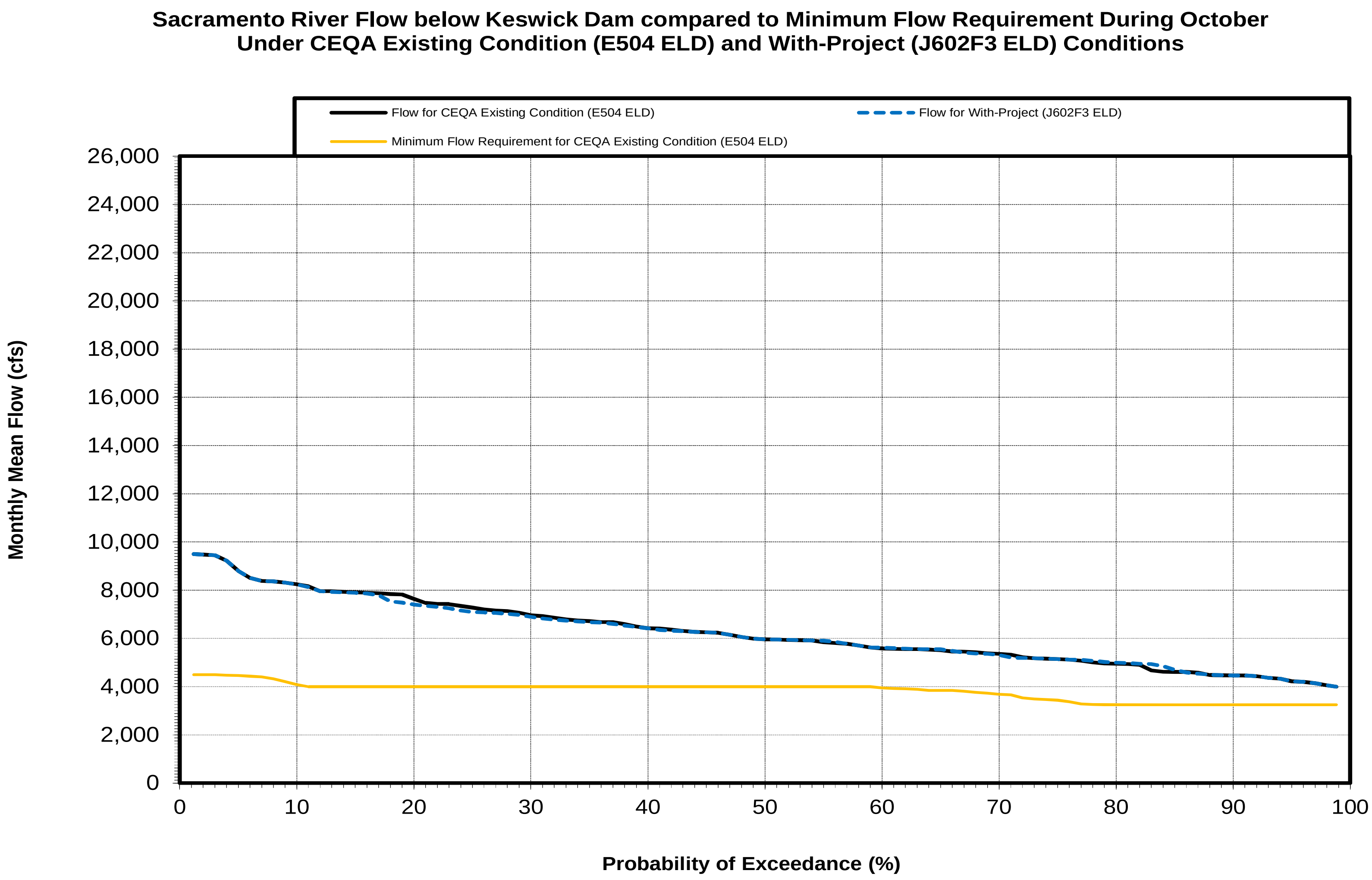
Figure 9 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

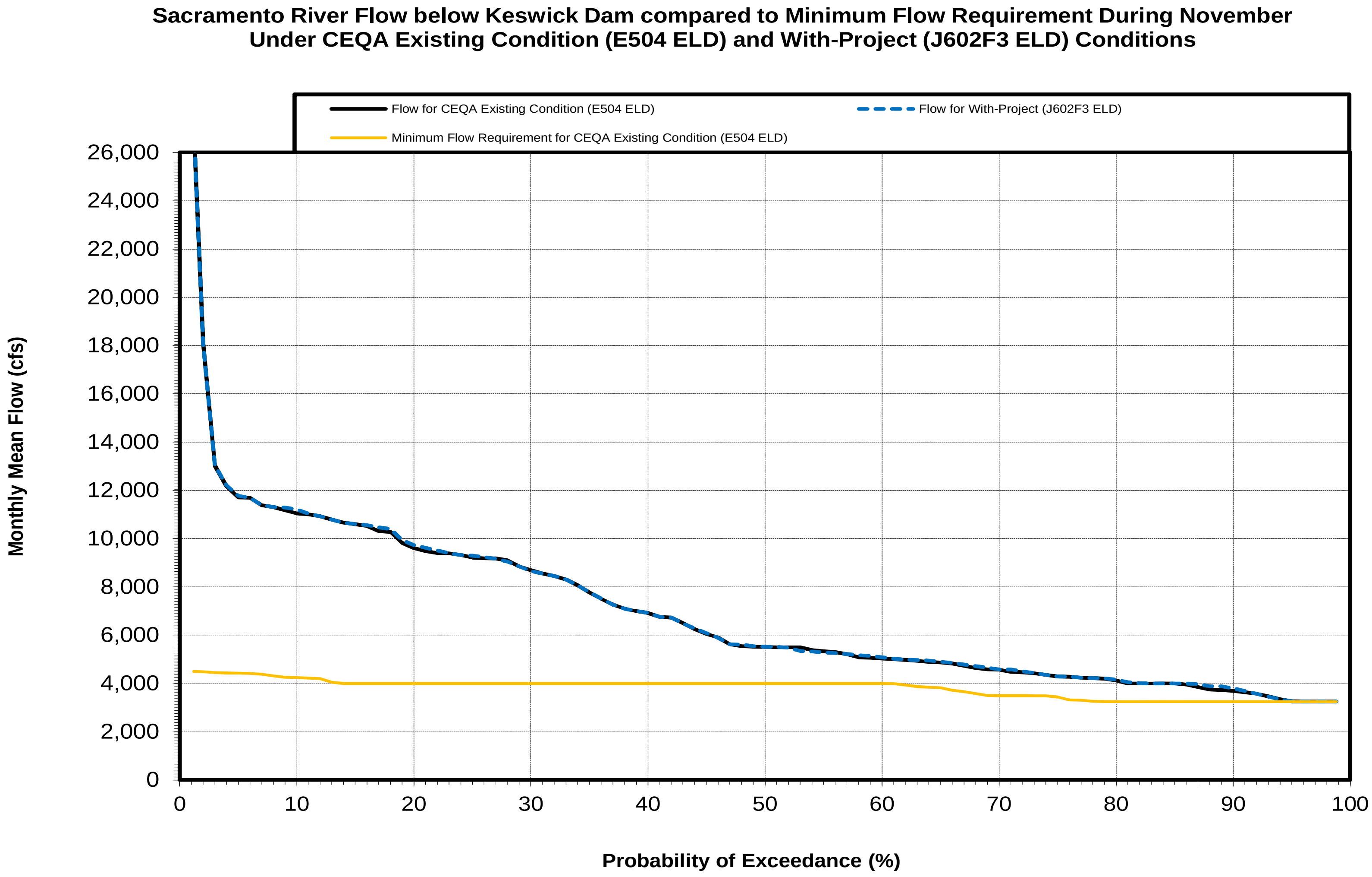
Figure 10 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

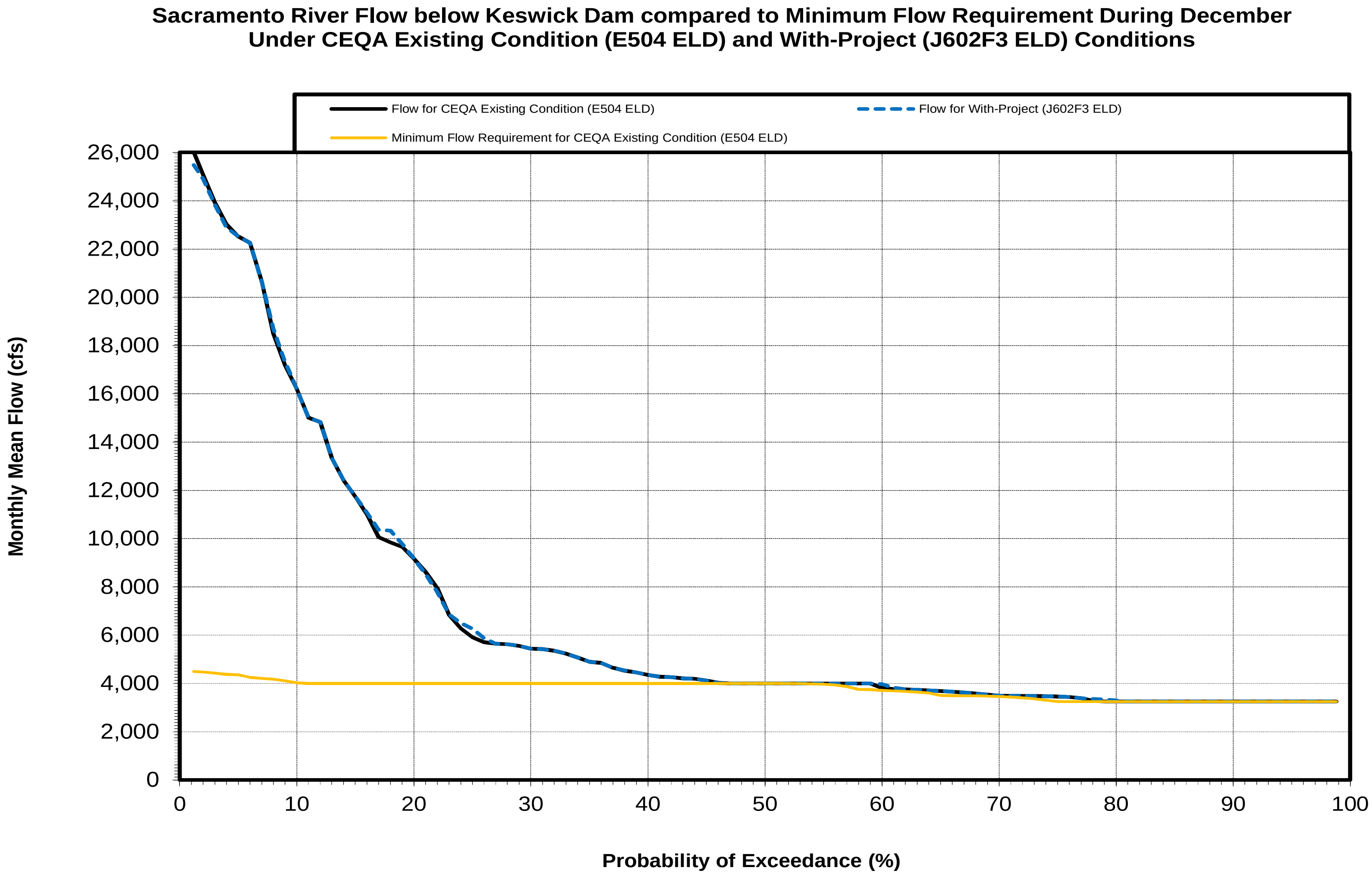
Figure 11 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

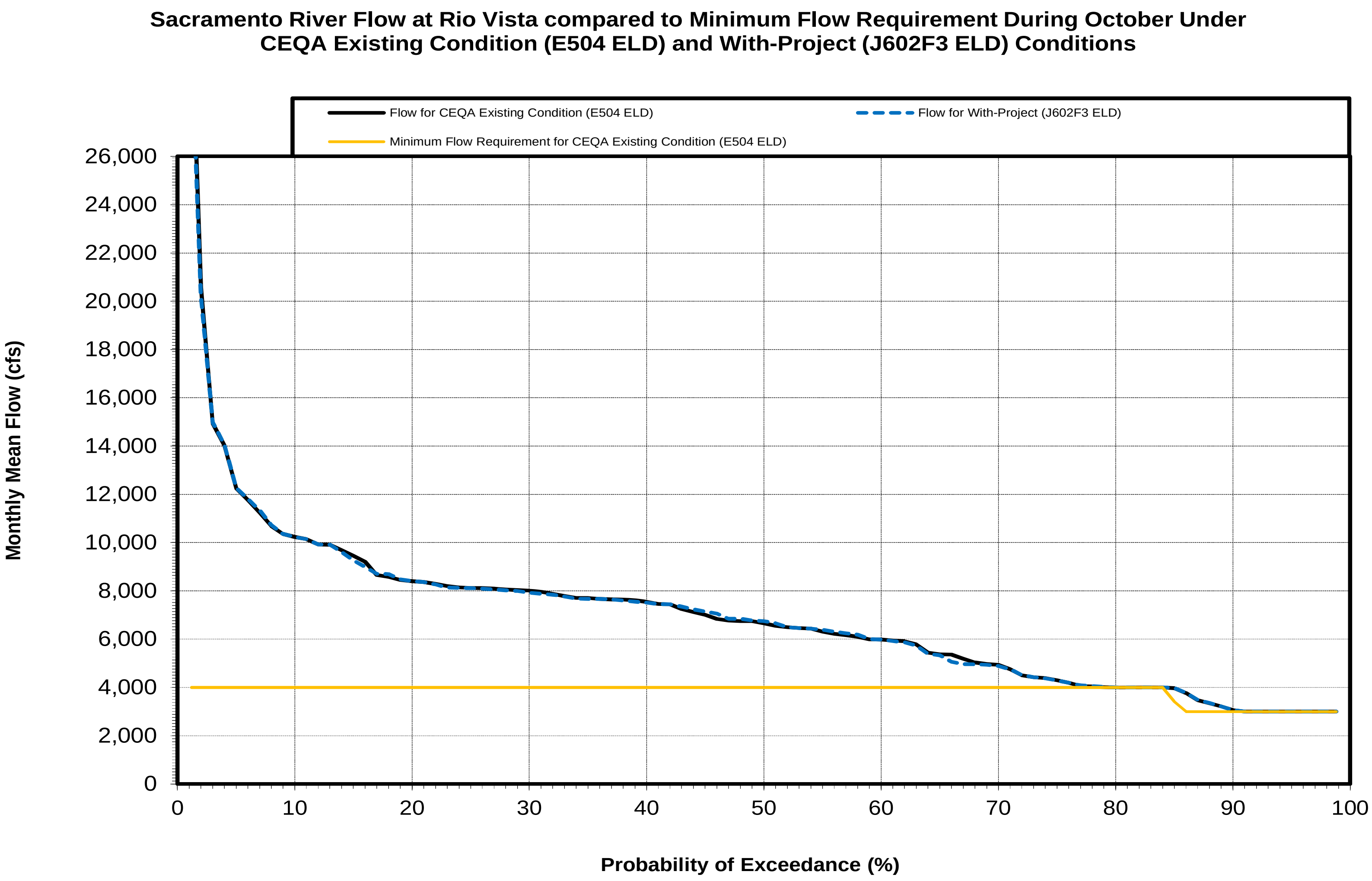
Figure 12 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

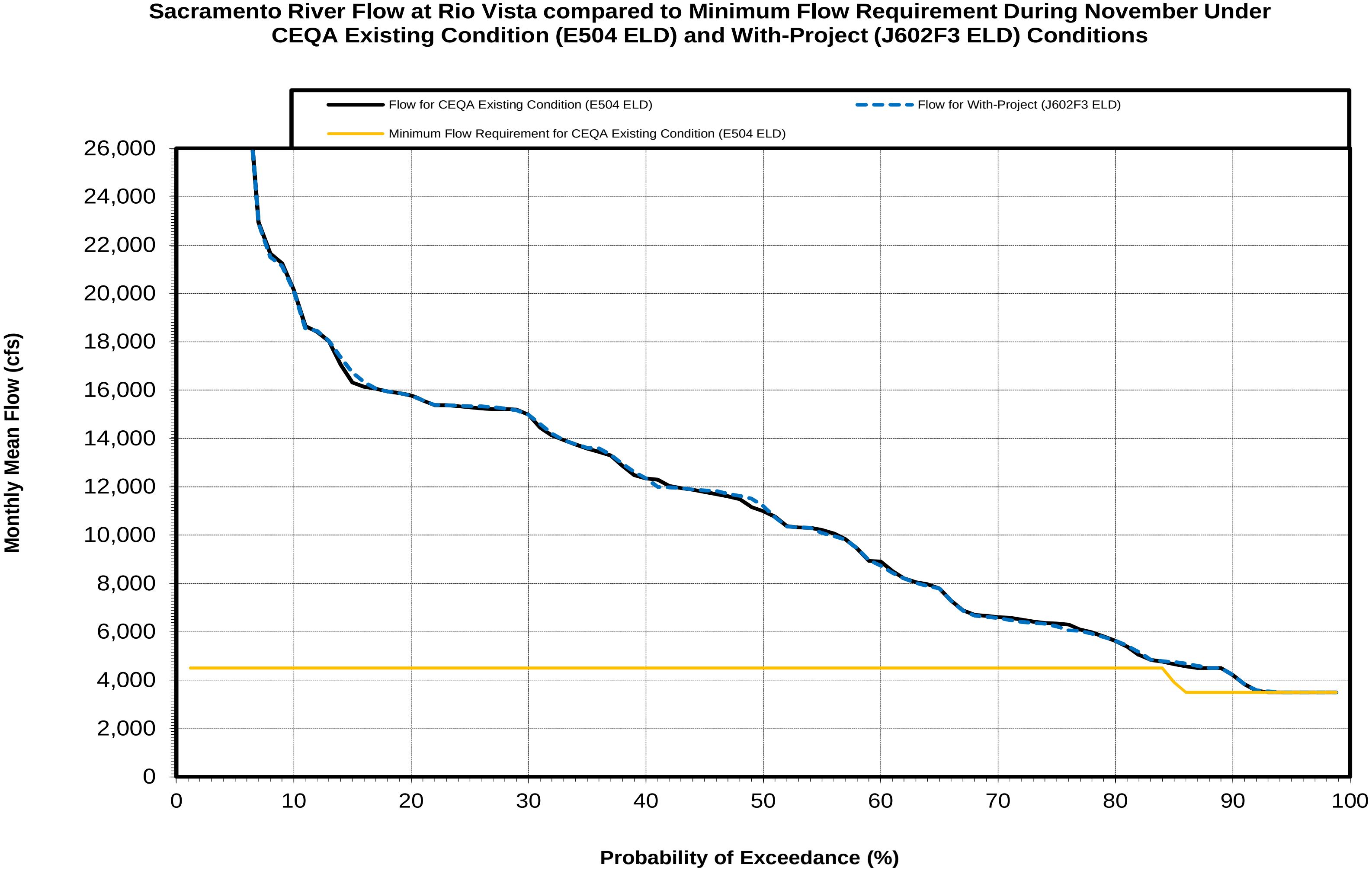
Figure 13 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

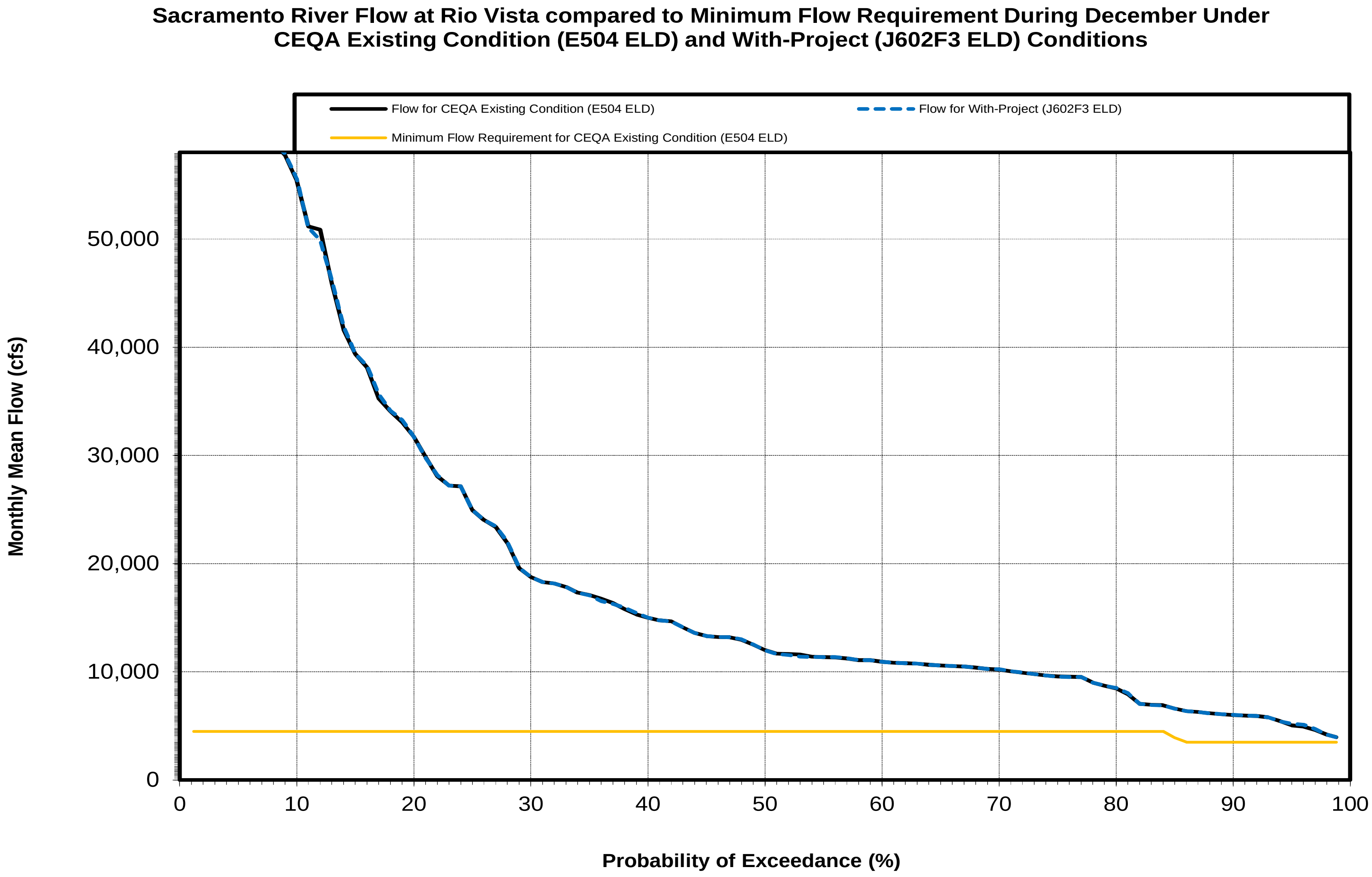
Figure 14 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 15 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 1 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to CVP M&I Contractors North of Delta Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period[2]	
CEQA Existing Condition (E504 ELD)	220
With-Project (J602F3 ELD)	221
Absolute Difference	1
Relative Difference[3]	0
Water Year Types[1]	
Wet	
CEQA Existing Condition (E504 ELD)	246
With-Project (J602F3 ELD)	246
Absolute Difference	0
Relative Difference	0
Above Normal	
CEQA Existing Condition (E504 ELD)	264
With-Project (J602F3 ELD)	266
Absolute Difference	2
Relative Difference	1
Below Normal	
CEQA Existing Condition (E504 ELD)	219
With-Project (J602F3 ELD)	219
Absolute Difference	0
Relative Difference	0
Dry	
CEQA Existing Condition (E504 ELD)	192
With-Project (J602F3 ELD)	192
Absolute Difference	0
Relative Difference	0
Critical	
CEQA Existing Condition (E504 ELD)	170
With-Project (J602F3 ELD)	170
Absolute Difference	0
Relative Difference	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 annual average

Table 2 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to CVP Agricultural Contractors North of Delta Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period²	
CEQA Existing Condition (E504 ELD)	229
With-Project (J602F3 ELD)	232
Absolute Difference	3
Relative Difference³	1
Water Year Types¹	
Wet	
CEQA Existing Condition (E504 ELD)	329
With-Project (J602F3 ELD)	334
Absolute Difference	5
Relative Difference	2
Above Normal	
CEQA Existing Condition (E504 ELD)	317
With-Project (J602F3 ELD)	325
Absolute Difference	8
Relative Difference	3
Below Normal	
CEQA Existing Condition (E504 ELD)	216
With-Project (J602F3 ELD)	218
Absolute Difference	2
Relative Difference	1
Dry	
CEQA Existing Condition (E504 ELD)	155
With-Project (J602F3 ELD)	156
Absolute Difference	1
Relative Difference	1
Critical	
CEQA Existing Condition (E504 ELD)	55
With-Project (J602F3 ELD)	56
Absolute Difference	1
Relative Difference	2

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 annual average

Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 3 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to CVP Settlement Contractors North of Delta Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period[2]	
CEQA Existing Condition (E504 ELD)	1,863
With-Project (J602F3 ELD)	1,863
Absolute Difference	0
Relative Difference[3]	0
Water Year Types[1]	
Wet	
CEQA Existing Condition (E504 ELD)	1,857
With-Project (J602F3 ELD)	1,857
Absolute Difference	0
Relative Difference	0
Above Normal	
CEQA Existing Condition (E504 ELD)	1,871
With-Project (J602F3 ELD)	1,871
Absolute Difference	0
Relative Difference	0
Below Normal	
CEQA Existing Condition (E504 ELD)	1,902
With-Project (J602F3 ELD)	1,902
Absolute Difference	0
Relative Difference	0
Dry	
CEQA Existing Condition (E504 ELD)	1,898
With-Project (J602F3 ELD)	1,898
Absolute Difference	0
Relative Difference	0
Critical	
CEQA Existing Condition (E504 ELD)	1,769
With-Project (J602F3 ELD)	1,769
Absolute Difference	0
Relative Difference	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 annual average

Table 4 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to CVP Refuges North of Delta Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period²	
CEQA Existing Condition (E504 ELD)	83
With-Project (J602F3 ELD)	83
Absolute Difference	0
Relative Difference³	0
Water Year Types¹	
Wet	
CEQA Existing Condition (E504 ELD)	88
With-Project (J602F3 ELD)	88
Absolute Difference	0
Relative Difference	0
Above Normal	
CEQA Existing Condition (E504 ELD)	88
With-Project (J602F3 ELD)	88
Absolute Difference	0
Relative Difference	0
Below Normal	
CEQA Existing Condition (E504 ELD)	89
With-Project (J602F3 ELD)	89
Absolute Difference	0
Relative Difference	0
Dry	
CEQA Existing Condition (E504 ELD)	85
With-Project (J602F3 ELD)	85
Absolute Difference	0
Relative Difference	0
Critical	
CEQA Existing Condition (E504 ELD)	57
With-Project (J602F3 ELD)	57
Absolute Difference	0
Relative Difference	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 annual average

Table 5 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to CVP M&I Contractors South of Delta Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period[2]	
CEQA Existing Condition (E504 ELD)	118
With-Project (J602F3 ELD)	118
Absolute Difference	0
Relative Difference[3]	0
Water Year Types[1]	
Wet	
CEQA Existing Condition (E504 ELD)	136
With-Project (J602F3 ELD)	137
Absolute Difference	1
Relative Difference	1
Above Normal	
CEQA Existing Condition (E504 ELD)	125
With-Project (J602F3 ELD)	125
Absolute Difference	0
Relative Difference	0
Below Normal	
CEQA Existing Condition (E504 ELD)	113
With-Project (J602F3 ELD)	113
Absolute Difference	0
Relative Difference	0
Dry	
CEQA Existing Condition (E504 ELD)	110
With-Project (J602F3 ELD)	110
Absolute Difference	0
Relative Difference	0
Critical	
CEQA Existing Condition (E504 ELD)	92
With-Project (J602F3 ELD)	91
Absolute Difference	-1
Relative Difference	-1

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 annual average

Table 6 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to CVP Agricultural Contractors South of Delta Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period[2]	
CEQA Existing Condition (E504 ELD)	915
With-Project (J602F3 ELD)	920
Absolute Difference	5
Relative Difference[3]	1
Water Year Types[1]	
Wet	
CEQA Existing Condition (E504 ELD)	1,401
With-Project (J602F3 ELD)	1,405
Absolute Difference	4
Relative Difference	0
Above Normal	
CEQA Existing Condition (E504 ELD)	1,076
With-Project (J602F3 ELD)	1,089
Absolute Difference	13
Relative Difference	1
Below Normal	
CEQA Existing Condition (E504 ELD)	778
With-Project (J602F3 ELD)	782
Absolute Difference	4
Relative Difference	1
Dry	
CEQA Existing Condition (E504 ELD)	654
With-Project (J602F3 ELD)	660
Absolute Difference	6
Relative Difference	1
Critical	
CEQA Existing Condition (E504 ELD)	265
With-Project (J602F3 ELD)	267
Absolute Difference	2
Relative Difference	1

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 annual average

Table 7 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to CVP Exchange Contractors South of Delta Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period²	
CEQA Existing Condition (E504 ELD)	852
With-Project (J602F3 ELD)	852
Absolute Difference	0
Relative Difference³	0
Water Year Types¹	
Wet	
CEQA Existing Condition (E504 ELD)	875
With-Project (J602F3 ELD)	875
Absolute Difference	0
Relative Difference	0
Above Normal	
CEQA Existing Condition (E504 ELD)	875
With-Project (J602F3 ELD)	875
Absolute Difference	0
Relative Difference	0
Below Normal	
CEQA Existing Condition (E504 ELD)	873
With-Project (J602F3 ELD)	873
Absolute Difference	0
Relative Difference	0
Dry	
CEQA Existing Condition (E504 ELD)	864
With-Project (J602F3 ELD)	864
Absolute Difference	0
Relative Difference	0
Critical	
CEQA Existing Condition (E504 ELD)	741
With-Project (J602F3 ELD)	741
Absolute Difference	0
Relative Difference	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 annual average

Table 8 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to CVP Refuges South of Delta Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period²	
CEQA Existing Condition (E504 ELD)	273
With-Project (J602F3 ELD)	273
Absolute Difference	0
Relative Difference³	0
Water Year Types¹	
Wet	
CEQA Existing Condition (E504 ELD)	281
With-Project (J602F3 ELD)	281
Absolute Difference	0
Relative Difference	0
Above Normal	
CEQA Existing Condition (E504 ELD)	280
With-Project (J602F3 ELD)	280
Absolute Difference	0
Relative Difference	0
Below Normal	
CEQA Existing Condition (E504 ELD)	281
With-Project (J602F3 ELD)	281
Absolute Difference	0
Relative Difference	0
Dry	
CEQA Existing Condition (E504 ELD)	277
With-Project (J602F3 ELD)	277
Absolute Difference	0
Relative Difference	0
Critical	
CEQA Existing Condition (E504 ELD)	234
With-Project (J602F3 ELD)	234
Absolute Difference	0
Relative Difference	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 annual average

Table 9 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to SWP Contractors Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period[2]	
CEQA Existing Condition (E504 ELD)	3,311
With-Project (J602F3 ELD)	3,309
Absolute Difference	-2
Relative Difference[3]	0
Water Year Types[1]	
Wet	
CEQA Existing Condition (E504 ELD)	4,129
With-Project (J602F3 ELD)	4,126
Absolute Difference	-3
Relative Difference	0
Above Normal	
CEQA Existing Condition (E504 ELD)	3,792
With-Project (J602F3 ELD)	3,792
Absolute Difference	0
Relative Difference	0
Below Normal	
CEQA Existing Condition (E504 ELD)	3,479
With-Project (J602F3 ELD)	3,472
Absolute Difference	-7
Relative Difference	0
Dry	
CEQA Existing Condition (E504 ELD)	2,709
With-Project (J602F3 ELD)	2,714
Absolute Difference	5
Relative Difference	0
Critical	
CEQA Existing Condition (E504 ELD)	1,804
With-Project (J602F3 ELD)	1,799
Absolute Difference	-5
Relative Difference	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 annual average

Table 10 E504ELD-J602F3ELD

Long-term Average Jones Pumping Plant Export and Average Jones Pumping Plant Export by Water Year Type Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Exports (TAF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	227	218	238	197	176	189	66	64	146	246	247	235
With-Project (J602F3 ELD)	228	219	238	197	176	189	66	64	148	246	248	236
Difference	1	1	0	0	0	0	0	0	2	0	1	1
Percent Difference[3]	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.4	0.4
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	241	231	243	217	218	237	88	90	221	280	282	262
With-Project (J602F3 ELD)	239	231	243	217	219	237	88	90	221	280	282	262
Difference	-2	0	0	0	1	0	0	0	0	0	0	0
Percent Difference	-0.8	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	205	224	241	189	170	233	58	53	192	243	279	244
With-Project (J602F3 ELD)	205	224	241	190	170	234	58	53	193	242	279	249
Difference	0	0	0	1	0	1	0	0	1	-1	0	5
Percent Difference	0.0	0.0	0.0	0.5	0.0	0.4	0.0	0.0	0.5	-0.4	0.0	2.0
Below Normal												
CEQA Existing Condition (E504 ELD)	247	231	254	187	163	190	53	52	133	267	251	257
With-Project (J602F3 ELD)	246	230	254	188	165	190	53	52	133	267	251	258
Difference	-1	-1	0	1	2	0	0	0	0	0	0	1
Percent Difference	-0.4	-0.4	0.0	0.5	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Dry												
CEQA Existing Condition (E504 ELD)	223	211	244	198	167	147	57	51	92	258	210	226
With-Project (J602F3 ELD)	228	214	244	198	167	145	57	51	96	258	214	227
Difference	5	3	0	0	0	-2	0	0	4	0	4	1
Percent Difference	2.2	1.4	0.0	0.0	0.0	-1.4	0.0	0.0	4.3	0.0	1.9	0.4
Critical												
CEQA Existing Condition (E504 ELD)	204	181	196	171	116	102	57	53	36	136	190	153
With-Project (J602F3 ELD)	206	184	198	169	116	101	57	53	37	133	189	152
Difference	2	3	2	-2	0	-1	0	0	1	-3	-1	-1
Percent Difference	1.0	1.7	1.0	-1.2	0.0	-1.0	0.0	0.0	2.8	-2.2	-0.5	-0.7

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 11 E504ELD-J602F3ELD

Long-term Average Banks Pumping Plant Export and Average Banks Pumping Plant Export by Water Year Type Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Exports (TAF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	211	229	303	224	228	247	64	63	148	371	322	314
With-Project (J602F3 ELD)	211	228	303	223	227	247	64	63	149	371	322	314
Difference	0	-1	0	-1	-1	0	0	0	1	0	0	0
Percent Difference[3]	0.0	-0.4	0.0	-0.4	-0.4	0.0	0.0	0.0	0.7	0.0	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	241	282	309	286	309	363	95	102	251	424	438	391
With-Project (J602F3 ELD)	240	282	309	286	309	363	95	102	251	424	438	391
Difference	-1	0	0	0	0	0	0	0	0	0	0	0
Percent Difference	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	201	205	349	209	226	286	57	49	177	408	431	398
With-Project (J602F3 ELD)	201	205	349	208	226	286	57	49	177	408	431	398
Difference	0	0	0	-1	0	0	0	0	0	0	0	0
Percent Difference	0.0	0.0	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below Normal												
CEQA Existing Condition (E504 ELD)	218	250	311	197	221	242	53	47	129	428	429	381
With-Project (J602F3 ELD)	219	247	312	196	218	242	53	47	129	428	428	378
Difference	1	-3	1	-1	-3	0	0	0	0	0	-1	-3
Percent Difference	0.5	-1.2	0.3	-0.5	-1.4	0.0	0.0	0.0	0.0	0.0	-0.2	-0.8
Dry												
CEQA Existing Condition (E504 ELD)	199	217	319	199	167	147	49	48	78	377	186	248
With-Project (J602F3 ELD)	197	216	319	199	167	150	49	48	83	376	187	251
Difference	-2	-1	0	0	0	3	0	0	5	-1	1	3
Percent Difference	-1.0	-0.5	0.0	0.0	0.0	2.0	0.0	0.0	6.4	-0.3	0.5	1.2
Critical												
CEQA Existing Condition (E504 ELD)	170	130	210	171	153	107	37	33	22	146	41	86
With-Project (J602F3 ELD)	171	130	211	169	153	107	37	33	21	146	41	86
Difference	1	0	1	-2	0	0	0	0	-1	0	0	0
Percent Difference	0.6	0.0	0.5	-1.2	0.0	0.0	0.0	0.0	-4.5	0.0	0.0	0.0

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 12 E504ELD-J602F3ELD

Long-term and Water Year Type Average Flow in Old and Middle River (OMR) Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
						Long-term						
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	-6,453	-6,704	-6,570	-3,649	-3,331	-2,904	859	258	-3,713	-9,213	-8,627	-8,219
With-Project (J602F3 ELD)	-6,459	-6,711	-6,577	-3,639	-3,336	-2,906	859	257	-3,743	-9,201	-8,636	-8,235
Difference	-6	-7	-7	10	-5	-2	0	-1	-30	12	-9	-16
Percent Difference[3]	-0.1	-0.1	-0.1	0.3	-0.2	-0.1	0.0	-0.4	-0.8	0.1	-0.1	-0.2
						Water Year Types[1]						
Wet												
CEQA Existing Condition (E504 ELD)	-7,017	-7,538	-5,693	-2,233	-2,656	-1,973	2,650	1,653	-4,417	-9,016	-10,460	-9,533
With-Project (J602F3 ELD)	-6,982	-7,547	-5,693	-2,230	-2,677	-1,977	2,650	1,653	-4,417	-9,016	-10,460	-9,528
Difference	35	-9	0	3	-21	-4	0	0	0	0	0	5
Percent Difference[3]	0.5	-0.1	0.0	0.1	-0.8	-0.2	0.0	0.0	0.0	0.0	0.0	0.1
Above Normal												
CEQA Existing Condition (E504 ELD)	-6,038	-6,531	-7,423	-3,657	-3,141	-4,133	1,051	330	-4,850	-9,925	-10,796	-9,726
With-Project (J602F3 ELD)	-6,032	-6,533	-7,423	-3,657	-3,149	-4,143	1,051	330	-4,850	-9,908	-10,798	-9,811
Difference	6	-2	0	0	-8	-10	0	0	0	17	-2	-85
Percent Difference[3]	0.1	0.0	0.0	0.0	-0.3	-0.2	0.0	0.0	0.0	0.2	0.0	-0.9
Below Normal												
CEQA Existing Condition (E504 ELD)	-6,863	-7,295	-7,283	-4,240	-3,577	-3,988	596	26	-4,134	-10,981	-10,424	-9,653
With-Project (J602F3 ELD)	-6,865	-7,232	-7,282	-4,240	-3,561	-3,990	596	26	-4,134	-10,992	-10,402	-9,612
Difference	-2	63	1	0	16	-2	0	0	0	-11	22	41
Percent Difference[3]	0.0	0.9	0.0	0.0	0.4	-0.1	0.0	0.0	0.0	-0.1	0.2	0.4
Dry												
CEQA Existing Condition (E504 ELD)	-6,192	-6,453	-7,483	-4,801	-4,164	-3,002	-368	-766	-3,072	-10,336	-6,251	-7,200
With-Project (J602F3 ELD)	-6,253	-6,502	-7,481	-4,803	-4,164	-3,001	-369	-766	-3,205	-10,318	-6,326	-7,257
Difference	-61	-49	2	-2	0	1	-1	0	-133	18	-75	-57
Percent Difference[3]	-1.0	-0.8	0.0	0.0	0.0	0.0	-0.3	0.0	-4.3	0.2	-1.2	-0.8
Critical												
CEQA Existing Condition (E504 ELD)	-5,562	-4,754	-5,417	-4,293	-3,445	-2,278	-1,066	-1,032	-1,519	-5,180	-3,953	-3,718
With-Project (J602F3 ELD)	-5,589	-4,784	-5,467	-4,229	-3,445	-2,272	-1,066	-1,037	-1,526	-5,131	-3,926	-3,718
Difference	-27	-30	-50	64	0	6	0	-5	-7	49	27	0
Percent Difference[3]	-0.5	-0.6	-0.9	1.5	0.0	0.3	0.0	-0.5	-0.5	0.9	0.7	0.0

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 13 E504ELD-J602F3ELD

Long-term and Driest Periods CVP Facilities Power and Pumping Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

					Baseline - CEQA Existing Condition (E504 ELD)	Alternative - With-Project (J602F3 ELD)	Difference = Alternative Minus Base	Percent Difference
CVP Facilities								
Power Facilities								
	Capacity	Total of all Facilities at load center[3]	(MW)	Long Term[1]	1,628	1,629	1	0.1
				Driest Periods[2]	1,320	1,320	0	0.0
	Energy Generation	Total of all Facilities at load center	(GWh)	Long Term	4,715	4,730	15	0.3
				Driest Periods	2,969	2,964	-5	-0.2
Pumping Facilities								
	Energy Use	Total of all Facilities at load center	(GWh)	Long Term	1,190	1,194	4	0.3
				Driest Periods	794	796	2	0.3
Losses								
	Foregone Energy[4]	Total of all Facilities	(GWh)	Long Term	251	245	-6	-2.4
				Driest Periods	19	19	0	0.0
	Transmission Losses	Total of all Facilities	(GWh)	Long Term	201	201	0	0.0
				Driest Periods	127	127	0	0.0
Total								
	Net Generation[5]	Total of all Facilities	(GWh)	Long Term	3,525	3,536	11	0.3
				Driest Periods	2,175	2,168	-7	-0.3

Notes:
1. Long Term is the average quantity for the calendar years 1922-2002.
2. Driest Periods is the average quantity for the calendar years 1929-1934, 1976-1977, and 1987-1992.
3. Load Center is the geographical area where energy is delivered, in this case the Western Area Power Administration's Tracy transmission area.
4. Foregone Energy is the difference between the reservoir release and the powerplant release; as a function of head requirement and energy factor at the powerplant.
5. Net Generation is the difference between energy generation and energy use at pumping facilities.

Table 14 E504ELD-J602F3ELD

Long-term and Driest Periods SWP Facilities Power and Pumping Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

					Baseline - CEQA Existing Condition (E504 ELD)	Alternative - With-Project (J602F3 ELD)	Difference = Alternative Minus Base	Percent Difference
SWP Facilities								
Power Facilities								
	Capacity	Total of all Facilities at load center[3]	(MW)	Long Term[1]	982	980	-2	-0.2
				Driest Periods[2]	561	558	-3	-0.5
	Energy Generation	Total of all Facilities at load center	(GWh)	Long Term	4,309	4,306	-3	-0.1
				Driest Periods	2,041	2,036	-5	-0.2
Pumping Facilities								
	Energy Use	Total of all Facilities at load center	(GWh)	Long Term	8,077	8,068	-9	-0.1
				Driest Periods	4,123	4,120	-3	-0.1
Losses								
	Foregone Energy[4]	Total of all Facilities	(GWh)	Long Term	79	80	1	1.3
				Driest Periods	16	20	4	25.0
	Transmission Losses	Total of all Facilities	(GWh)	Long Term	140	140	0	0.0
				Driest Periods	62	61	-1	-1.6
Total								
	Net Generation[5]	Total of all Facilities	(GWh)	Long Term	-3,768	-3,763	5	-0.1
				Driest Periods	-2,083	-2,084	-1	0.0

Notes:

1. Long Term is the average quantity for the calendar years 1922-2002.
2. Driest Periods is the average quantity for the calendar years 1929-1934, 1976-1977, and 1987-1992.
3. Load Center is the geographical area where energy is delivered, in this case the Western Area Power Administration's Tracy transmission area.
4. Foregone Energy is the difference between the reservoir release and the powerplant release; as a function of head requirement and energy factor at the powerplant.
5. Net Generation is the difference between energy generation and energy use at pumping facilities.

Table 15 E504ELD- J602F3ELD

Maximum and Minimum1 Power Capacity Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

				Baseline - CEQA Existing Condition (E504 ELD)	Alternative - With-Project (J602F3 ELD)	Difference = Alternative Minus Base	Percent Difference
CVP Facilities							
Power Facilities							
Capacity	Maximum of all Facilities at load center[2]	(MW) Month-Year		1996 Jun-83	1996 Jun-83	0	0.0
Capacity	Minimum of all Facilities at load center	(MW) Month-Year		657 Nov-77	657 Nov-77	0	0.0
SWP Facilities							
Power Facilities							
Capacity	Maximum of all Facilities at load center	(MW) Month-Year		1535 Mar-38	1535 Mar-38	0	0.0
Capacity	Minimum of all Facilities at load center	(MW) Month-Year		34 Oct-92	34 Oct-92	0.0	0.0

1. Maximum and Minimum quantity for the calendar years 1922-2002.
2. Load Center is the geographical area where energy is delivered, in this case the Western Area Power Administration's Tracy transmission area.

Table 42 E504ELD-J602F3ELD

Long-term and Water Year Type Average Sacramento River Water Temperature below Keswick Dam Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Temperature (ºF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	56.7	54.7	48.7	45.1	47.5	50.9	49.3	48.3	47.6	50.1	52.4	54.6
With-Project (J602F3 ELD)	56.7	54.7	48.7	45.1	47.4	50.9	49.3	48.3	47.6	50.1	52.4	54.6
Difference	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	56.1	54.3	48.6	45.7	48.4	50.9	48.9	48.0	47.4	49.4	50.7	52.7
With-Project (J602F3 ELD)	56.1	54.3	48.6	45.7	48.4	50.9	48.9	48.0	47.4	49.4	50.7	52.7
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	55.7	54.2	48.8	44.9	47.7	51.1	49.4	48.3	47.1	49.0	50.9	52.7
With-Project (J602F3 ELD)	55.7	54.2	48.8	44.9	47.7	51.1	49.4	48.3	47.1	49.0	50.9	52.6
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
Below Normal												
CEQA Existing Condition (E504 ELD)	56.7	55.3	49.3	44.9	46.9	51.1	49.6	48.4	47.5	49.6	51.7	53.5
With-Project (J602F3 ELD)	56.7	55.3	49.3	44.9	47.0	51.0	49.6	48.4	47.6	49.6	51.6	53.4
Difference	0.0	0.0	0.0	0.0	0.1	-0.1	0.0	0.0	0.1	0.0	-0.1	-0.1
Dry												
CEQA Existing Condition (E504 ELD)	56.9	54.3	48.5	44.8	46.9	51.5	49.7	48.3	47.6	49.7	52.1	54.8
With-Project (J602F3 ELD)	56.9	54.3	48.5	44.7	46.8	51.5	49.7	48.3	47.6	49.8	52.1	54.8
Difference	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Critical												
CEQA Existing Condition (E504 ELD)	58.6	55.8	48.5	44.9	46.7	50.0	49.4	48.6	48.7	53.5	58.6	61.7
With-Project (J602F3 ELD)	58.7	55.8	48.5	44.9	46.5	49.9	49.4	48.6	48.8	53.6	58.5	61.6
Difference	0.1	0.0	0.0	0.0	-0.2	-0.1	0.0	0.0	0.1	0.1	-0.1	-0.1

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

Table 43 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	64.5	64.7	0.2
2.4	63.6	63.6	0.0
3.7	62.0	62.1	0.1
4.9	61.6	61.7	0.1
6.1	61.6	61.6	0.0
7.3	61.3	61.4	0.1
8.5	61.3	61.1	-0.2
9.8	61.2	61.1	-0.1
11.0	61.1	60.8	-0.3
12.2	60.6	60.2	-0.4
13.4	60.4	60.2	-0.2
14.6	60.4	60.2	-0.2
15.9	60.3	60.2	-0.1
17.1	60.2	60.0	-0.2
18.3	59.5	59.6	0.1
19.5	59.5	59.5	0.0
20.7	59.2	59.2	0.0
22.0	58.9	58.9	0.0
23.2	58.9	58.8	-0.1
24.4	58.6	58.6	0.0
25.6	58.6	58.6	0.0
26.8	58.3	58.3	0.0
28.0	58.2	58.2	0.0
29.3	58.1	58.1	0.0
30.5	58.0	58.0	0.0
31.7	58.0	57.9	-0.1
32.9	57.7	57.9	0.2
34.1	57.6	57.7	0.1
35.4	57.3	57.2	-0.1
36.6	57.2	57.1	-0.1
37.8	57.1	57.0	-0.1
39.0	57.0	57.0	0.0
40.2	56.8	56.9	0.1
41.5	56.8	56.8	0.0
42.7	56.7	56.8	0.1
43.9	56.7	56.8	0.1
45.1	56.7	56.8	0.1
46.3	56.7	56.7	0.0
47.6	56.7	56.7	0.0
48.8	56.7	56.7	0.0
50.0	56.6	56.6	0.0
51.2	56.6	56.5	-0.1
52.4	56.5	56.5	0.0
53.7	56.4	56.4	0.0
54.9	56.4	56.4	0.0
56.1	56.4	56.3	-0.1
57.3	56.2	56.2	0.0
58.5	56.1	56.2	0.1
59.8	56.1	56.1	0.0
61.0	56.1	56.0	-0.1
62.2	56.0	56.0	0.0
63.4	55.9	55.9	0.0
64.6	55.9	55.9	0.0
65.9	55.9	55.9	0.0
67.1	55.9	55.8	-0.1
68.3	55.9	55.8	-0.1
69.5	55.8	55.7	-0.1
70.7	55.8	55.7	-0.1
72.0	55.7	55.5	-0.2
73.2	55.7	55.3	-0.4
74.4	55.1	55.1	0.0
75.6	55.0	55.0	0.0
76.8	54.8	54.8	0.0
78.0	54.6	54.6	0.0
79.3	54.6	54.6	0.0
80.5	54.6	54.5	-0.1
81.7	54.3	54.5	0.2
82.9	54.2	54.4	0.2
84.1	54.0	54.3	0.3
85.4	53.9	54.1	0.2
86.6	53.8	54.1	0.3
87.8	53.7	53.7	0.0
89.0	53.5	53.6	0.1
90.2	53.2	53.2	0.0
91.5	52.9	53.0	0.1
92.7	52.7	52.7	0.0
93.9	51.8	52.7	0.9
95.1	50.5	50.2	-0.3
96.3	50.0	50.0	0.0
97.6	47.7	47.7	0.0
98.8	46.3	46.3	0.0
Min	46.3	46.3	-0.4
Max	64.5	64.7	0.9
Mean	56.7	56.7	0.0
Median	56.6	56.6	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	96.3
X > 0.30		1.2
X < -0.30		2.5
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-1.2**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	95.0
X > 0.30		0.0
X < -0.30		5.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-5.0**

Table 44 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

November			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD) Temperature (ºF)**	**With-Project (J602F3 ELD) Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	59.7	59.7	0.0
2.4	59.3	59.3	0.0
3.7	58.9	58.9	0.0
4.9	58.4	58.4	0.0
6.1	58.3	58.4	0.1
7.3	58.1	58.1	0.0
8.5	57.5	57.5	0.0
9.8	57.4	57.4	0.0
11.0	57.4	57.3	-0.1
12.2	57.3	57.3	0.0
13.4	57.2	57.2	0.0
14.6	57.0	57.0	0.0
15.9	56.9	56.9	0.0
17.1	56.8	56.8	0.0
18.3	56.4	56.4	0.0
19.5	56.3	56.4	0.1
20.7	56.2	56.3	0.1
22.0	56.2	56.2	0.0
23.2	56.2	56.2	0.0
24.4	56.0	56.0	0.0
25.6	55.8	55.8	0.0
26.8	55.7	55.8	0.1
28.0	55.6	55.6	0.0
29.3	55.3	55.5	0.2
30.5	55.3	55.3	0.0
31.7	55.2	55.3	0.1
32.9	55.1	55.2	0.1
34.1	55.1	55.1	0.0
35.4	55.0	55.1	0.1
36.6	54.9	55.0	0.1
37.8	54.9	55.0	0.1
39.0	54.9	54.9	0.0
40.2	54.8	54.8	0.0
41.5	54.7	54.7	0.0
42.7	54.6	54.6	0.0
43.9	54.6	54.6	0.0
45.1	54.6	54.6	0.0
46.3	54.6	54.6	0.0
47.6	54.5	54.5	0.0
48.8	54.5	54.5	0.0
50.0	54.4	54.5	0.1
51.2	54.4	54.4	0.0
52.4	54.4	54.3	-0.1
53.7	54.3	54.3	0.0
54.9	54.3	54.2	-0.1
56.1	54.2	54.2	0.0
57.3	54.1	54.1	0.0
58.5	54.1	54.1	0.0
59.8	54.1	54.1	0.0
61.0	54.1	54.1	0.0
62.2	54.1	54.0	-0.1
63.4	54.0	54.0	0.0
64.6	54.0	54.0	0.0
65.9	54.0	54.0	0.0
67.1	53.9	53.9	0.0
68.3	53.8	53.9	0.1
69.5	53.8	53.8	0.0
70.7	53.7	53.7	0.0
72.0	53.6	53.7	0.1
73.2	53.6	53.6	0.0
74.4	53.6	53.6	0.0
75.6	53.6	53.6	0.0
76.8	53.5	53.5	0.0
78.0	53.5	53.5	0.0
79.3	53.5	53.4	-0.1
80.5	53.2	53.2	0.0
81.7	53.0	53.0	0.0
82.9	52.9	52.9	0.0
84.1	52.9	52.8	-0.1
85.4	52.8	52.8	0.0
86.6	52.8	52.8	0.0
87.8	52.4	52.4	0.0
89.0	52.4	52.3	-0.1
90.2	51.7	51.7	0.0
91.5	51.6	51.6	0.0
92.7	51.6	51.6	0.0
93.9	51.6	51.5	-0.1
95.1	51.4	51.4	0.0
96.3	51.3	51.3	0.0
97.6	51.2	51.2	0.0
98.8	51.1	51.1	0.0
Min	51.1	51.1	-0.1
Max	59.7	59.7	0.2
Mean	54.7	54.7	0.0
Median	54.4	54.5	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 45 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	54.4	54.4	0.0
2.4	53.2	53.2	0.0
3.7	52.9	52.9	0.0
4.9	52.4	52.4	0.0
6.1	52.3	52.3	0.0
7.3	52.2	52.2	0.0
8.5	51.7	51.7	0.0
9.8	51.5	51.5	0.0
11.0	51.3	51.3	0.0
12.2	51.3	51.3	0.0
13.4	51.2	51.2	0.0
14.6	51.0	51.0	0.0
15.9	50.7	50.6	-0.1
17.1	50.3	50.3	0.0
18.3	50.2	50.2	0.0
19.5	50.1	50.1	0.0
20.7	49.9	49.9	0.0
22.0	49.9	49.9	0.0
23.2	49.9	49.9	0.0
24.4	49.8	49.8	0.0
25.6	49.8	49.8	0.0
26.8	49.8	49.8	0.0
28.0	49.7	49.7	0.0
29.3	49.7	49.7	0.0
30.5	49.7	49.7	0.0
31.7	49.3	49.3	0.0
32.9	49.3	49.2	-0.1
34.1	49.2	49.2	0.0
35.4	49.1	49.2	0.1
36.6	49.1	49.1	0.0
37.8	49.1	49.1	0.0
39.0	49.1	49.1	0.0
40.2	49.0	49.0	0.0
41.5	49.0	49.0	0.0
42.7	48.9	49.0	0.1
43.9	48.9	48.9	0.0
45.1	48.8	48.9	0.1
46.3	48.8	48.8	0.0
47.6	48.7	48.7	0.0
48.8	48.6	48.6	0.0
50.0	48.5	48.6	0.1
51.2	48.5	48.5	0.0
52.4	48.5	48.5	0.0
53.7	48.4	48.4	0.0
54.9	48.3	48.3	0.0
56.1	48.2	48.2	0.0
57.3	48.2	48.2	0.0
58.5	48.2	48.2	0.0
59.8	48.2	48.2	0.0
61.0	48.1	48.1	0.0
62.2	48.0	48.0	0.0
63.4	48.0	48.0	0.0
64.6	47.9	48.0	0.1
65.9	47.9	47.9	0.0
67.1	47.9	47.9	0.0
68.3	47.9	47.9	0.0
69.5	47.8	47.8	0.0
70.7	47.8	47.8	0.0
72.0	47.8	47.8	0.0
73.2	47.7	47.7	0.0
74.4	47.6	47.6	0.0
75.6	47.6	47.6	0.0
76.8	47.5	47.5	0.0
78.0	47.5	47.5	0.0
79.3	47.5	47.5	0.0
80.5	47.3	47.2	-0.1
81.7	47.0	46.9	-0.1
82.9	46.9	46.9	0.0
84.1	46.6	46.6	0.0
85.4	46.6	46.6	0.0
86.6	46.6	46.6	0.0
87.8	46.6	46.6	0.0
89.0	46.6	46.6	0.0
90.2	46.5	46.5	0.0
91.5	46.3	46.3	0.0
92.7	46.1	46.1	0.0
93.9	45.7	45.7	0.0
95.1	44.7	44.7	0.0
96.3	44.6	44.7	0.1
97.6	44.5	44.5	0.0
98.8	43.1	43.1	0.0
Min	43.1	43.1	-0.1
Max	54.4	54.4	0.1
Mean	48.7	48.7	0.0
Median	48.5	48.6	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 46 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	48.2	48.2	0.0
2.4	47.9	47.9	0.0
3.7	47.9	47.9	0.0
4.9	47.9	47.9	0.0
6.1	47.8	47.8	0.0
7.3	47.7	47.7	0.0
8.5	47.6	47.6	0.0
9.8	47.4	47.3	-0.1
11.0	47.2	47.2	0.0
12.2	47.1	47.1	0.0
13.4	47.0	47.0	0.0
14.6	46.9	46.9	0.0
15.9	46.6	46.6	0.0
17.1	46.6	46.6	0.0
18.3	46.6	46.6	0.0
19.5	46.6	46.6	0.0
20.7	46.5	46.5	0.0
22.0	46.3	46.3	0.0
23.2	46.3	46.3	0.0
24.4	46.3	46.3	0.0
25.6	46.2	46.3	0.1
26.8	46.2	46.2	0.0
28.0	46.1	46.1	0.0
29.3	46.1	46.1	0.0
30.5	46.1	46.1	0.0
31.7	46.1	46.1	0.0
32.9	46.1	46.1	0.0
34.1	46.0	46.0	0.0
35.4	46.0	46.0	0.0
36.6	45.9	45.9	0.0
37.8	45.9	45.8	-0.1
39.0	45.8	45.8	0.0
40.2	45.8	45.8	0.0
41.5	45.6	45.6	0.0
42.7	45.6	45.6	0.0
43.9	45.5	45.5	0.0
45.1	45.5	45.5	0.0
46.3	45.4	45.4	0.0
47.6	45.3	45.3	0.0
48.8	45.3	45.3	0.0
50.0	45.2	45.2	0.0
51.2	45.2	45.2	0.0
52.4	45.2	45.2	0.0
53.7	45.1	45.1	0.0
54.9	45.1	45.1	0.0
56.1	45.0	45.0	0.0
57.3	45.0	45.0	0.0
58.5	44.9	44.9	0.0
59.8	44.9	44.9	0.0
61.0	44.9	44.8	-0.1
62.2	44.8	44.8	0.0
63.4	44.8	44.8	0.0
64.6	44.8	44.8	0.0
65.9	44.6	44.6	0.0
67.1	44.6	44.6	0.0
68.3	44.6	44.6	0.0
69.5	44.6	44.6	0.0
70.7	44.4	44.4	0.0
72.0	44.3	44.3	0.0
73.2	44.2	44.2	0.0
74.4	44.0	44.0	0.0
75.6	43.9	43.9	0.0
76.8	43.8	43.9	0.1
78.0	43.8	43.8	0.0
79.3	43.8	43.8	0.0
80.5	43.7	43.8	0.1
81.7	43.6	43.6	0.0
82.9	43.6	43.6	0.0
84.1	43.5	43.6	0.1
85.4	43.5	43.5	0.0
86.6	43.4	43.3	-0.1
87.8	43.2	43.0	-0.2
89.0	42.9	42.9	0.0
90.2	42.8	42.8	0.0
91.5	42.8	42.8	0.0
92.7	42.7	42.7	0.0
93.9	42.6	42.6	0.0
95.1	41.2	41.2	0.0
96.3	41.1	41.1	0.0
97.6	40.7	40.7	0.0
98.8	40.2	40.2	0.0
Min	40.2	40.2	-0.2
Max	48.2	48.2	0.1
Mean	45.1	45.1	0.0
Median	45.2	45.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 47 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	53.2	53.2	0.0
2.4	52.5	52.5	0.0
3.7	52.2	52.2	0.0
4.9	51.8	51.8	0.0
6.1	50.7	50.7	0.0
7.3	50.7	50.7	0.0
8.5	50.4	50.4	0.0
9.8	50.4	50.3	-0.1
11.0	50.3	50.3	0.0
12.2	50.2	50.2	0.0
13.4	50.0	50.0	0.0
14.6	50.0	50.0	0.0
15.9	49.9	49.9	0.0
17.1	49.9	49.7	-0.2
18.3	49.7	49.5	-0.2
19.5	49.5	49.4	-0.1
20.7	49.5	49.1	-0.4
22.0	49.4	49.1	-0.3
23.2	49.1	49.1	0.0
24.4	49.1	49.0	-0.1
25.6	49.1	49.0	-0.1
26.8	49.1	49.0	-0.1
28.0	49.0	49.0	0.0
29.3	49.0	48.9	-0.1
30.5	48.9	48.8	-0.1
31.7	48.8	48.8	0.0
32.9	48.8	48.7	-0.1
34.1	48.6	48.6	0.0
35.4	48.5	48.5	0.0
36.6	48.5	48.5	0.0
37.8	48.4	48.4	0.0
39.0	48.4	48.4	0.0
40.2	48.4	48.3	-0.1
41.5	48.3	48.2	-0.1
42.7	48.2	48.1	-0.1
43.9	48.0	48.0	0.0
45.1	48.0	48.0	0.0
46.3	47.9	47.9	0.0
47.6	47.9	47.9	0.0
48.8	47.9	47.8	-0.1
50.0	47.8	47.8	0.0
51.2	47.4	47.4	0.0
52.4	47.3	47.2	-0.1
53.7	47.1	47.1	0.0
54.9	47.1	47.1	0.0
56.1	47.1	47.0	-0.1
57.3	46.9	46.9	0.0
58.5	46.8	46.8	0.0
59.8	46.8	46.8	0.0
61.0	46.7	46.7	0.0
62.2	46.6	46.6	0.0
63.4	46.6	46.6	0.0
64.6	46.6	46.6	0.0
65.9	46.5	46.5	0.0
67.1	46.4	46.4	0.0
68.3	46.3	46.3	0.0
69.5	46.2	46.2	0.0
70.7	46.2	46.2	0.0
72.0	46.2	46.2	0.0
73.2	45.9	45.9	0.0
74.4	45.7	45.7	0.0
75.6	45.6	45.6	0.0
76.8	45.5	45.5	0.0
78.0	45.5	45.4	-0.1
79.3	45.3	45.3	0.0
80.5	45.3	45.2	-0.1
81.7	45.2	45.2	0.0
82.9	45.2	45.2	0.0
84.1	45.2	45.0	-0.2
85.4	44.9	44.9	0.0
86.6	44.7	44.7	0.0
87.8	44.6	44.6	0.0
89.0	44.5	44.5	0.0
90.2	44.4	44.4	0.0
91.5	44.3	44.3	0.0
92.7	44.2	44.2	0.0
93.9	43.8	43.8	0.0
95.1	43.8	43.8	0.0
96.3	42.7	42.7	0.0
97.6	41.5	41.5	0.0
98.8	41.0	40.9	-0.1
Min	41.0	40.9	-0.4
Max	53.2	53.2	0.0
Mean	47.5	47.4	0.0
Median	47.8	47.8	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	98.8
X > 0.30		0.0
X < -0.30		1.2
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-1.2**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	95.0
X > 0.30		0.0
X < -0.30		5.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-5.0**

Table 48 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	57.0	57.0	0.0
2.4	56.0	56.0	0.0
3.7	55.9	55.9	0.0
4.9	55.3	55.3	0.0
6.1	55.0	55.0	0.0
7.3	54.5	54.5	0.0
8.5	54.4	54.4	0.0
9.8	54.4	54.4	0.0
11.0	54.0	54.0	0.0
12.2	53.9	53.9	0.0
13.4	53.7	53.8	0.1
14.6	53.6	53.7	0.1
15.9	53.6	53.6	0.0
17.1	53.5	53.5	0.0
18.3	53.3	53.3	0.0
19.5	53.3	53.3	0.0
20.7	53.3	53.2	-0.1
22.0	53.2	53.2	0.0
23.2	53.0	53.0	0.0
24.4	52.9	52.9	0.0
25.6	52.7	52.7	0.0
26.8	52.7	52.6	-0.1
28.0	52.6	52.6	0.0
29.3	52.6	52.5	-0.1
30.5	52.6	52.5	-0.1
31.7	52.5	52.4	-0.1
32.9	52.4	52.4	0.0
34.1	52.3	52.3	0.0
35.4	52.0	52.0	0.0
36.6	51.9	51.9	0.0
37.8	51.8	51.8	0.0
39.0	51.6	51.6	0.0
40.2	51.5	51.6	0.1
41.5	51.5	51.5	0.0
42.7	51.5	51.5	0.0
43.9	51.5	51.5	0.0
45.1	51.4	51.4	0.0
46.3	51.3	51.3	0.0
47.6	51.2	51.2	0.0
48.8	51.2	51.2	0.0
50.0	51.2	51.2	0.0
51.2	51.1	51.1	0.0
52.4	50.9	51.0	0.1
53.7	50.8	50.8	0.0
54.9	50.7	50.7	0.0
56.1	50.7	50.6	-0.1
57.3	50.2	50.3	0.1
58.5	50.0	50.2	0.2
59.8	50.0	50.0	0.0
61.0	50.0	50.0	0.0
62.2	49.7	49.7	0.0
63.4	49.6	49.6	0.0
64.6	49.6	49.6	0.0
65.9	49.5	49.5	0.0
67.1	49.4	49.4	0.0
68.3	49.3	49.3	0.0
69.5	49.3	49.1	-0.2
70.7	49.1	49.1	0.0
72.0	49.1	49.1	0.0
73.2	49.1	49.0	-0.1
74.4	49.0	48.9	-0.1
75.6	49.0	48.9	-0.1
76.8	48.9	48.9	0.0
78.0	48.9	48.8	-0.1
79.3	48.9	48.8	-0.1
80.5	48.8	48.8	0.0
81.7	48.6	48.6	0.0
82.9	48.4	48.4	0.0
84.1	48.3	48.3	0.0
85.4	48.2	48.2	0.0
86.6	47.8	47.8	0.0
87.8	47.8	47.8	0.0
89.0	47.8	47.8	0.0
90.2	47.8	47.7	-0.1
91.5	47.7	47.7	0.0
92.7	47.4	47.3	-0.1
93.9	47.1	47.1	0.0
95.1	47.0	47.0	0.0
96.3	46.5	46.5	0.0
97.6	46.2	46.2	0.0
98.8	44.9	44.8	-0.1
Min	44.9	44.8	-0.2
Max	57.0	57.0	0.2
Mean	50.9	50.9	0.0
Median	51.2	51.2	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 49 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	51.0	51.0	0.0
2.4	50.8	50.8	0.0
3.7	50.7	50.8	0.1
4.9	50.6	50.7	0.1
6.1	50.4	50.4	0.0
7.3	50.3	50.3	0.0
8.5	50.2	50.2	0.0
9.8	50.2	50.2	0.0
11.0	50.1	50.1	0.0
12.2	50.1	50.1	0.0
13.4	50.0	50.0	0.0
14.6	50.0	50.0	0.0
15.9	50.0	50.0	0.0
17.1	49.9	49.8	-0.1
18.3	49.9	49.8	-0.1
19.5	49.8	49.8	0.0
20.7	49.8	49.8	0.0
22.0	49.8	49.8	0.0
23.2	49.8	49.7	-0.1
24.4	49.7	49.7	0.0
25.6	49.7	49.7	0.0
26.8	49.7	49.7	0.0
28.0	49.7	49.7	0.0
29.3	49.7	49.7	0.0
30.5	49.7	49.6	-0.1
31.7	49.6	49.6	0.0
32.9	49.6	49.6	0.0
34.1	49.6	49.6	0.0
35.4	49.6	49.6	0.0
36.6	49.5	49.5	0.0
37.8	49.5	49.5	0.0
39.0	49.5	49.5	0.0
40.2	49.5	49.5	0.0
41.5	49.5	49.5	0.0
42.7	49.4	49.4	0.0
43.9	49.4	49.4	0.0
45.1	49.4	49.4	0.0
46.3	49.4	49.3	-0.1
47.6	49.3	49.3	0.0
48.8	49.3	49.3	0.0
50.0	49.3	49.3	0.0
51.2	49.3	49.3	0.0
52.4	49.3	49.3	0.0
53.7	49.2	49.3	0.1
54.9	49.2	49.2	0.0
56.1	49.2	49.2	0.0
57.3	49.2	49.2	0.0
58.5	49.2	49.2	0.0
59.8	49.2	49.2	0.0
61.0	49.1	49.2	0.1
62.2	49.1	49.1	0.0
63.4	49.1	49.1	0.0
64.6	49.1	49.1	0.0
65.9	49.1	49.1	0.0
67.1	49.1	49.1	0.0
68.3	49.1	49.1	0.0
69.5	49.1	49.1	0.0
70.7	49.1	49.1	0.0
72.0	49.1	49.1	0.0
73.2	49.1	49.0	-0.1
74.4	49.1	49.0	-0.1
75.6	49.0	49.0	0.0
76.8	49.0	49.0	0.0
78.0	49.0	49.0	0.0
79.3	48.9	48.9	0.0
80.5	48.8	48.8	0.0
81.7	48.8	48.8	0.0
82.9	48.7	48.8	0.1
84.1	48.7	48.7	0.0
85.4	48.6	48.6	0.0
86.6	48.6	48.6	0.0
87.8	48.5	48.5	0.0
89.0	48.5	48.5	0.0
90.2	48.4	48.4	0.0
91.5	48.4	48.4	0.0
92.7	48.3	48.3	0.0
93.9	48.3	48.3	0.0
95.1	48.2	48.2	0.0
96.3	48.2	48.2	0.0
97.6	48.1	48.1	0.0
98.8	47.9	47.9	0.0
Min	47.9	47.9	-0.1
Max	51.0	51.0	0.1
Mean	49.3	49.3	0.0
Median	49.3	49.3	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 50 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

May			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	50.4	50.4	0.0
2.4	49.6	49.6	0.0
3.7	49.6	49.6	0.0
4.9	49.2	49.2	0.0
6.1	49.2	49.2	0.0
7.3	49.1	49.2	0.1
8.5	49.1	49.1	0.0
9.8	49.1	49.1	0.0
11.0	49.1	48.9	-0.2
12.2	48.9	48.9	0.0
13.4	48.8	48.8	0.0
14.6	48.8	48.8	0.0
15.9	48.8	48.8	0.0
17.1	48.8	48.8	0.0
18.3	48.8	48.8	0.0
19.5	48.8	48.8	0.0
20.7	48.8	48.7	-0.1
22.0	48.7	48.7	0.0
23.2	48.7	48.7	0.0
24.4	48.7	48.6	-0.1
25.6	48.6	48.6	0.0
26.8	48.6	48.6	0.0
28.0	48.6	48.6	0.0
29.3	48.6	48.6	0.0
30.5	48.5	48.5	0.0
31.7	48.5	48.5	0.0
32.9	48.5	48.5	0.0
34.1	48.5	48.5	0.0
35.4	48.5	48.5	0.0
36.6	48.5	48.5	0.0
37.8	48.4	48.4	0.0
39.0	48.4	48.4	0.0
40.2	48.4	48.4	0.0
41.5	48.3	48.3	0.0
42.7	48.3	48.3	0.0
43.9	48.3	48.3	0.0
45.1	48.3	48.3	0.0
46.3	48.3	48.3	0.0
47.6	48.3	48.3	0.0
48.8	48.2	48.2	0.0
50.0	48.2	48.2	0.0
51.2	48.2	48.2	0.0
52.4	48.2	48.1	-0.1
53.7	48.2	48.1	-0.1
54.9	48.1	48.1	0.0
56.1	48.1	48.1	0.0
57.3	48.1	48.1	0.0
58.5	48.0	48.0	0.0
59.8	48.0	48.0	0.0
61.0	48.0	48.0	0.0
62.2	48.0	48.0	0.0
63.4	48.0	48.0	0.0
64.6	48.0	48.0	0.0
65.9	48.0	48.0	0.0
67.1	48.0	48.0	0.0
68.3	47.9	47.9	0.0
69.5	47.9	47.9	0.0
70.7	47.9	47.9	0.0
72.0	47.9	47.9	0.0
73.2	47.9	47.9	0.0
74.4	47.9	47.9	0.0
75.6	47.9	47.9	0.0
76.8	47.9	47.9	0.0
78.0	47.8	47.8	0.0
79.3	47.8	47.8	0.0
80.5	47.7	47.8	0.1
81.7	47.7	47.8	0.1
82.9	47.7	47.7	0.0
84.1	47.7	47.7	0.0
85.4	47.6	47.7	0.1
86.6	47.6	47.6	0.0
87.8	47.6	47.6	0.0
89.0	47.6	47.6	0.0
90.2	47.5	47.5	0.0
91.5	47.4	47.4	0.0
92.7	47.3	47.3	0.0
93.9	47.3	47.3	0.0
95.1	47.3	47.3	0.0
96.3	47.2	47.2	0.0
97.6	47.2	47.2	0.0
98.8	47.0	47.0	0.0
Min	47.0	47.0	-0.2
Max	50.4	50.4	0.1
Mean	48.3	48.3	0.0
Median	48.2	48.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 51 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

June			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	51.7	51.7	0.0
2.4	50.9	51.3	0.4
3.7	50.8	51.2	0.4
4.9	49.9	49.9	0.0
6.1	49.4	49.4	0.0
7.3	49.2	49.4	0.2
8.5	48.9	48.9	0.0
9.8	48.4	48.5	0.1
11.0	48.4	48.5	0.1
12.2	48.3	48.2	-0.1
13.4	48.2	48.2	0.0
14.6	48.1	48.2	0.1
15.9	48.0	48.1	0.1
17.1	48.0	48.0	0.0
18.3	47.9	48.0	0.1
19.5	47.9	47.9	0.0
20.7	47.9	47.9	0.0
22.0	47.9	47.9	0.0
23.2	47.7	47.9	0.2
24.4	47.7	47.8	0.1
25.6	47.7	47.7	0.0
26.8	47.6	47.6	0.0
28.0	47.6	47.6	0.0
29.3	47.6	47.6	0.0
30.5	47.6	47.6	0.0
31.7	47.6	47.6	0.0
32.9	47.6	47.5	-0.1
34.1	47.5	47.5	0.0
35.4	47.5	47.5	0.0
36.6	47.5	47.4	-0.1
37.8	47.4	47.4	0.0
39.0	47.4	47.4	0.0
40.2	47.4	47.4	0.0
41.5	47.4	47.4	0.0
42.7	47.4	47.4	0.0
43.9	47.4	47.4	0.0
45.1	47.4	47.4	0.0
46.3	47.4	47.4	0.0
47.6	47.4	47.4	0.0
48.8	47.4	47.4	0.0
50.0	47.4	47.4	0.0
51.2	47.3	47.4	0.1
52.4	47.3	47.4	0.1
53.7	47.3	47.3	0.0
54.9	47.3	47.3	0.0
56.1	47.3	47.3	0.0
57.3	47.3	47.3	0.0
58.5	47.2	47.3	0.1
59.8	47.2	47.3	0.1
61.0	47.2	47.2	0.0
62.2	47.2	47.2	0.0
63.4	47.2	47.2	0.0
64.6	47.2	47.2	0.0
65.9	47.2	47.2	0.0
67.1	47.2	47.2	0.0
68.3	47.2	47.2	0.0
69.5	47.2	47.2	0.0
70.7	47.2	47.2	0.0
72.0	47.2	47.2	0.0
73.2	47.2	47.2	0.0
74.4	47.1	47.2	0.1
75.6	47.1	47.1	0.0
76.8	47.1	47.1	0.0
78.0	47.1	47.1	0.0
79.3	47.1	47.1	0.0
80.5	47.1	47.1	0.0
81.7	47.1	47.1	0.0
82.9	47.1	47.1	0.0
84.1	47.1	47.1	0.0
85.4	47.0	47.0	0.0
86.6	47.0	47.0	0.0
87.8	47.0	47.0	0.0
89.0	47.0	47.0	0.0
90.2	47.0	47.0	0.0
91.5	46.9	47.0	0.1
92.7	46.9	47.0	0.1
93.9	46.9	46.9	0.0
95.1	46.9	46.9	0.0
96.3	46.7	46.7	0.0
97.6	46.6	46.6	0.0
98.8	46.6	46.6	0.0
Min	46.6	46.6	-0.1
Max	51.7	51.7	0.4
Mean	47.6	47.6	0.0
Median	47.4	47.4	0.0

Entire 81-Year Simulation Period		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	97.5
X > 0.30		2.5
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**2.5**

Warmest Conditions (Lower 25% of Distribution)		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	90.0
X > 0.30		10.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**10.0**

Table 52 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	60.0	60.0	0.0
2.4	58.0	58.0	0.0
3.7	57.9	57.6	-0.3
4.9	56.4	57.0	0.6
6.1	53.8	53.8	0.0
7.3	53.1	53.2	0.1
8.5	52.9	53.1	0.2
9.8	51.6	51.8	0.2
11.0	51.5	51.6	0.1
12.2	51.4	51.5	0.1
13.4	51.0	51.2	0.2
14.6	50.8	51.2	0.4
15.9	50.7	50.7	0.0
17.1	50.3	50.3	0.0
18.3	50.2	50.3	0.1
19.5	50.2	50.2	0.0
20.7	50.1	50.1	0.0
22.0	50.1	50.1	0.0
23.2	50.0	50.0	0.0
24.4	50.0	50.0	0.0
25.6	50.0	49.9	-0.1
26.8	49.9	49.8	-0.1
28.0	49.8	49.7	-0.1
29.3	49.7	49.7	0.0
30.5	49.7	49.7	0.0
31.7	49.7	49.7	0.0
32.9	49.7	49.7	0.0
34.1	49.7	49.7	0.0
35.4	49.7	49.7	0.0
36.6	49.7	49.7	0.0
37.8	49.7	49.7	0.0
39.0	49.6	49.7	0.1
40.2	49.6	49.7	0.1
41.5	49.6	49.6	0.0
42.7	49.6	49.6	0.0
43.9	49.6	49.6	0.0
45.1	49.6	49.6	0.0
46.3	49.5	49.6	0.1
47.6	49.5	49.6	0.1
48.8	49.5	49.5	0.0
50.0	49.5	49.5	0.0
51.2	49.5	49.5	0.0
52.4	49.4	49.5	0.1
53.7	49.4	49.5	0.1
54.9	49.4	49.4	0.0
56.1	49.4	49.4	0.0
57.3	49.3	49.4	0.1
58.5	49.3	49.3	0.0
59.8	49.3	49.3	0.0
61.0	49.3	49.3	0.0
62.2	49.3	49.3	0.0
63.4	49.3	49.3	0.0
64.6	49.2	49.2	0.0
65.9	49.2	49.2	0.0
67.1	49.2	49.2	0.0
68.3	49.2	49.2	0.0
69.5	49.2	49.2	0.0
70.7	49.2	49.2	0.0
72.0	49.2	49.1	-0.1
73.2	49.1	49.1	0.0
74.4	49.1	49.1	0.0
75.6	49.1	49.1	0.0
76.8	49.1	49.1	0.0
78.0	49.0	49.0	0.0
79.3	49.0	49.0	0.0
80.5	49.0	49.0	0.0
81.7	49.0	49.0	0.0
82.9	48.9	48.9	0.0
84.1	48.9	48.9	0.0
85.4	48.9	48.9	0.0
86.6	48.9	48.9	0.0
87.8	48.9	48.8	-0.1
89.0	48.8	48.8	0.0
90.2	48.8	48.8	0.0
91.5	48.8	48.8	0.0
92.7	48.8	48.8	0.0
93.9	48.8	48.7	-0.1
95.1	48.7	48.7	0.0
96.3	48.7	48.7	0.0
97.6	48.6	48.6	0.0
98.8	48.6	48.6	0.0
Min	48.6	48.6	-0.3
Max	60.0	60.0	0.6
Mean	50.1	50.1	0.0
Median	49.5	49.5	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	97.5
X > 0.30		2.5
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**2.5**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	90.0
X > 0.30		10.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**10.0**

Table 53 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

August			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	65.3	65.3	0.0
2.4	64.6	64.6	0.0
3.7	64.6	64.5	-0.1
4.9	64.3	64.4	0.1
6.1	60.6	60.5	-0.1
7.3	60.2	60.4	0.2
8.5	59.9	59.8	-0.1
9.8	56.0	55.6	-0.4
11.0	55.4	54.9	-0.5
12.2	54.9	54.8	-0.1
13.4	54.8	54.8	0.0
14.6	54.3	54.3	0.0
15.9	54.2	54.2	0.0
17.1	53.9	53.8	-0.1
18.3	53.8	53.2	-0.6
19.5	53.6	53.2	-0.4
20.7	53.2	53.2	0.0
22.0	52.9	52.9	0.0
23.2	52.9	52.7	-0.2
24.4	52.7	52.7	0.0
25.6	52.7	52.6	-0.1
26.8	52.6	52.5	-0.1
28.0	52.4	52.5	0.1
29.3	52.4	52.4	0.0
30.5	52.3	52.3	0.0
31.7	52.1	52.1	0.0
32.9	52.1	52.0	-0.1
34.1	52.1	52.0	-0.1
35.4	52.0	52.0	0.0
36.6	51.9	51.9	0.0
37.8	51.8	51.8	0.0
39.0	51.8	51.8	0.0
40.2	51.7	51.7	0.0
41.5	51.7	51.7	0.0
42.7	51.6	51.7	0.1
43.9	51.6	51.6	0.0
45.1	51.6	51.6	0.0
46.3	51.4	51.5	0.1
47.6	51.4	51.5	0.1
48.8	51.4	51.4	0.0
50.0	51.4	51.4	0.0
51.2	51.4	51.3	-0.1
52.4	51.2	51.2	0.0
53.7	51.2	51.1	-0.1
54.9	51.1	51.0	-0.1
56.1	51.1	50.9	-0.2
57.3	51.0	50.9	-0.1
58.5	50.9	50.9	0.0
59.8	50.9	50.9	0.0
61.0	50.8	50.8	0.0
62.2	50.8	50.7	-0.1
63.4	50.7	50.7	0.0
64.6	50.6	50.6	0.0
65.9	50.6	50.5	-0.1
67.1	50.6	50.5	-0.1
68.3	50.5	50.5	0.0
69.5	50.5	50.5	0.0
70.7	50.5	50.5	0.0
72.0	50.5	50.4	-0.1
73.2	50.4	50.4	0.0
74.4	50.4	50.4	0.0
75.6	50.4	50.4	0.0
76.8	50.3	50.3	0.0
78.0	50.3	50.3	0.0
79.3	50.1	50.1	0.0
80.5	50.0	50.1	0.1
81.7	50.0	50.0	0.0
82.9	50.0	50.0	0.0
84.1	49.9	49.9	0.0
85.4	49.9	49.9	0.0
86.6	49.9	49.9	0.0
87.8	49.8	49.9	0.1
89.0	49.8	49.8	0.0
90.2	49.8	49.8	0.0
91.5	49.7	49.8	0.1
92.7	49.6	49.7	0.1
93.9	49.5	49.6	0.1
95.1	49.4	49.5	0.1
96.3	49.4	49.4	0.0
97.6	49.2	49.2	0.0
98.8	49.0	49.0	0.0
Min	49.0	49.0	-0.6
Max	65.3	65.3	0.2
Mean	52.4	52.4	0.0
Median	51.4	51.4	0.0

Entire 81-Year Simulation Period		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	95.1
X > 0.30		0.0
X < -0.30		4.9
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-4.9**

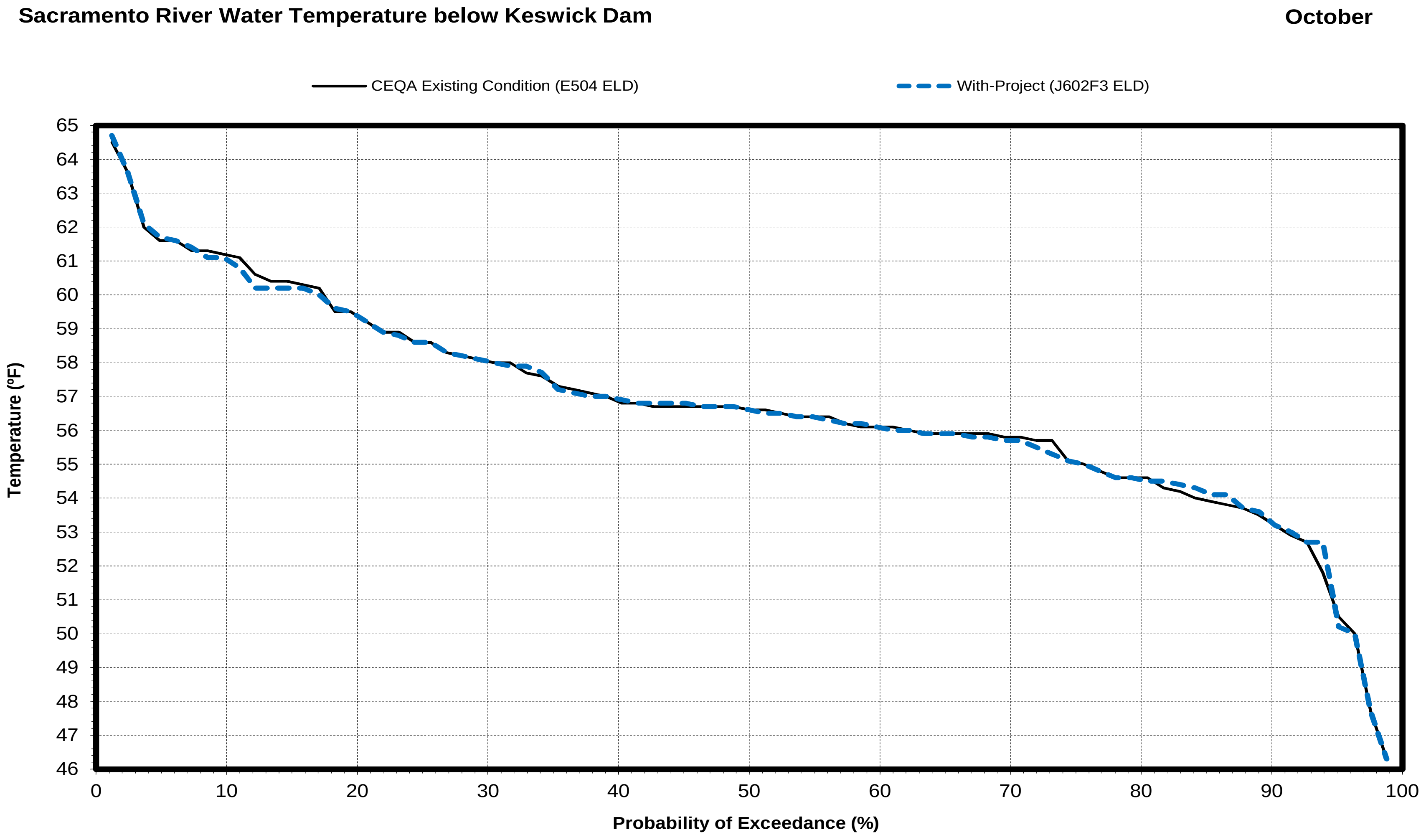
Warmest Conditions (Lower 25% of Distribution)		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	80.0
X > 0.30		0.0
X < -0.30		20.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-20.0**

Table 54 E504ELD-J602F3ELD

Sacramento River Water Temperature below Keswick Dam - Probability of Exceedance

September			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	67.3	67.3	0.0
2.4	65.7	65.8	0.1
3.7	65.6	65.7	0.1
4.9	65.6	65.6	0.0
6.1	65.0	65.0	0.0
7.3	64.7	64.1	-0.6
8.5	61.9	61.7	-0.2
9.8	60.9	60.9	0.0
11.0	60.6	60.4	-0.2
12.2	59.6	59.8	0.2
13.4	59.0	58.7	-0.3
14.6	58.8	58.7	-0.1
15.9	57.7	57.8	0.1
17.1	57.4	57.3	-0.1
18.3	57.4	57.3	-0.1
19.5	57.3	57.3	0.0
20.7	56.9	56.9	0.0
22.0	56.1	56.6	0.5
23.2	56.0	56.0	0.0
24.4	55.9	55.9	0.0
25.6	55.7	55.7	0.0
26.8	55.7	55.7	0.0
28.0	55.7	55.6	-0.1
29.3	55.5	55.6	0.1
30.5	55.5	55.5	0.0
31.7	55.4	55.5	0.1
32.9	55.3	55.5	0.2
34.1	55.2	55.3	0.1
35.4	55.2	55.1	-0.1
36.6	55.2	55.0	-0.2
37.8	55.1	55.0	-0.1
39.0	55.1	54.9	-0.2
40.2	55.1	54.8	-0.3
41.5	54.9	54.7	-0.2
42.7	54.8	54.7	-0.1
43.9	54.7	54.6	-0.1
45.1	54.6	54.4	-0.2
46.3	54.4	54.3	-0.1
47.6	54.4	54.3	-0.1
48.8	54.3	54.2	-0.1
50.0	54.2	54.2	0.0
51.2	54.2	54.1	-0.1
52.4	54.1	54.0	-0.1
53.7	53.8	54.0	0.2
54.9	53.6	53.6	0.0
56.1	53.4	53.4	0.0
57.3	53.2	53.2	0.0
58.5	53.2	53.2	0.0
59.8	53.2	53.2	0.0
61.0	53.0	53.1	0.1
62.2	53.0	53.1	0.1
63.4	52.8	52.8	0.0
64.6	52.8	52.8	0.0
65.9	52.7	52.6	-0.1
67.1	52.7	52.6	-0.1
68.3	52.4	52.5	0.1
69.5	52.3	52.4	0.1
70.7	52.3	52.4	0.1
72.0	52.3	52.3	0.0
73.2	52.2	52.1	-0.1
74.4	52.1	52.0	-0.1
75.6	52.0	52.0	0.0
76.8	52.0	51.9	-0.1
78.0	51.9	51.8	-0.1
79.3	51.7	51.7	0.0
80.5	51.6	51.6	0.0
81.7	51.6	51.6	0.0
82.9	51.4	51.5	0.1
84.1	51.4	51.3	-0.1
85.4	51.3	51.2	-0.1
86.6	51.0	51.2	0.2
87.8	51.0	51.0	0.0
89.0	50.4	50.2	-0.2
90.2	49.7	49.7	0.0
91.5	49.7	49.7	0.0
92.7	49.1	49.1	0.0
93.9	47.5	47.5	0.0
95.1	47.5	47.5	0.0
96.3	47.1	47.3	0.2
97.6	46.5	46.5	0.0
98.8	45.7	45.7	0.0
Min	45.7	45.7	-0.6
Max	67.3	67.3	0.5
Mean	54.6	54.6	0.0
Median	54.2	54.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		97.5
X > 0.30			1.2
X < -0.30			1.2
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		90.0
X > 0.30			5.0
X < -0.30			5.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

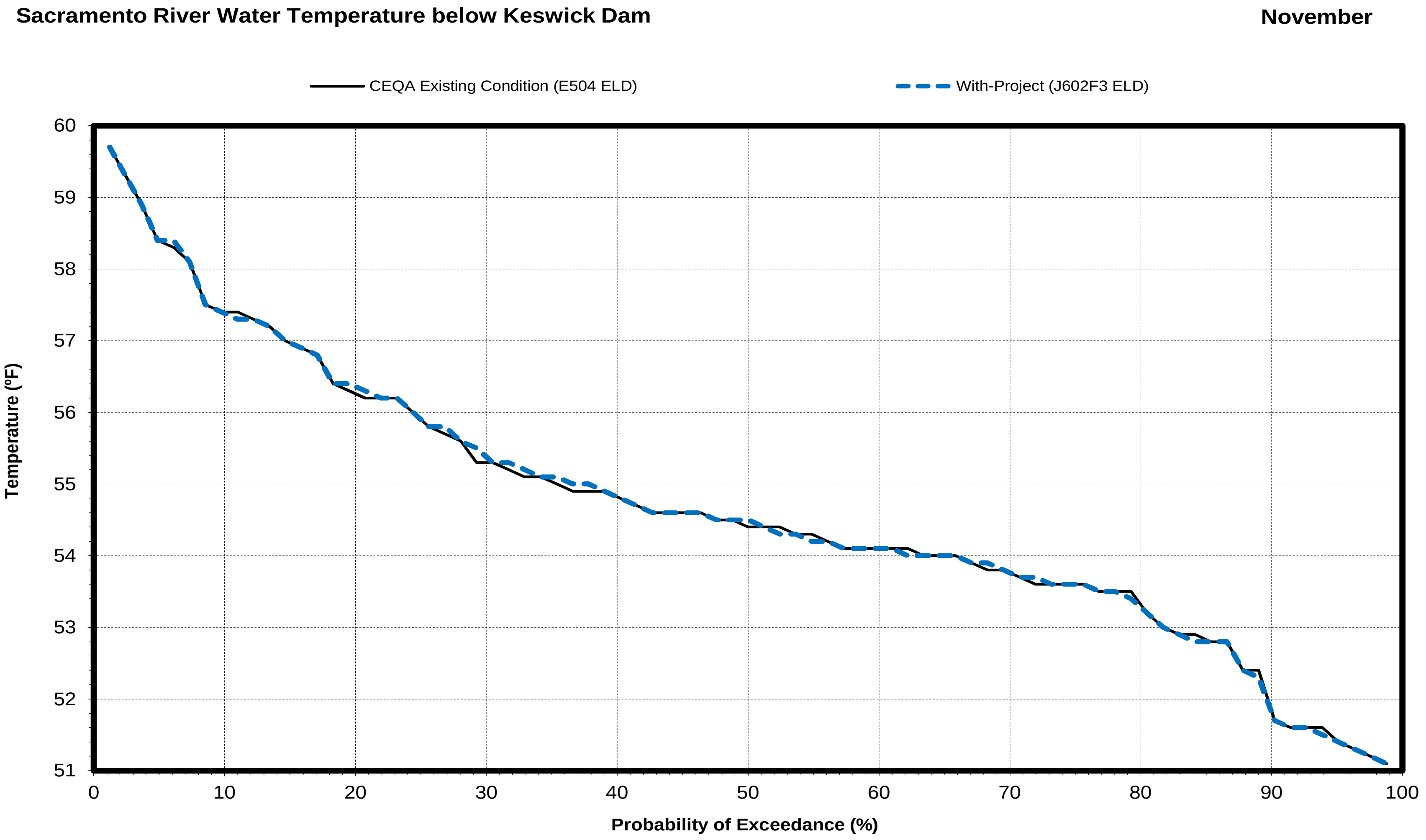
Figure 40 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

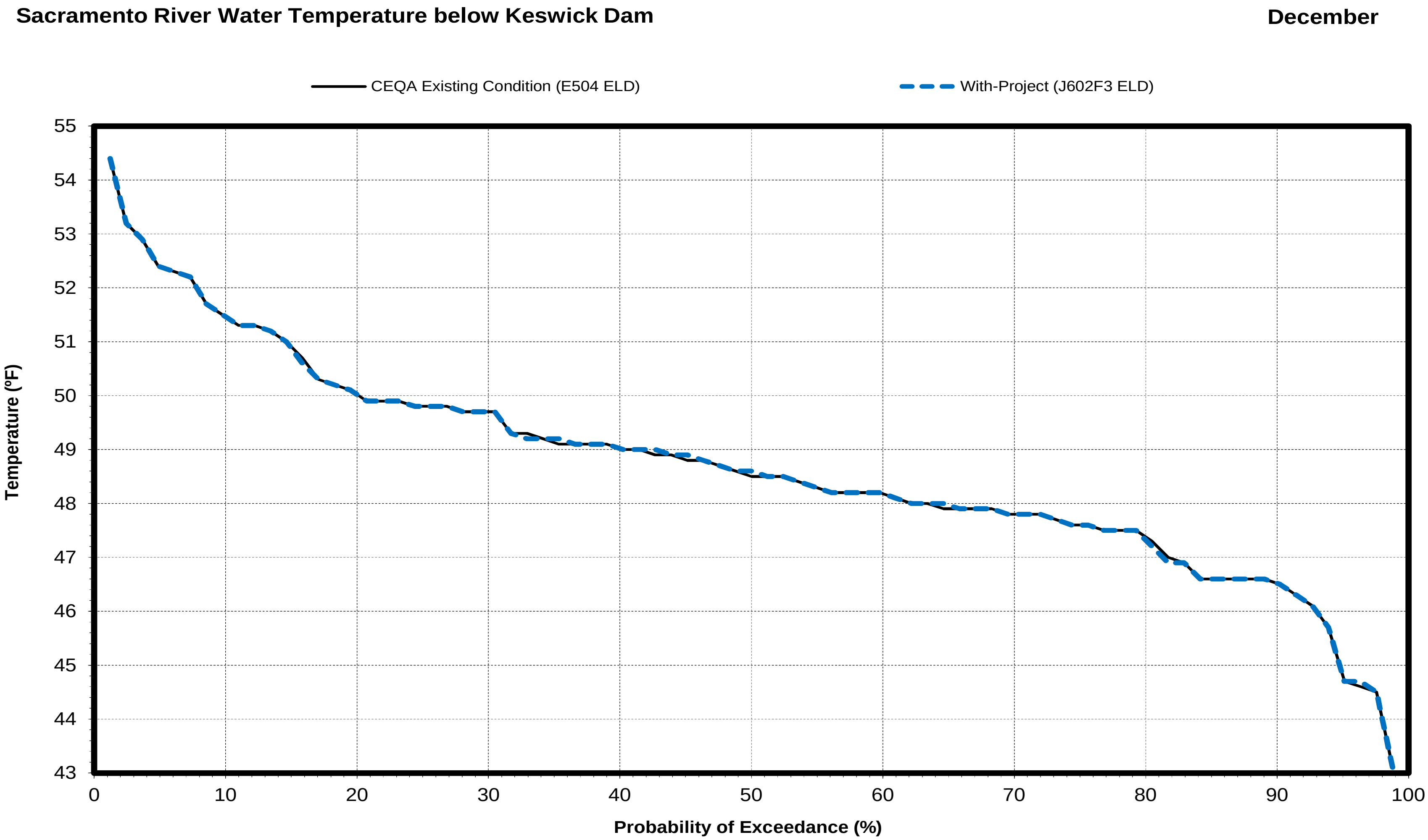
Figure 41 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

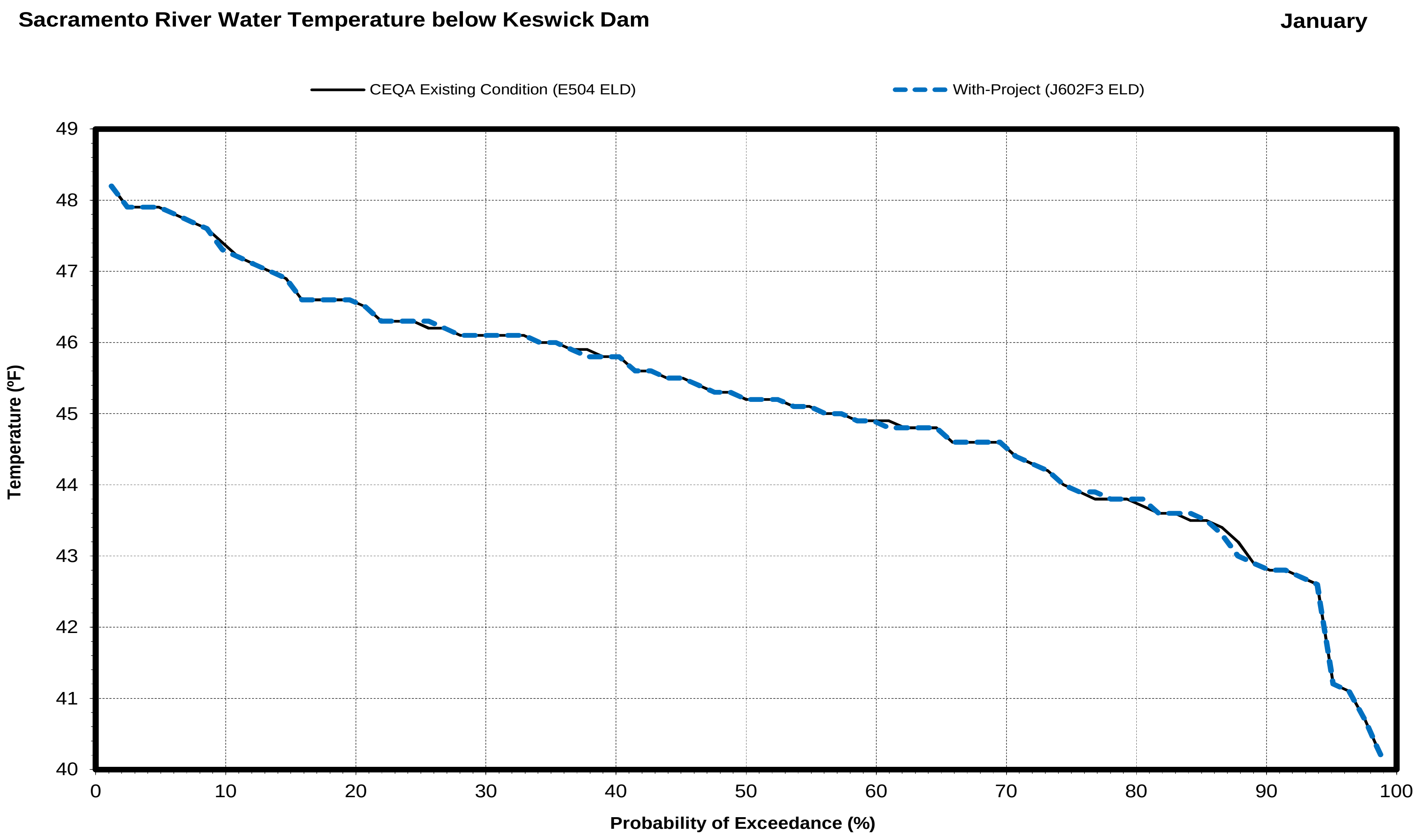
Figure 42 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

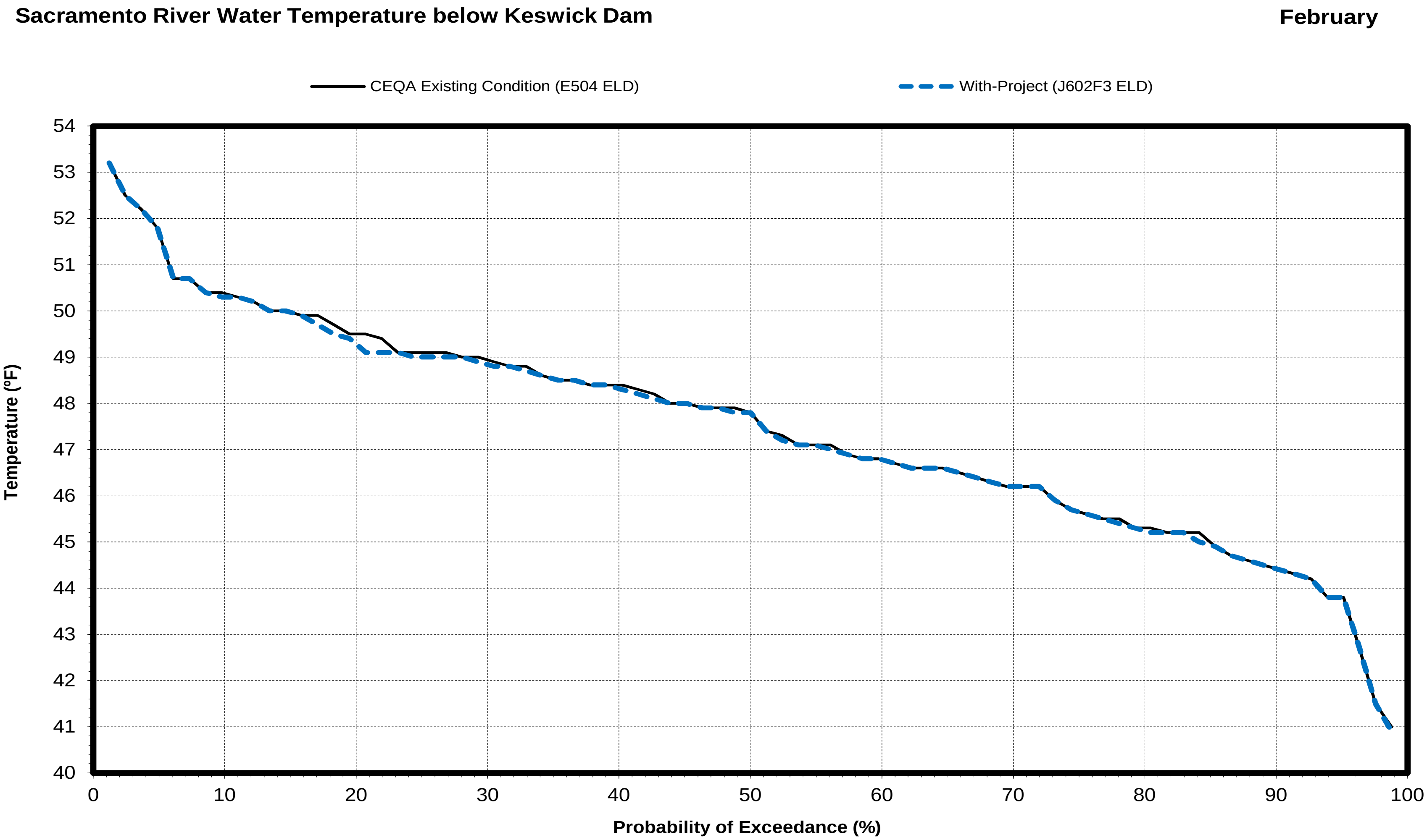
Figure 43 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

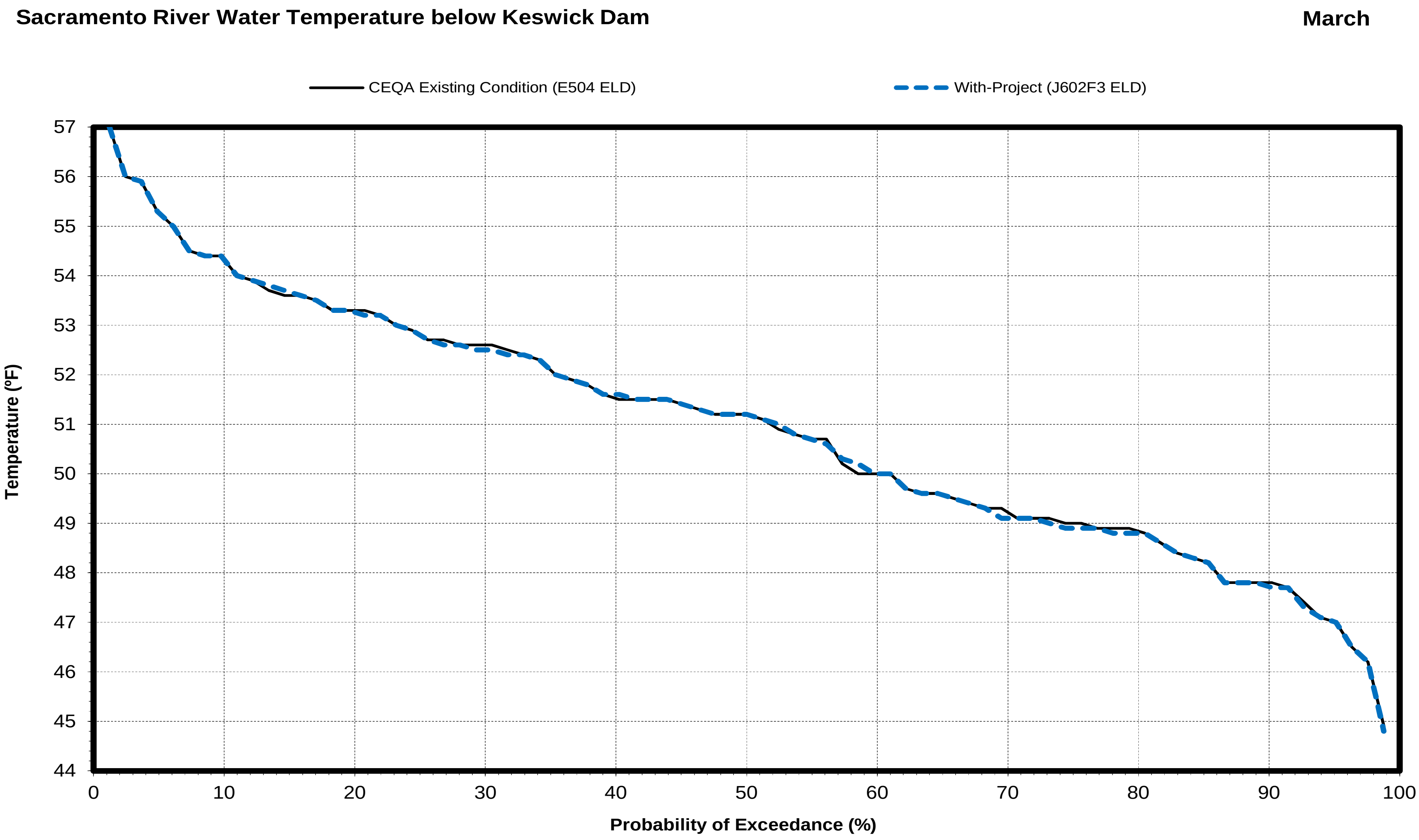
Figure 44 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

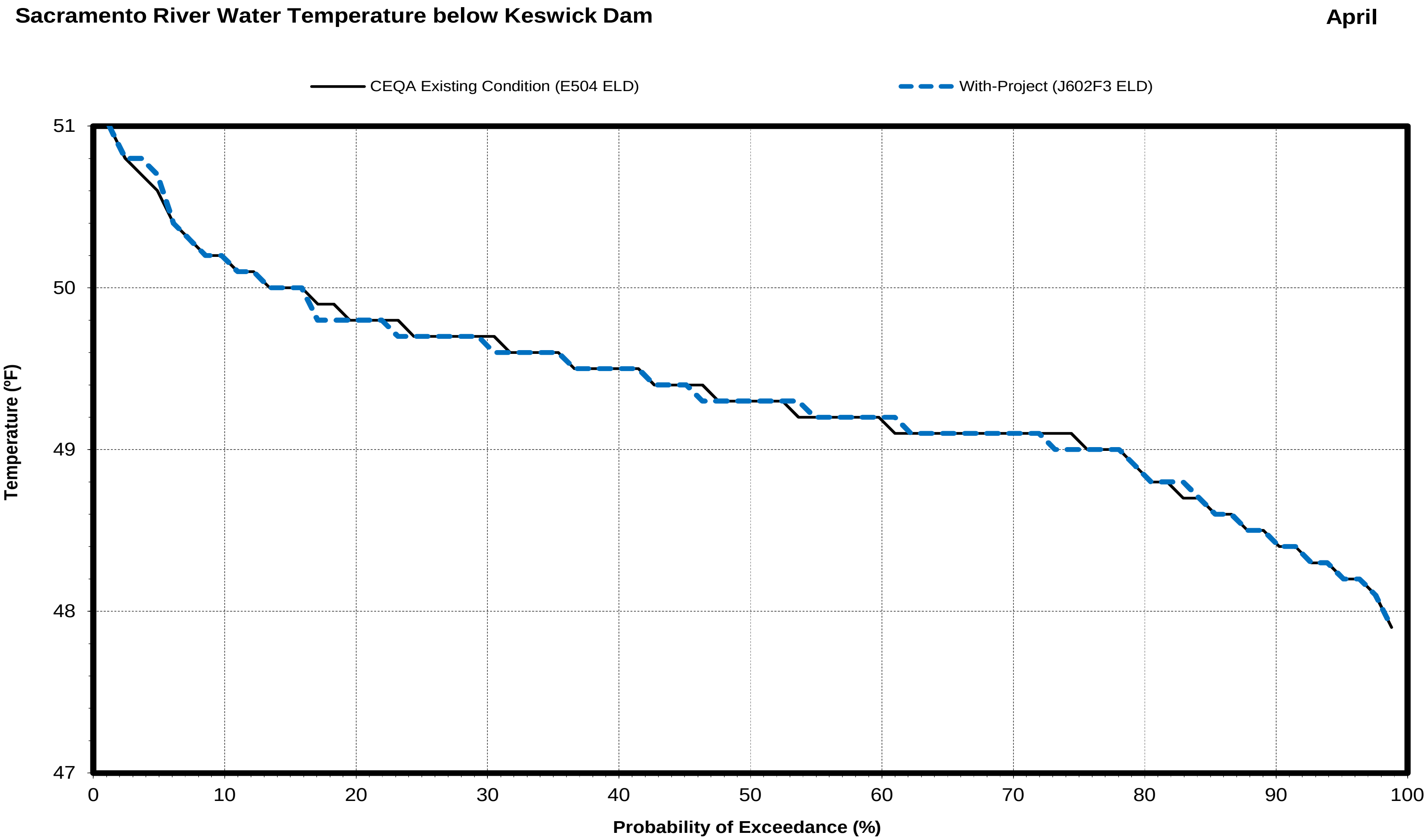
Figure 45 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

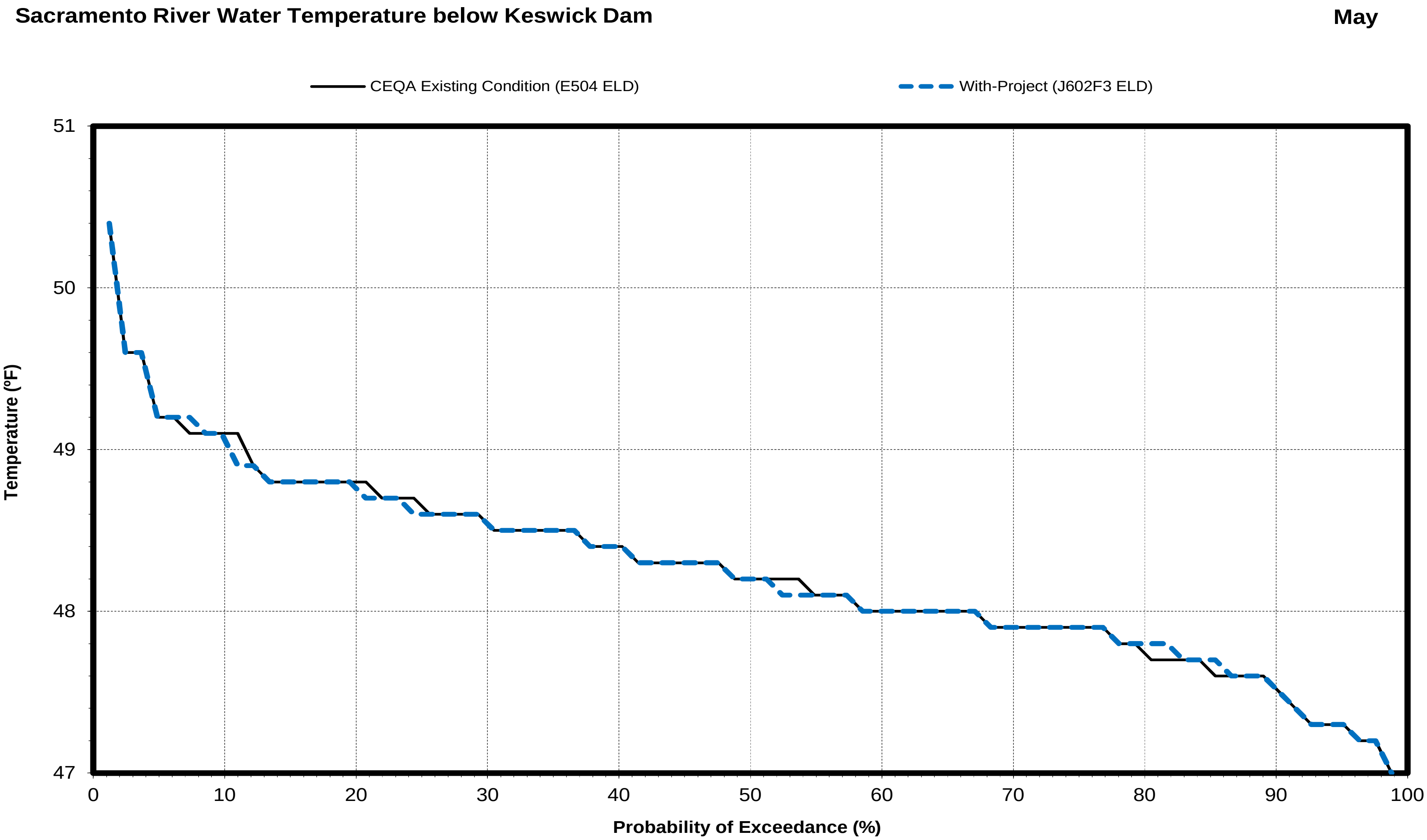
Figure 46 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

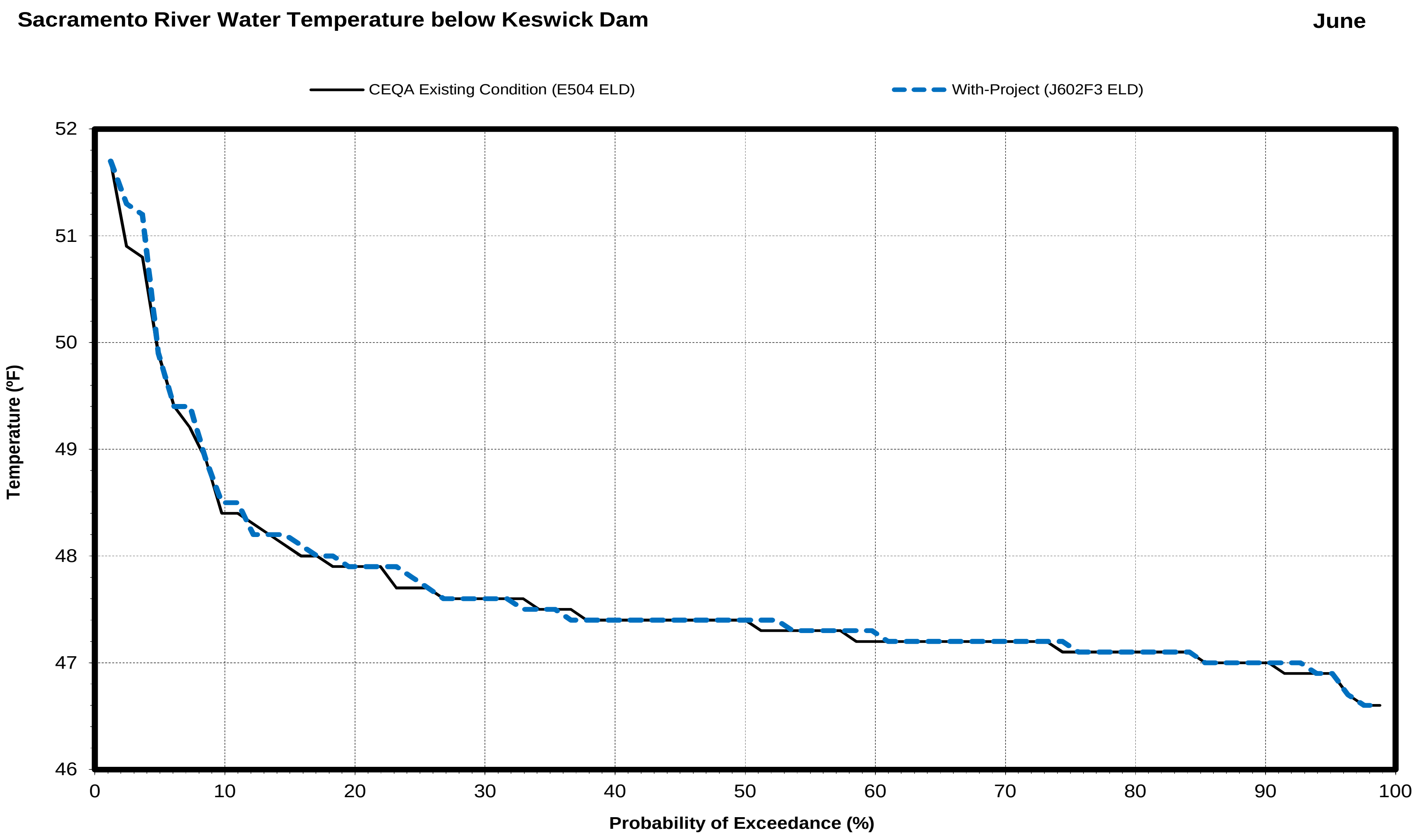
Figure 47 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

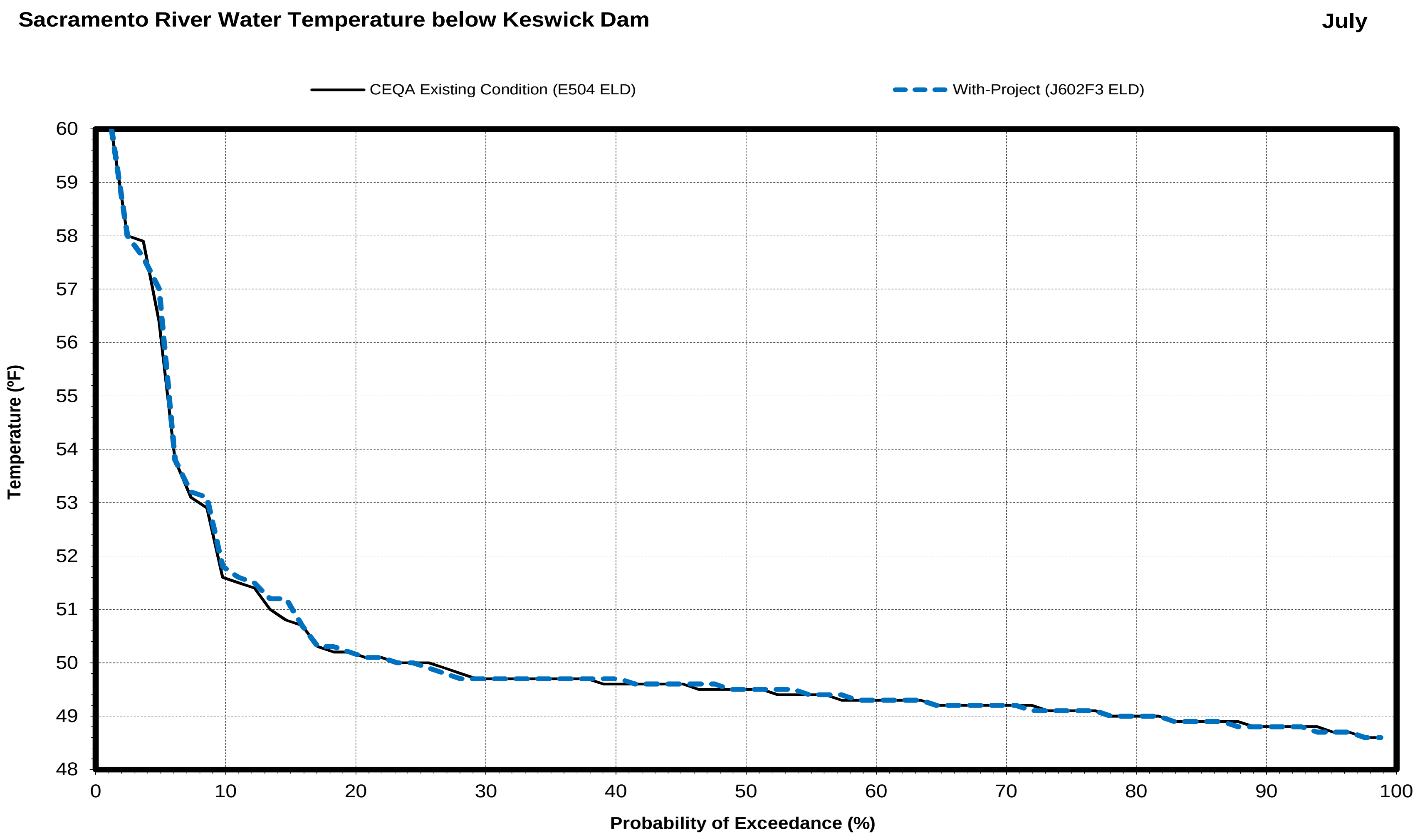
Figure 48 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

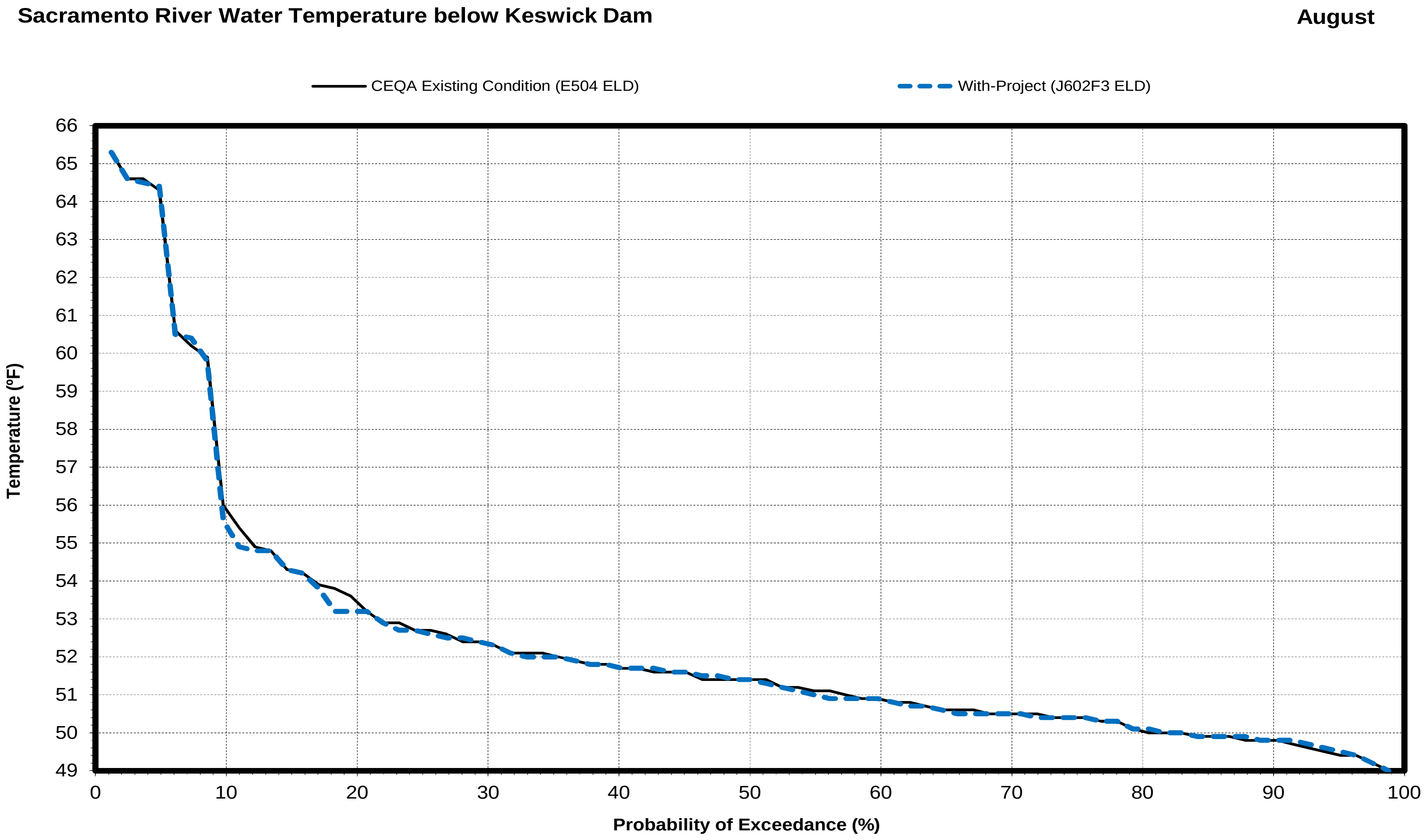
Figure 49 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

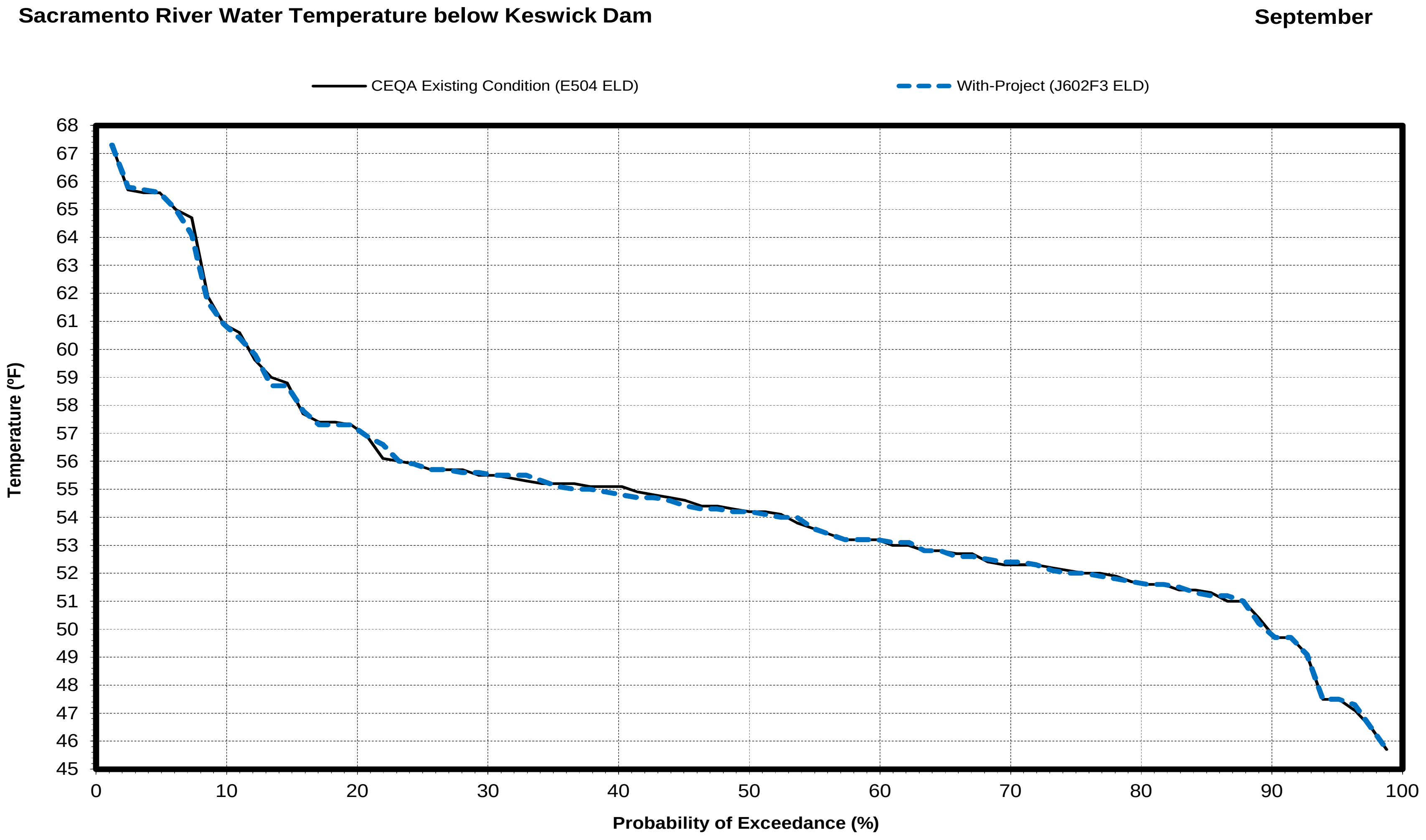
Figure 50 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 51 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 55 E504ELD-J602F3ELD

Long-term and Water Year Type Average Sacramento River Water Temperature at Bend Bridge Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
	Average Temperature (°F)											
Long-term												
Full Simulation Period²												
CEQA Existing Condition (E504 ELD)	57.7	53.5	47.1	45.0	48.1	52.2	54.2	55.9	55.1	56.0	57.8	58.6
With-Project (J602F3 ELD)	57.7	53.5	47.1	45.0	48.1	52.2	54.2	55.9	55.1	56.1	57.8	58.6
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Water Year Types¹												
Wet												
CEQA Existing Condition (E504 ELD)	57.3	53.2	47.1	45.6	48.5	51.7	53.8	55.9	55.7	56.1	56.5	55.9
With-Project (J602F3 ELD)	57.3	53.2	47.1	45.6	48.5	51.7	53.8	55.9	55.7	56.1	56.5	55.9
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	57.2	53.2	47.4	45.0	48.3	52.2	54.8	56.5	54.5	54.6	56.4	57.1
With-Project (J602F3 ELD)	57.2	53.2	47.4	45.0	48.3	52.2	54.8	56.4	54.6	54.6	56.4	57.0
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.1	0.0	0.0	-0.1
Below Normal												
CEQA Existing Condition (E504 ELD)	57.8	54.0	47.4	44.8	47.9	52.4	54.9	56.1	54.7	55.5	57.4	58.9
With-Project (J602F3 ELD)	57.8	54.0	47.4	44.8	47.9	52.4	54.9	56.1	54.7	55.5	57.3	58.8
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
Dry												
CEQA Existing Condition (E504 ELD)	57.7	53.1	46.9	44.5	47.8	52.7	54.4	55.4	54.5	55.2	57.6	59.7
With-Project (J602F3 ELD)	57.7	53.1	46.9	44.5	47.8	52.7	54.4	55.4	54.6	55.3	57.6	59.7
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
Critical												
CEQA Existing Condition (E504 ELD)	59.2	54.4	46.8	44.9	47.9	52.2	53.7	55.6	55.4	59.0	62.7	64.2
With-Project (J602F3 ELD)	59.2	54.4	46.8	44.9	47.9	52.1	53.7	55.6	55.5	59.1	62.7	64.1
Difference	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.1	0.1	0.0	-0.1

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

Table 56 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

October

Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD) Temperature (ºF)**	**With-Project (J602F3 ELD) Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	64.3	64.4	0.1
2.4	62.5	62.5	0.0
3.7	62.1	62.2	0.1
4.9	61.8	61.8	0.0
6.1	60.9	61.0	0.1
7.3	60.9	60.9	0.0
8.5	60.7	60.4	-0.3
9.8	60.6	60.3	-0.3
11.0	60.3	60.2	-0.1
12.2	60.2	60.2	0.0
13.4	60.2	60.2	0.0
14.6	60.2	60.1	-0.1
15.9	60.1	60.1	0.0
17.1	60.1	60.1	0.0
18.3	60.1	60.0	-0.1
19.5	60.0	59.9	-0.1
20.7	59.9	59.8	-0.1
22.0	59.6	59.6	0.0
23.2	59.1	59.1	0.0
24.4	59.1	59.0	-0.1
25.6	58.9	59.0	0.1
26.8	58.8	58.8	0.0
28.0	58.7	58.7	0.0
29.3	58.7	58.7	0.0
30.5	58.6	58.6	0.0
31.7	58.5	58.6	0.1
32.9	58.4	58.5	0.1
34.1	58.4	58.4	0.0
35.4	58.3	58.4	0.1
36.6	58.3	58.3	0.0
37.8	58.2	58.2	0.0
39.0	58.2	58.2	0.0
40.2	58.1	58.2	0.1
41.5	57.9	58.0	0.1
42.7	57.8	57.9	0.1
43.9	57.8	57.8	0.0
45.1	57.7	57.8	0.1
46.3	57.7	57.6	-0.1
47.6	57.7	57.6	-0.1
48.8	57.6	57.5	-0.1
50.0	57.5	57.5	0.0
51.2	57.4	57.4	0.0
52.4	57.4	57.4	0.0
53.7	57.4	57.4	0.0
54.9	57.4	57.4	0.0
56.1	57.4	57.4	0.0
57.3	57.3	57.3	0.0
58.5	57.3	57.3	0.0
59.8	57.3	57.2	-0.1
61.0	57.3	57.1	-0.2
62.2	57.2	57.0	-0.2
63.4	57.1	57.0	-0.1
64.6	57.0	57.0	0.0
65.9	57.0	56.9	-0.1
67.1	56.9	56.9	0.0
68.3	56.9	56.8	-0.1
69.5	56.8	56.8	0.0
70.7	56.8	56.8	0.0
72.0	56.8	56.7	-0.1
73.2	56.7	56.7	0.0
74.4	56.6	56.7	0.1
75.6	56.4	56.5	0.1
76.8	56.3	56.5	0.2
78.0	56.2	56.3	0.1
79.3	56.2	56.3	0.1
80.5	56.1	56.2	0.1
81.7	56.0	56.1	0.1
82.9	55.9	56.0	0.1
84.1	55.8	56.0	0.2
85.4	55.8	55.8	0.0
86.6	55.7	55.7	0.0
87.8	55.6	55.6	0.0
89.0	55.4	55.4	0.0
90.2	55.3	55.4	0.1
91.5	55.2	55.3	0.1
92.7	54.9	54.9	0.0
93.9	54.8	54.9	0.1
95.1	54.5	54.6	0.1
96.3	52.2	52.2	0.0
97.6	51.4	51.4	0.0
98.8	51.0	51.0	0.0
Min	51.0	51.0	-0.3
Max	64.3	64.4	0.2
Mean	57.7	57.7	0.0
Median	57.5	57.5	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 57 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	58.0	58.0	0.0
2.4	57.7	57.7	0.0
3.7	57.5	57.5	0.0
4.9	57.0	57.0	0.0
6.1	56.9	56.9	0.0
7.3	56.5	56.7	0.2
8.5	56.5	56.4	-0.1
9.8	56.4	56.4	0.0
11.0	56.2	56.2	0.0
12.2	56.0	56.0	0.0
13.4	55.7	55.7	0.0
14.6	55.7	55.7	0.0
15.9	55.7	55.7	0.0
17.1	55.6	55.6	0.0
18.3	55.3	55.3	0.0
19.5	54.9	54.9	0.0
20.7	54.8	54.8	0.0
22.0	54.8	54.8	0.0
23.2	54.8	54.8	0.0
24.4	54.7	54.7	0.0
25.6	54.6	54.7	0.1
26.8	54.5	54.5	0.0
28.0	54.4	54.5	0.1
29.3	54.0	54.3	0.3
30.5	53.9	54.0	0.1
31.7	53.9	53.9	0.0
32.9	53.8	53.8	0.0
34.1	53.7	53.7	0.0
35.4	53.6	53.6	0.0
36.6	53.5	53.6	0.1
37.8	53.5	53.5	0.0
39.0	53.5	53.4	-0.1
40.2	53.4	53.4	0.0
41.5	53.4	53.4	0.0
42.7	53.4	53.4	0.0
43.9	53.4	53.4	0.0
45.1	53.3	53.3	0.0
46.3	53.2	53.2	0.0
47.6	53.2	53.2	0.0
48.8	53.2	53.2	0.0
50.0	53.2	53.2	0.0
51.2	53.2	53.2	0.0
52.4	53.1	53.0	-0.1
53.7	53.0	53.0	0.0
54.9	53.0	53.0	0.0
56.1	53.0	53.0	0.0
57.3	53.0	52.9	-0.1
58.5	52.9	52.9	0.0
59.8	52.9	52.8	-0.1
61.0	52.7	52.7	0.0
62.2	52.7	52.7	0.0
63.4	52.7	52.7	0.0
64.6	52.7	52.7	0.0
65.9	52.6	52.6	0.0
67.1	52.6	52.6	0.0
68.3	52.6	52.6	0.0
69.5	52.5	52.6	0.1
70.7	52.5	52.5	0.0
72.0	52.4	52.4	0.0
73.2	52.4	52.4	0.0
74.4	52.3	52.3	0.0
75.6	52.2	52.2	0.0
76.8	52.2	52.2	0.0
78.0	52.1	52.2	0.1
79.3	52.1	52.1	0.0
80.5	52.0	52.0	0.0
81.7	52.0	52.0	0.0
82.9	52.0	51.9	-0.1
84.1	51.9	51.9	0.0
85.4	51.9	51.9	0.0
86.6	51.8	51.8	0.0
87.8	51.8	51.8	0.0
89.0	51.7	51.7	0.0
90.2	51.6	51.6	0.0
91.5	51.5	51.5	0.0
92.7	51.4	51.4	0.0
93.9	51.2	51.2	0.0
95.1	50.8	50.8	0.0
96.3	50.7	50.7	0.0
97.6	50.4	50.4	0.0
98.8	49.7	49.7	0.0
Min	49.7	49.7	-0.1
Max	58.0	58.0	0.3
Mean	53.5	53.5	0.0
Median	53.2	53.2	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 58 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

December			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	52.3	52.3	0.0
2.4	51.5	51.5	0.0
3.7	50.5	50.5	0.0
4.9	50.2	50.2	0.0
6.1	49.9	49.9	0.0
7.3	49.3	49.3	0.0
8.5	49.2	49.2	0.0
9.8	48.8	48.8	0.0
11.0	48.8	48.8	0.0
12.2	48.8	48.8	0.0
13.4	48.5	48.5	0.0
14.6	48.4	48.4	0.0
15.9	48.4	48.4	0.0
17.1	48.4	48.4	0.0
18.3	48.3	48.3	0.0
19.5	48.3	48.3	0.0
20.7	48.3	48.3	0.0
22.0	48.2	48.2	0.0
23.2	48.2	48.2	0.0
24.4	48.2	48.2	0.0
25.6	48.2	48.2	0.0
26.8	47.9	47.9	0.0
28.0	47.8	47.8	0.0
29.3	47.8	47.8	0.0
30.5	47.8	47.8	0.0
31.7	47.6	47.6	0.0
32.9	47.5	47.5	0.0
34.1	47.5	47.5	0.0
35.4	47.5	47.5	0.0
36.6	47.4	47.4	0.0
37.8	47.4	47.4	0.0
39.0	47.4	47.4	0.0
40.2	47.3	47.3	0.0
41.5	47.2	47.2	0.0
42.7	47.2	47.2	0.0
43.9	47.2	47.2	0.0
45.1	47.2	47.2	0.0
46.3	47.1	47.1	0.0
47.6	47.0	47.1	0.1
48.8	47.0	47.0	0.0
50.0	46.9	46.9	0.0
51.2	46.9	46.9	0.0
52.4	46.8	46.9	0.1
53.7	46.8	46.8	0.0
54.9	46.8	46.8	0.0
56.1	46.8	46.8	0.0
57.3	46.7	46.8	0.1
58.5	46.7	46.7	0.0
59.8	46.7	46.7	0.0
61.0	46.7	46.7	0.0
62.2	46.6	46.6	0.0
63.4	46.6	46.6	0.0
64.6	46.6	46.6	0.0
65.9	46.5	46.5	0.0
67.1	46.4	46.4	0.0
68.3	46.4	46.4	0.0
69.5	46.4	46.4	0.0
70.7	46.4	46.4	0.0
72.0	46.4	46.4	0.0
73.2	46.2	46.2	0.0
74.4	46.2	46.2	0.0
75.6	46.2	46.2	0.0
76.8	46.1	46.1	0.0
78.0	46.0	46.0	0.0
79.3	46.0	46.0	0.0
80.5	46.0	46.0	0.0
81.7	45.9	45.9	0.0
82.9	45.8	45.8	0.0
84.1	45.8	45.8	0.0
85.4	45.8	45.8	0.0
86.6	45.8	45.8	0.0
87.8	45.7	45.7	0.0
89.0	45.6	45.6	0.0
90.2	45.3	45.3	0.0
91.5	45.0	45.0	0.0
92.7	45.0	45.0	0.0
93.9	44.8	44.8	0.0
95.1	44.7	44.7	0.0
96.3	44.6	44.6	0.0
97.6	43.6	43.6	0.0
98.8	43.0	43.1	0.1
Min	43.0	43.1	0.0
Max	52.3	52.3	0.1
Mean	47.1	47.1	0.0
Median	46.9	46.9	0.0

Entire 81-Year Simulation Period		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 59 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	47.1	47.1	0.0
2.4	47.1	47.1	0.0
3.7	46.8	46.8	0.0
4.9	46.7	46.7	0.0
6.1	46.6	46.6	0.0
7.3	46.6	46.6	0.0
8.5	46.6	46.6	0.0
9.8	46.5	46.5	0.0
11.0	46.3	46.3	0.0
12.2	46.3	46.3	0.0
13.4	46.2	46.2	0.0
14.6	46.1	46.1	0.0
15.9	46.1	46.1	0.0
17.1	46.1	46.0	-0.1
18.3	46.0	46.0	0.0
19.5	46.0	46.0	0.0
20.7	45.9	45.9	0.0
22.0	45.9	45.9	0.0
23.2	45.8	45.8	0.0
24.4	45.8	45.8	0.0
25.6	45.7	45.7	0.0
26.8	45.7	45.7	0.0
28.0	45.7	45.7	0.0
29.3	45.7	45.7	0.0
30.5	45.7	45.6	-0.1
31.7	45.6	45.6	0.0
32.9	45.6	45.6	0.0
34.1	45.5	45.5	0.0
35.4	45.5	45.5	0.0
36.6	45.5	45.5	0.0
37.8	45.5	45.5	0.0
39.0	45.5	45.5	0.0
40.2	45.4	45.5	0.1
41.5	45.3	45.3	0.0
42.7	45.3	45.3	0.0
43.9	45.3	45.3	0.0
45.1	45.3	45.3	0.0
46.3	45.3	45.3	0.0
47.6	45.2	45.2	0.0
48.8	45.1	45.1	0.0
50.0	45.1	45.1	0.0
51.2	45.1	45.1	0.0
52.4	45.1	45.1	0.0
53.7	45.1	45.1	0.0
54.9	45.0	45.0	0.0
56.1	45.0	45.0	0.0
57.3	44.9	44.9	0.0
58.5	44.9	44.9	0.0
59.8	44.9	44.9	0.0
61.0	44.9	44.9	0.0
62.2	44.9	44.9	0.0
63.4	44.9	44.9	0.0
64.6	44.9	44.9	0.0
65.9	44.8	44.8	0.0
67.1	44.7	44.7	0.0
68.3	44.7	44.7	0.0
69.5	44.7	44.7	0.0
70.7	44.6	44.6	0.0
72.0	44.6	44.6	0.0
73.2	44.5	44.5	0.0
74.4	44.5	44.5	0.0
75.6	44.4	44.4	0.0
76.8	44.3	44.3	0.0
78.0	44.3	44.3	0.0
79.3	44.3	44.3	0.0
80.5	44.2	44.2	0.0
81.7	44.2	44.2	0.0
82.9	44.1	44.1	0.0
84.1	44.0	44.0	0.0
85.4	44.0	44.0	0.0
86.6	44.0	44.0	0.0
87.8	44.0	44.0	0.0
89.0	43.9	44.0	0.1
90.2	43.9	43.9	0.0
91.5	43.8	43.7	-0.1
92.7	43.7	43.6	-0.1
93.9	42.9	42.9	0.0
95.1	42.6	42.6	0.0
96.3	42.2	42.2	0.0
97.6	41.0	41.0	0.0
98.8	40.1	40.1	0.0
Min	40.1	40.1	-0.1
Max	47.1	47.1	0.1
Mean	45.0	45.0	0.0
Median	45.1	45.1	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 60 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	51.3	51.3	0.0
2.4	51.0	51.0	0.0
3.7	50.8	50.8	0.0
4.9	50.4	50.4	0.0
6.1	50.0	50.0	0.0
7.3	49.9	49.9	0.0
8.5	49.9	49.9	0.0
9.8	49.9	49.9	0.0
11.0	49.9	49.8	-0.1
12.2	49.8	49.8	0.0
13.4	49.8	49.7	-0.1
14.6	49.6	49.6	0.0
15.9	49.6	49.6	0.0
17.1	49.6	49.5	-0.1
18.3	49.4	49.4	0.0
19.5	49.4	49.3	-0.1
20.7	49.3	49.3	0.0
22.0	49.3	49.2	-0.1
23.2	49.2	49.1	-0.1
24.4	49.1	49.1	0.0
25.6	49.1	49.0	-0.1
26.8	49.0	49.0	0.0
28.0	49.0	49.0	0.0
29.3	48.9	48.9	0.0
30.5	48.9	48.9	0.0
31.7	48.9	48.9	0.0
32.9	48.9	48.9	0.0
34.1	48.9	48.9	0.0
35.4	48.8	48.9	0.1
36.6	48.8	48.8	0.0
37.8	48.8	48.8	0.0
39.0	48.7	48.6	-0.1
40.2	48.6	48.6	0.0
41.5	48.6	48.6	0.0
42.7	48.5	48.5	0.0
43.9	48.5	48.5	0.0
45.1	48.4	48.4	0.0
46.3	48.3	48.3	0.0
47.6	48.3	48.3	0.0
48.8	48.2	48.2	0.0
50.0	48.2	48.2	0.0
51.2	48.2	48.2	0.0
52.4	48.1	48.1	0.0
53.7	48.1	48.1	0.0
54.9	48.0	48.0	0.0
56.1	48.0	48.0	0.0
57.3	48.0	48.0	0.0
58.5	47.9	47.9	0.0
59.8	47.8	47.8	0.0
61.0	47.6	47.6	0.0
62.2	47.6	47.6	0.0
63.4	47.6	47.6	0.0
64.6	47.6	47.6	0.0
65.9	47.4	47.4	0.0
67.1	47.4	47.4	0.0
68.3	47.4	47.4	0.0
69.5	47.4	47.4	0.0
70.7	47.3	47.3	0.0
72.0	47.3	47.3	0.0
73.2	47.3	47.3	0.0
74.4	47.3	47.3	0.0
75.6	47.3	47.2	-0.1
76.8	47.2	47.2	0.0
78.0	47.2	47.2	0.0
79.3	47.0	47.0	0.0
80.5	47.0	47.0	0.0
81.7	47.0	47.0	0.0
82.9	46.9	46.9	0.0
84.1	46.7	46.7	0.0
85.4	46.6	46.6	0.0
86.6	46.5	46.6	0.1
87.8	46.5	46.5	0.0
89.0	46.5	46.5	0.0
90.2	46.1	46.1	0.0
91.5	46.0	46.0	0.0
92.7	45.9	45.9	0.0
93.9	45.8	45.8	0.0
95.1	45.6	45.6	0.0
96.3	45.5	45.5	0.0
97.6	44.5	44.5	0.0
98.8	44.2	44.2	0.0
Min	44.2	44.2	-0.1
Max	51.3	51.3	0.1
Mean	48.1	48.1	0.0
Median	48.2	48.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 61 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	56.8	56.8	0.0
2.4	56.5	56.5	0.0
3.7	55.0	55.0	0.0
4.9	55.0	55.0	0.0
6.1	54.7	54.7	0.0
7.3	54.5	54.5	0.0
8.5	54.4	54.4	0.0
9.8	54.0	54.0	0.0
11.0	54.0	54.0	0.0
12.2	53.9	53.9	0.0
13.4	53.8	53.7	-0.1
14.6	53.7	53.7	0.0
15.9	53.6	53.6	0.0
17.1	53.5	53.5	0.0
18.3	53.5	53.5	0.0
19.5	53.4	53.4	0.0
20.7	53.4	53.4	0.0
22.0	53.4	53.4	0.0
23.2	53.3	53.2	-0.1
24.4	53.2	53.2	0.0
25.6	53.2	53.2	0.0
26.8	53.2	53.1	-0.1
28.0	53.1	53.1	0.0
29.3	53.1	53.1	0.0
30.5	53.0	53.1	0.1
31.7	53.0	53.0	0.0
32.9	52.8	52.8	0.0
34.1	52.6	52.6	0.0
35.4	52.6	52.6	0.0
36.6	52.6	52.6	0.0
37.8	52.6	52.6	0.0
39.0	52.6	52.6	0.0
40.2	52.5	52.5	0.0
41.5	52.5	52.5	0.0
42.7	52.5	52.5	0.0
43.9	52.4	52.4	0.0
45.1	52.3	52.4	0.1
46.3	52.3	52.3	0.0
47.6	52.3	52.3	0.0
48.8	52.3	52.2	-0.1
50.0	52.3	52.2	-0.1
51.2	52.2	52.2	0.0
52.4	52.1	52.1	0.0
53.7	52.1	52.1	0.0
54.9	52.1	52.1	0.0
56.1	52.1	52.0	-0.1
57.3	52.0	52.0	0.0
58.5	52.0	51.9	-0.1
59.8	51.9	51.9	0.0
61.0	51.8	51.8	0.0
62.2	51.7	51.7	0.0
63.4	51.7	51.7	0.0
64.6	51.7	51.7	0.0
65.9	51.7	51.7	0.0
67.1	51.7	51.7	0.0
68.3	51.5	51.5	0.0
69.5	51.5	51.4	-0.1
70.7	51.4	51.4	0.0
72.0	51.1	51.1	0.0
73.2	51.0	51.0	0.0
74.4	50.8	50.8	0.0
75.6	50.8	50.8	0.0
76.8	50.7	50.7	0.0
78.0	50.7	50.7	0.0
79.3	50.7	50.7	0.0
80.5	50.7	50.7	0.0
81.7	50.7	50.7	0.0
82.9	50.6	50.6	0.0
84.1	50.5	50.5	0.0
85.4	50.5	50.5	0.0
86.6	50.5	50.5	0.0
87.8	50.4	50.4	0.0
89.0	50.4	50.4	0.0
90.2	50.2	50.2	0.0
91.5	50.2	50.2	0.0
92.7	50.1	50.1	0.0
93.9	50.0	50.0	0.0
95.1	49.6	49.6	0.0
96.3	49.3	49.3	0.0
97.6	48.9	48.9	0.0
98.8	48.8	48.8	0.0
Min	48.8	48.8	-0.1
Max	56.8	56.8	0.1
Mean	52.2	52.2	0.0
Median	52.3	52.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 62 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	57.3	57.3	0.0
2.4	56.7	56.7	0.0
3.7	56.5	56.7	0.2
4.9	56.4	56.5	0.1
6.1	56.4	56.4	0.0
7.3	56.2	56.2	0.0
8.5	56.2	56.2	0.0
9.8	56.2	56.2	0.0
11.0	56.2	56.2	0.0
12.2	55.7	55.7	0.0
13.4	55.7	55.7	0.0
14.6	55.7	55.7	0.0
15.9	55.5	55.5	0.0
17.1	55.5	55.5	0.0
18.3	55.5	55.5	0.0
19.5	55.5	55.5	0.0
20.7	55.3	55.3	0.0
22.0	55.3	55.3	0.0
23.2	55.3	55.3	0.0
24.4	55.3	55.3	0.0
25.6	55.3	55.3	0.0
26.8	55.3	55.3	0.0
28.0	55.2	55.2	0.0
29.3	55.2	55.2	0.0
30.5	55.1	55.1	0.0
31.7	54.9	54.9	0.0
32.9	54.9	54.9	0.0
34.1	54.9	54.9	0.0
35.4	54.9	54.9	0.0
36.6	54.9	54.8	-0.1
37.8	54.9	54.8	-0.1
39.0	54.8	54.8	0.0
40.2	54.8	54.8	0.0
41.5	54.8	54.7	-0.1
42.7	54.7	54.7	0.0
43.9	54.7	54.6	-0.1
45.1	54.6	54.6	0.0
46.3	54.6	54.6	0.0
47.6	54.6	54.5	-0.1
48.8	54.4	54.4	0.0
50.0	54.4	54.4	0.0
51.2	54.4	54.4	0.0
52.4	54.3	54.3	0.0
53.7	54.2	54.2	0.0
54.9	54.1	54.1	0.0
56.1	54.1	54.1	0.0
57.3	54.0	54.0	0.0
58.5	53.8	53.8	0.0
59.8	53.8	53.8	0.0
61.0	53.8	53.8	0.0
62.2	53.8	53.7	-0.1
63.4	53.7	53.7	0.0
64.6	53.7	53.7	0.0
65.9	53.7	53.7	0.0
67.1	53.6	53.7	0.1
68.3	53.5	53.5	0.0
69.5	53.4	53.4	0.0
70.7	53.3	53.3	0.0
72.0	53.3	53.3	0.0
73.2	53.2	53.3	0.1
74.4	53.2	53.2	0.0
75.6	53.2	53.2	0.0
76.8	53.1	53.1	0.0
78.0	53.1	53.0	-0.1
79.3	53.0	53.0	0.0
80.5	53.0	52.9	-0.1
81.7	52.9	52.9	0.0
82.9	52.8	52.8	0.0
84.1	52.8	52.8	0.0
85.4	52.8	52.8	0.0
86.6	52.8	52.8	0.0
87.8	52.6	52.6	0.0
89.0	52.5	52.5	0.0
90.2	52.5	52.5	0.0
91.5	52.4	52.4	0.0
92.7	52.2	52.2	0.0
93.9	52.2	52.2	0.0
95.1	51.7	51.7	0.0
96.3	51.2	51.2	0.0
97.6	51.1	51.1	0.0
98.8	51.1	51.1	0.0
Min	51.1	51.1	-0.1
Max	57.3	57.3	0.2
Mean	54.2	54.2	0.0
Median	54.4	54.4	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 63 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

May			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	60.7	60.7	0.0
2.4	60.1	60.1	0.0
3.7	59.2	59.2	0.0
4.9	58.9	58.9	0.0
6.1	58.7	58.7	0.0
7.3	58.7	58.7	0.0
8.5	58.4	58.5	0.1
9.8	58.4	58.1	-0.3
11.0	58.1	57.7	-0.4
12.2	57.7	57.6	-0.1
13.4	57.6	57.6	0.0
14.6	57.5	57.4	-0.1
15.9	57.1	57.1	0.0
17.1	57.1	57.0	-0.1
18.3	57.1	57.0	-0.1
19.5	57.0	56.8	-0.2
20.7	56.9	56.8	-0.1
22.0	56.8	56.7	-0.1
23.2	56.8	56.7	-0.1
24.4	56.7	56.7	0.0
25.6	56.7	56.6	-0.1
26.8	56.6	56.6	0.0
28.0	56.6	56.5	-0.1
29.3	56.5	56.5	0.0
30.5	56.5	56.5	0.0
31.7	56.4	56.4	0.0
32.9	56.2	56.2	0.0
34.1	56.2	56.2	0.0
35.4	56.2	56.2	0.0
36.6	56.1	56.1	0.0
37.8	56.1	56.1	0.0
39.0	56.1	56.1	0.0
40.2	56.0	56.1	0.1
41.5	55.9	56.0	0.1
42.7	55.9	55.9	0.0
43.9	55.9	55.9	0.0
45.1	55.9	55.9	0.0
46.3	55.8	55.8	0.0
47.6	55.8	55.7	-0.1
48.8	55.7	55.7	0.0
50.0	55.6	55.6	0.0
51.2	55.5	55.5	0.0
52.4	55.5	55.5	0.0
53.7	55.4	55.4	0.0
54.9	55.3	55.3	0.0
56.1	55.3	55.3	0.0
57.3	55.3	55.3	0.0
58.5	55.3	55.3	0.0
59.8	55.3	55.3	0.0
61.0	55.2	55.2	0.0
62.2	55.2	55.2	0.0
63.4	55.2	55.2	0.0
64.6	55.2	55.2	0.0
65.9	55.1	55.2	0.1
67.1	55.0	55.1	0.1
68.3	54.9	55.0	0.1
69.5	54.9	54.9	0.0
70.7	54.9	54.9	0.0
72.0	54.8	54.8	0.0
73.2	54.8	54.8	0.0
74.4	54.8	54.8	0.0
75.6	54.8	54.8	0.0
76.8	54.7	54.7	0.0
78.0	54.6	54.6	0.0
79.3	54.6	54.6	0.0
80.5	54.6	54.6	0.0
81.7	54.6	54.6	0.0
82.9	54.5	54.5	0.0
84.1	54.5	54.5	0.0
85.4	54.4	54.4	0.0
86.6	54.4	54.4	0.0
87.8	54.2	54.2	0.0
89.0	54.2	54.2	0.0
90.2	54.2	54.2	0.0
91.5	54.1	54.1	0.0
92.7	54.1	54.1	0.0
93.9	54.1	54.1	0.0
95.1	53.8	53.9	0.1
96.3	53.7	53.8	0.1
97.6	53.3	53.3	0.0
98.8	52.8	52.8	0.0
Min	52.8	52.8	-0.4
Max	60.7	60.7	0.1
Mean	55.9	55.9	0.0
Median	55.6	55.6	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		98.8
X > 0.30			0.0
X < -0.30			1.2
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**-1.2**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		95.0
X > 0.30			0.0
X < -0.30			5.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**-5.0**

Table 64 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	58.4	58.6	0.2
2.4	57.6	57.6	0.0
3.7	57.6	57.6	0.0
4.9	57.6	57.6	0.0
6.1	57.4	57.6	0.2
7.3	57.4	57.4	0.0
8.5	57.4	57.4	0.0
9.8	57.0	57.1	0.1
11.0	57.0	57.0	0.0
12.2	56.9	57.0	0.1
13.4	56.8	57.0	0.2
14.6	56.7	56.8	0.1
15.9	56.7	56.7	0.0
17.1	56.7	56.7	0.0
18.3	56.5	56.5	0.0
19.5	56.5	56.5	0.0
20.7	56.3	56.2	-0.1
22.0	56.3	56.2	-0.1
23.2	56.2	56.2	0.0
24.4	56.1	56.1	0.0
25.6	56.0	56.1	0.1
26.8	56.0	56.0	0.0
28.0	56.0	56.0	0.0
29.3	55.9	56.0	0.1
30.5	55.9	55.9	0.0
31.7	55.8	55.8	0.0
32.9	55.6	55.8	0.2
34.1	55.6	55.6	0.0
35.4	55.6	55.6	0.0
36.6	55.5	55.6	0.1
37.8	55.3	55.5	0.2
39.0	55.3	55.3	0.0
40.2	55.3	55.3	0.0
41.5	55.2	55.2	0.0
42.7	55.2	55.2	0.0
43.9	55.2	55.1	-0.1
45.1	55.2	55.1	-0.1
46.3	55.1	55.1	0.0
47.6	55.1	55.0	-0.1
48.8	55.1	55.0	-0.1
50.0	55.0	55.0	0.0
51.2	55.0	54.9	-0.1
52.4	54.9	54.9	0.0
53.7	54.9	54.8	-0.1
54.9	54.9	54.8	-0.1
56.1	54.8	54.8	0.0
57.3	54.7	54.8	0.1
58.5	54.7	54.7	0.0
59.8	54.6	54.6	0.0
61.0	54.5	54.5	0.0
62.2	54.4	54.5	0.1
63.4	54.4	54.5	0.1
64.6	54.3	54.5	0.2
65.9	54.3	54.4	0.1
67.1	54.3	54.3	0.0
68.3	54.3	54.3	0.0
69.5	54.2	54.3	0.1
70.7	54.2	54.3	0.1
72.0	54.2	54.2	0.0
73.2	54.2	54.2	0.0
74.4	54.2	54.2	0.0
75.6	54.2	54.2	0.0
76.8	54.2	54.2	0.0
78.0	54.1	54.2	0.1
79.3	54.1	54.1	0.0
80.5	53.9	54.1	0.2
81.7	53.9	53.9	0.0
82.9	53.9	53.9	0.0
84.1	53.7	53.7	0.0
85.4	53.6	53.6	0.0
86.6	53.5	53.5	0.0
87.8	53.3	53.5	0.2
89.0	53.3	53.4	0.1
90.2	53.1	53.3	0.2
91.5	53.1	53.2	0.1
92.7	52.9	53.1	0.2
93.9	52.9	52.9	0.0
95.1	52.7	52.7	0.0
96.3	52.4	52.4	0.0
97.6	52.4	52.4	0.0
98.8	52.2	52.2	0.0
Min	52.2	52.2	-0.1
Max	58.4	58.6	0.2
Mean	55.1	55.1	0.0
Median	55.0	55.0	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 65 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	63.5	63.5	0.0
2.4	62.3	63.0	0.7
3.7	62.1	62.7	0.6
4.9	61.0	61.2	0.2
6.1	61.0	60.8	-0.2
7.3	59.5	59.5	0.0
8.5	59.4	59.4	0.0
9.8	58.9	58.9	0.0
11.0	57.8	58.1	0.3
12.2	57.2	57.1	-0.1
13.4	57.1	57.0	-0.1
14.6	57.0	57.0	0.0
15.9	57.0	57.0	0.0
17.1	57.0	57.0	0.0
18.3	56.9	56.9	0.0
19.5	56.8	56.8	0.0
20.7	56.8	56.8	0.0
22.0	56.7	56.7	0.0
23.2	56.6	56.7	0.1
24.4	56.6	56.6	0.0
25.6	56.6	56.6	0.0
26.8	56.4	56.4	0.0
28.0	56.4	56.4	0.0
29.3	56.4	56.4	0.0
30.5	56.4	56.4	0.0
31.7	56.3	56.3	0.0
32.9	56.3	56.3	0.0
34.1	56.2	56.3	0.1
35.4	56.2	56.2	0.0
36.6	56.2	56.2	0.0
37.8	56.2	56.2	0.0
39.0	56.2	56.2	0.0
40.2	56.0	56.2	0.2
41.5	56.0	56.0	0.0
42.7	55.9	56.0	0.1
43.9	55.9	55.9	0.0
45.1	55.7	55.9	0.2
46.3	55.7	55.8	0.1
47.6	55.7	55.7	0.0
48.8	55.7	55.6	-0.1
50.0	55.6	55.6	0.0
51.2	55.6	55.6	0.0
52.4	55.6	55.6	0.0
53.7	55.6	55.6	0.0
54.9	55.4	55.6	0.2
56.1	55.4	55.5	0.1
57.3	55.4	55.4	0.0
58.5	55.4	55.4	0.0
59.8	55.3	55.4	0.1
61.0	55.3	55.4	0.1
62.2	55.3	55.4	0.1
63.4	55.3	55.3	0.0
64.6	55.2	55.3	0.1
65.9	55.2	55.3	0.1
67.1	55.2	55.1	-0.1
68.3	55.1	55.1	0.0
69.5	55.0	55.1	0.1
70.7	55.0	55.0	0.0
72.0	55.0	55.0	0.0
73.2	54.9	55.0	0.1
74.4	54.7	55.0	0.3
75.6	54.7	54.9	0.2
76.8	54.7	54.7	0.0
78.0	54.7	54.7	0.0
79.3	54.4	54.4	0.0
80.5	54.4	54.4	0.0
81.7	54.3	54.3	0.0
82.9	54.3	54.3	0.0
84.1	54.3	54.3	0.0
85.4	54.3	54.3	0.0
86.6	54.3	54.3	0.0
87.8	54.2	54.2	0.0
89.0	54.2	54.2	0.0
90.2	54.2	54.2	0.0
91.5	53.9	53.9	0.0
92.7	53.9	53.9	0.0
93.9	53.9	53.9	0.0
95.1	53.8	53.8	0.0
96.3	53.7	53.7	0.0
97.6	53.5	53.5	0.0
98.8	53.1	53.1	0.0
Min	53.1	53.1	-0.2
Max	63.5	63.5	0.7
Mean	56.0	56.1	0.0
Median	55.6	55.6	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		97.5
X > 0.30			2.5
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**2.5**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		90.0
X > 0.30			10.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**10.0**

Table 66 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

August			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD)** **Temperature (ºF)**	**With-Project (J602F3 ELD)** **Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	67.5	67.5	0.0
2.4	67.1	67.4	0.3
3.7	67.1	66.9	-0.2
4.9	66.7	66.7	0.0
6.1	64.5	64.6	0.1
7.3	64.2	64.2	0.0
8.5	63.6	63.9	0.3
9.8	61.0	60.7	-0.3
11.0	60.4	60.4	0.0
12.2	59.9	59.9	0.0
13.4	59.4	59.1	-0.3
14.6	59.1	59.1	0.0
15.9	58.9	58.8	-0.1
17.1	58.8	58.6	-0.2
18.3	58.8	58.5	-0.3
19.5	58.7	58.4	-0.3
20.7	58.6	58.4	-0.2
22.0	58.5	58.4	-0.1
23.2	58.4	58.4	0.0
24.4	58.2	58.2	0.0
25.6	58.1	58.0	-0.1
26.8	58.1	58.0	-0.1
28.0	58.0	57.9	-0.1
29.3	58.0	57.9	-0.1
30.5	57.9	57.9	0.0
31.7	57.9	57.9	0.0
32.9	57.8	57.8	0.0
34.1	57.8	57.8	0.0
35.4	57.8	57.7	-0.1
36.6	57.7	57.7	0.0
37.8	57.7	57.5	-0.2
39.0	57.6	57.5	-0.1
40.2	57.5	57.4	-0.1
41.5	57.5	57.4	-0.1
42.7	57.5	57.4	-0.1
43.9	57.4	57.4	0.0
45.1	57.3	57.3	0.0
46.3	57.3	57.2	-0.1
47.6	57.2	57.2	0.0
48.8	57.2	57.2	0.0
50.0	57.2	57.2	0.0
51.2	57.1	57.2	0.1
52.4	57.1	57.2	0.1
53.7	57.0	57.1	0.1
54.9	57.0	57.0	0.0
56.1	57.0	57.0	0.0
57.3	57.0	57.0	0.0
58.5	56.9	56.9	0.0
59.8	56.9	56.9	0.0
61.0	56.9	56.9	0.0
62.2	56.9	56.8	-0.1
63.4	56.8	56.8	0.0
64.6	56.8	56.8	0.0
65.9	56.8	56.7	-0.1
67.1	56.8	56.6	-0.2
68.3	56.5	56.5	0.0
69.5	56.5	56.5	0.0
70.7	56.4	56.5	0.1
72.0	56.3	56.4	0.1
73.2	56.3	56.3	0.0
74.4	56.3	56.3	0.0
75.6	56.0	56.2	0.2
76.8	56.0	56.0	0.0
78.0	55.9	55.9	0.0
79.3	55.9	55.9	0.0
80.5	55.9	55.8	-0.1
81.7	55.8	55.8	0.0
82.9	55.7	55.7	0.0
84.1	55.7	55.6	-0.1
85.4	55.6	55.5	-0.1
86.6	55.5	55.4	-0.1
87.8	55.3	55.3	0.0
89.0	55.2	55.2	0.0
90.2	55.2	55.2	0.0
91.5	55.0	55.0	0.0
92.7	54.9	55.0	0.1
93.9	54.8	54.9	0.1
95.1	54.8	54.8	0.0
96.3	54.7	54.8	0.1
97.6	54.6	54.6	0.0
98.8	54.4	54.4	0.0
Min	54.4	54.4	-0.3
Max	67.5	67.5	0.3
Mean	57.8	57.8	0.0
Median	57.2	57.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 67 E504ELD-J602F3ELD

Sacramento River Water Temperature at Bend Bridge - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	67.8	67.9	0.1
2.4	66.6	66.6	0.0
3.7	66.2	66.2	0.0
4.9	66.2	65.8	-0.4
6.1	65.6	65.6	0.0
7.3	65.6	65.6	0.0
8.5	64.1	64.0	-0.1
9.8	63.7	63.7	0.0
11.0	63.7	63.6	-0.1
12.2	63.6	63.5	-0.1
13.4	63.3	63.4	0.1
14.6	62.7	62.6	-0.1
15.9	61.8	61.8	0.0
17.1	61.8	61.8	0.0
18.3	61.6	61.5	-0.1
19.5	61.4	61.4	0.0
20.7	61.3	61.4	0.1
22.0	60.7	60.9	0.2
23.2	60.6	60.7	0.1
24.4	60.6	60.5	-0.1
25.6	60.5	60.5	0.0
26.8	60.4	60.4	0.0
28.0	60.1	60.3	0.2
29.3	60.0	60.1	0.1
30.5	59.9	60.0	0.1
31.7	59.9	59.9	0.0
32.9	59.8	59.7	-0.1
34.1	59.8	59.6	-0.2
35.4	59.6	59.6	0.0
36.6	59.6	59.5	-0.1
37.8	59.4	59.4	0.0
39.0	59.4	59.4	0.0
40.2	59.3	59.3	0.0
41.5	58.8	58.8	0.0
42.7	58.8	58.8	0.0
43.9	58.7	58.7	0.0
45.1	58.7	58.5	-0.2
46.3	58.5	58.5	0.0
47.6	58.1	58.0	-0.1
48.8	58.1	57.9	-0.2
50.0	58.0	57.7	-0.3
51.2	58.0	57.7	-0.3
52.4	57.7	57.7	0.0
53.7	57.6	57.6	0.0
54.9	57.4	57.4	0.0
56.1	57.2	57.2	0.0
57.3	57.2	57.2	0.0
58.5	57.2	57.2	0.0
59.8	57.1	57.1	0.0
61.0	57.0	57.1	0.1
62.2	56.9	57.1	0.2
63.4	56.9	56.8	-0.1
64.6	56.9	56.8	-0.1
65.9	56.8	56.8	0.0
67.1	56.7	56.7	0.0
68.3	56.7	56.7	0.0
69.5	56.7	56.7	0.0
70.7	56.7	56.7	0.0
72.0	56.6	56.7	0.1
73.2	56.5	56.5	0.0
74.4	56.4	55.8	-0.6
75.6	55.9	55.8	-0.1
76.8	55.8	55.8	0.0
78.0	55.8	55.7	-0.1
79.3	55.7	55.7	0.0
80.5	55.6	55.6	0.0
81.7	55.5	55.6	0.1
82.9	55.4	55.5	0.1
84.1	55.4	55.4	0.0
85.4	55.3	55.3	0.0
86.6	55.3	55.3	0.0
87.8	55.3	55.3	0.0
89.0	55.2	55.2	0.0
90.2	55.0	55.0	0.0
91.5	54.6	54.6	0.0
92.7	54.4	54.4	0.0
93.9	54.1	54.1	0.0
95.1	54.0	54.0	0.0
96.3	54.0	54.0	0.0
97.6	52.4	52.4	0.0
98.8	51.4	51.4	0.0
Min	51.4	51.4	-0.6
Max	67.8	67.9	0.2
Mean	58.6	58.6	0.0
Median	58.0	57.7	0.0

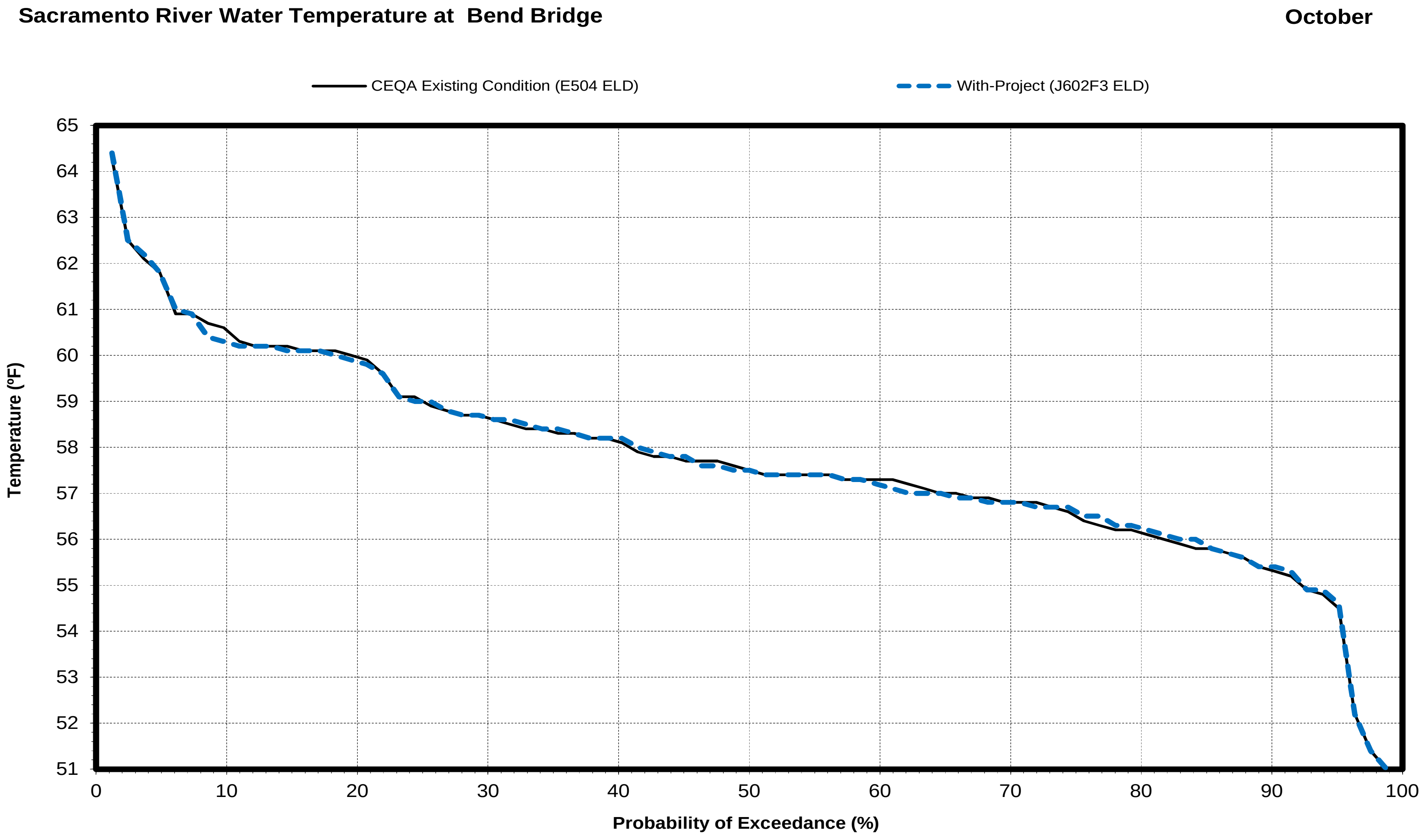
Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	97.5
X > 0.30		0.0
X < -0.30		2.5
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-2.5**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	95.0
X > 0.30		0.0
X < -0.30		5.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-5.0**

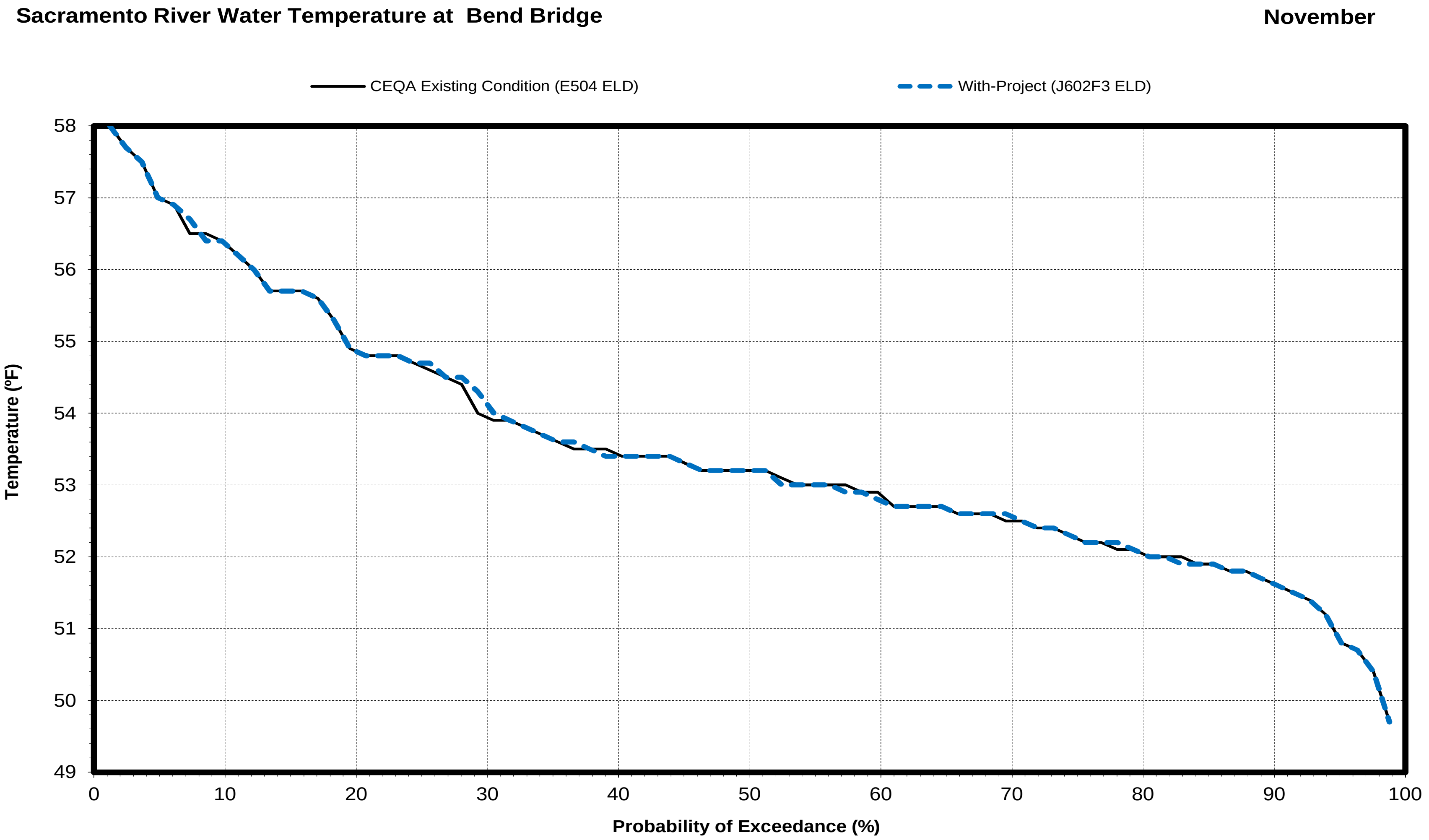
Figure 52 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

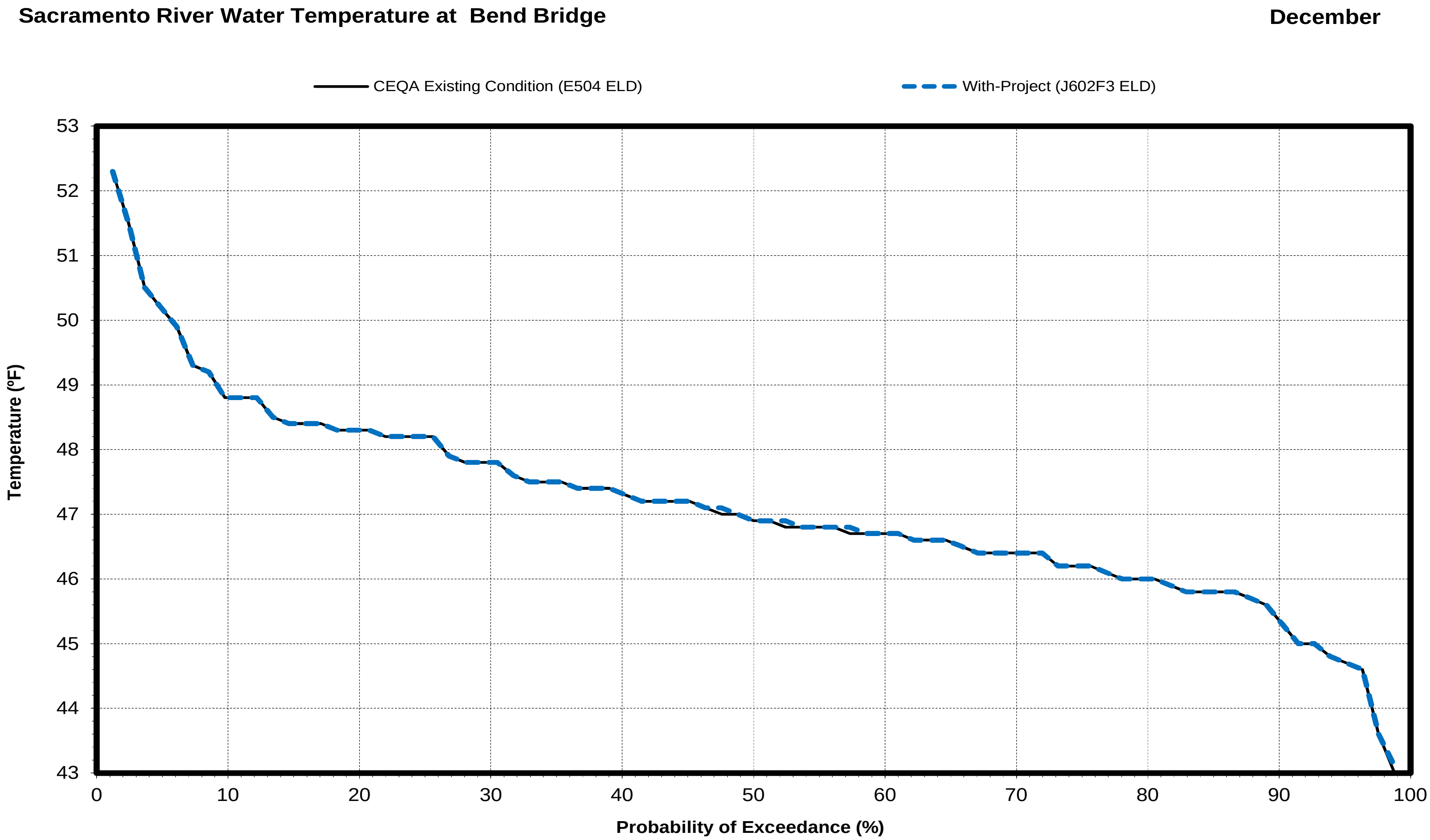
Figure 53 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

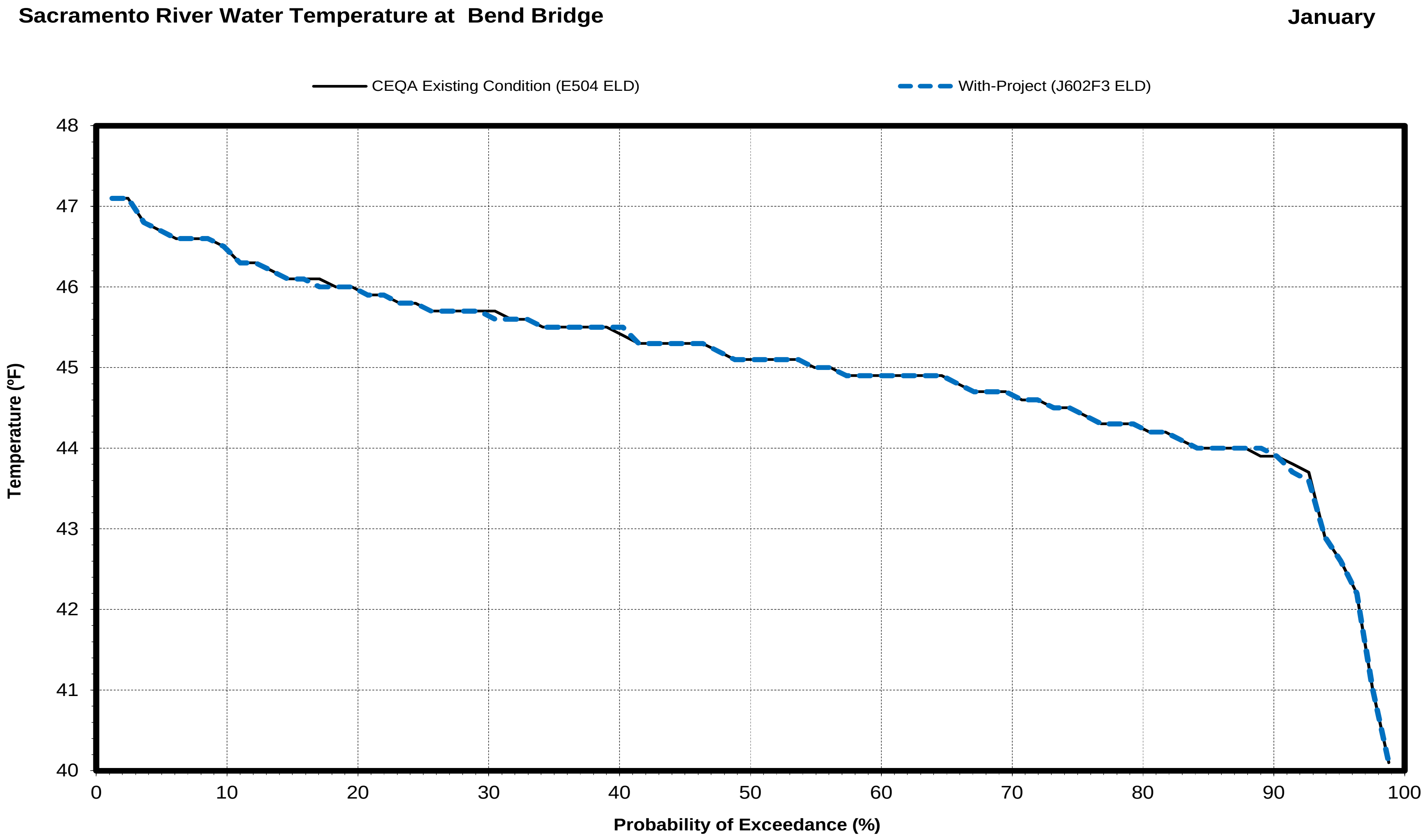
Figure 54 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

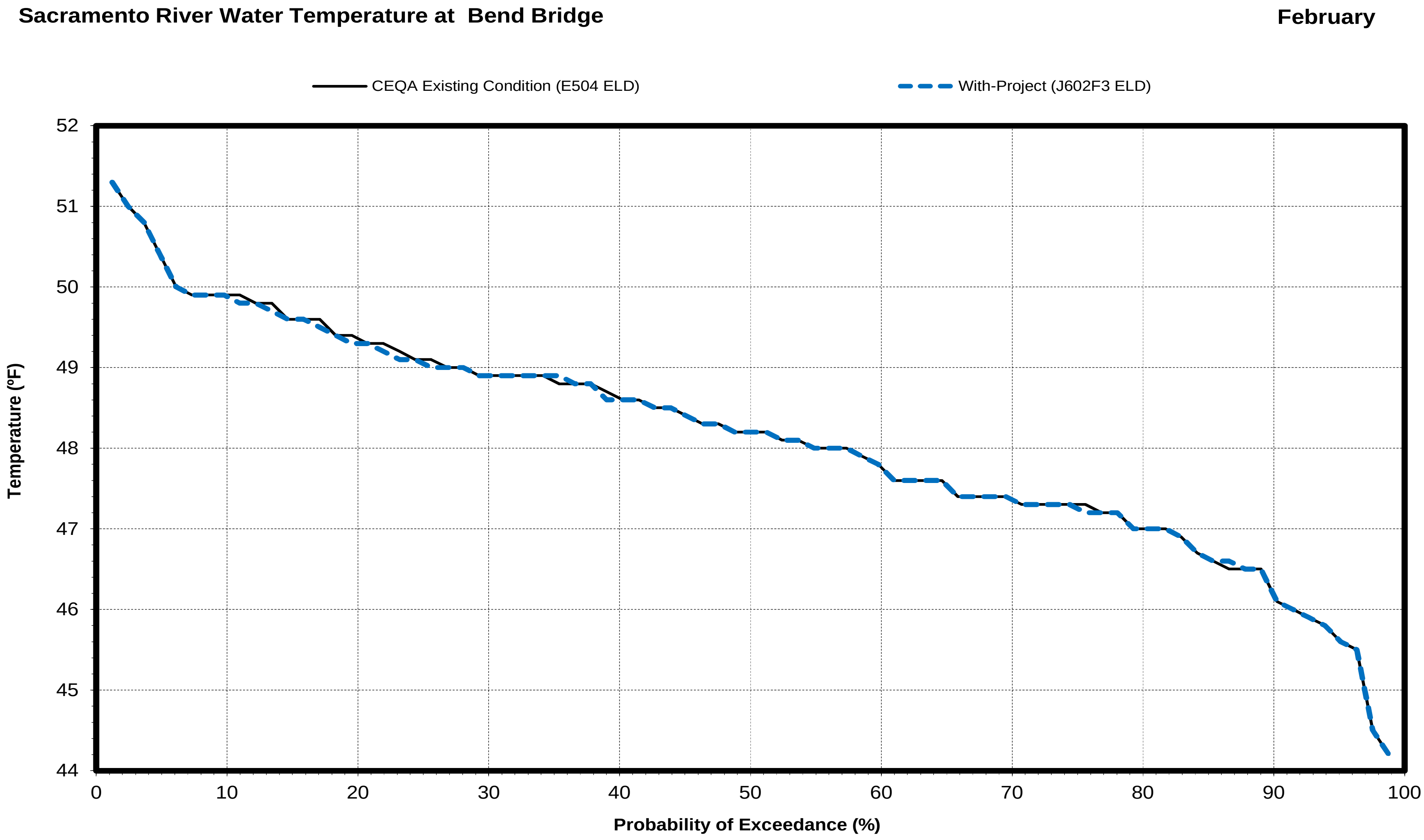
Figure 55 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

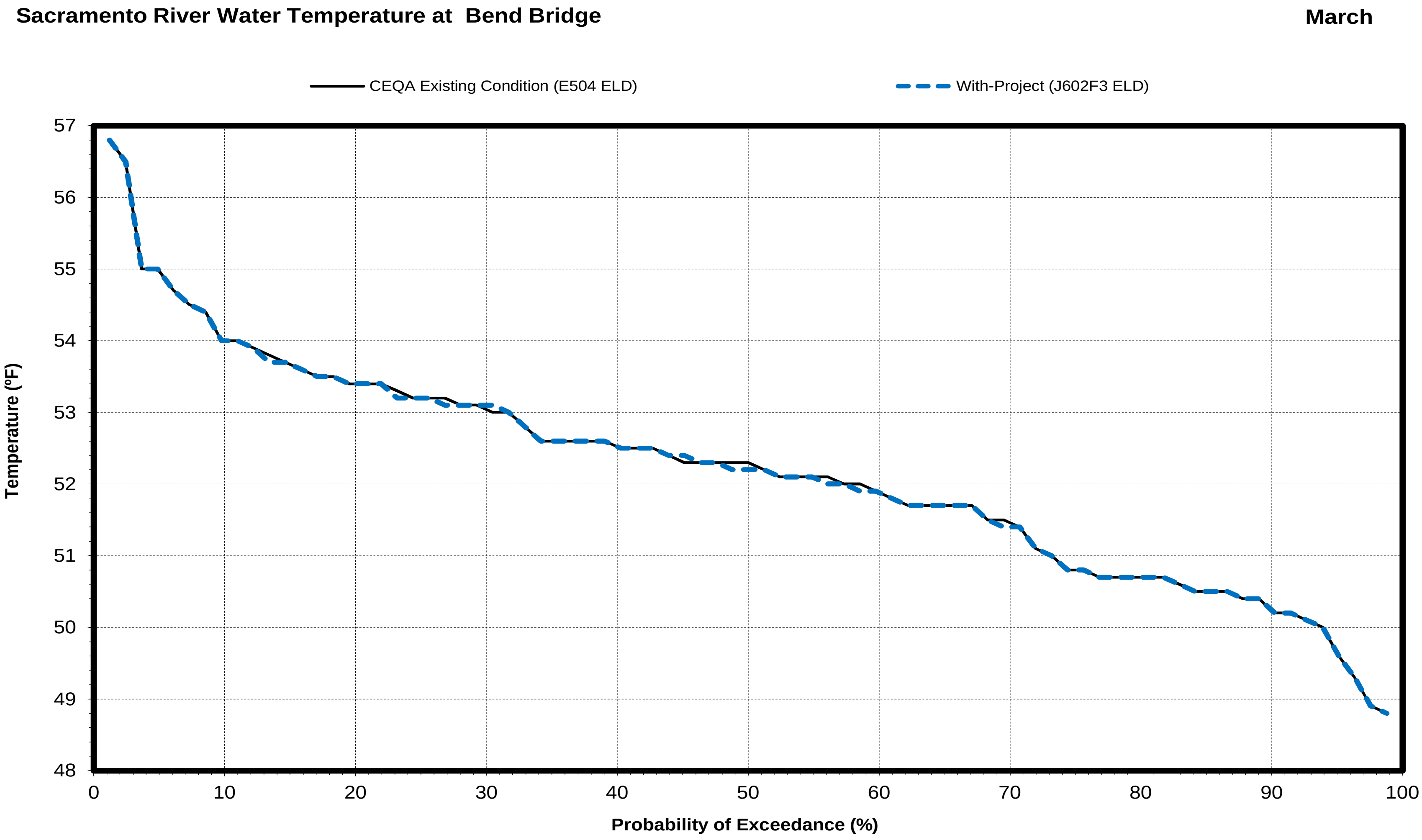
Figure 56 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

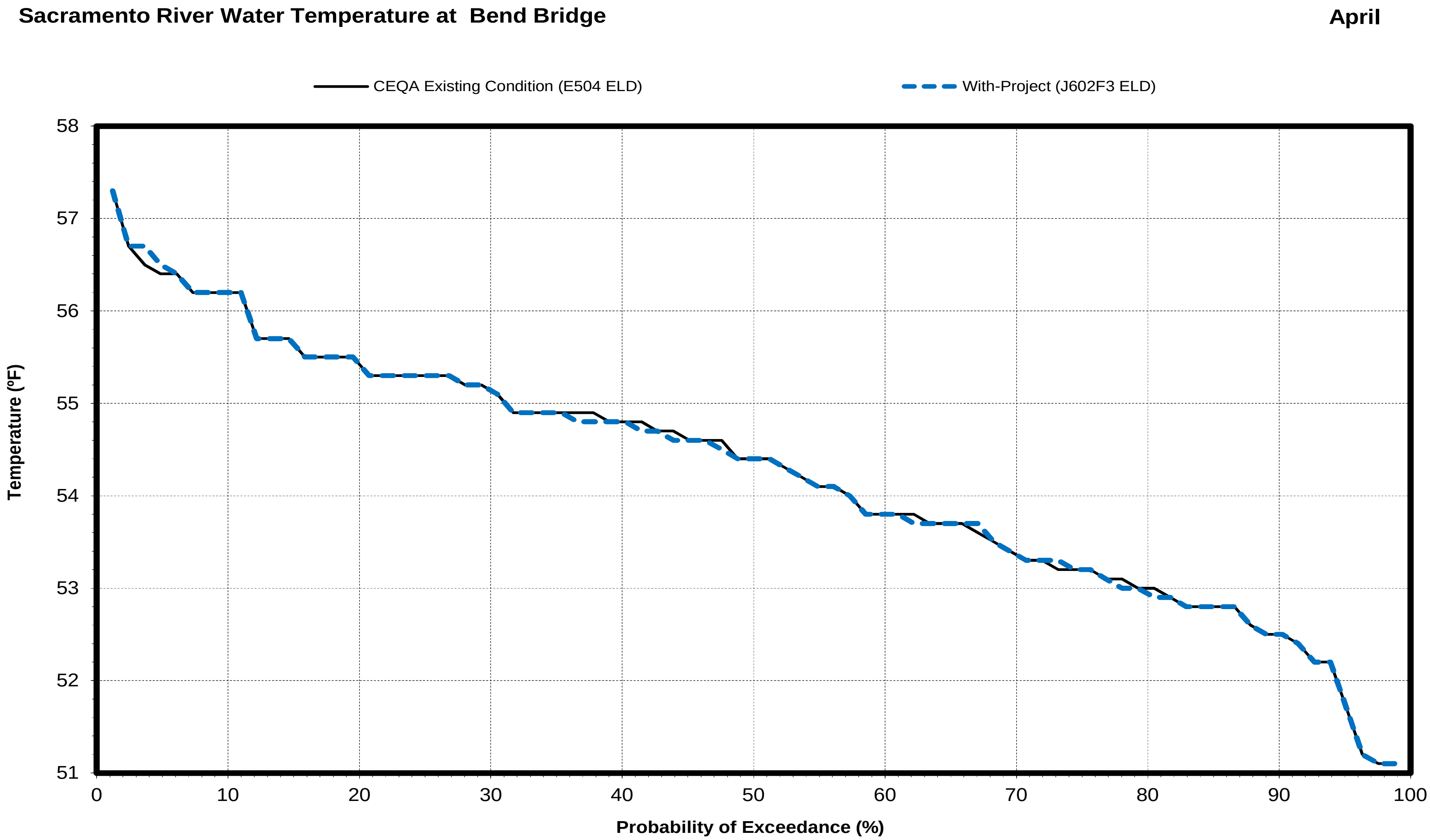
Figure 57 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

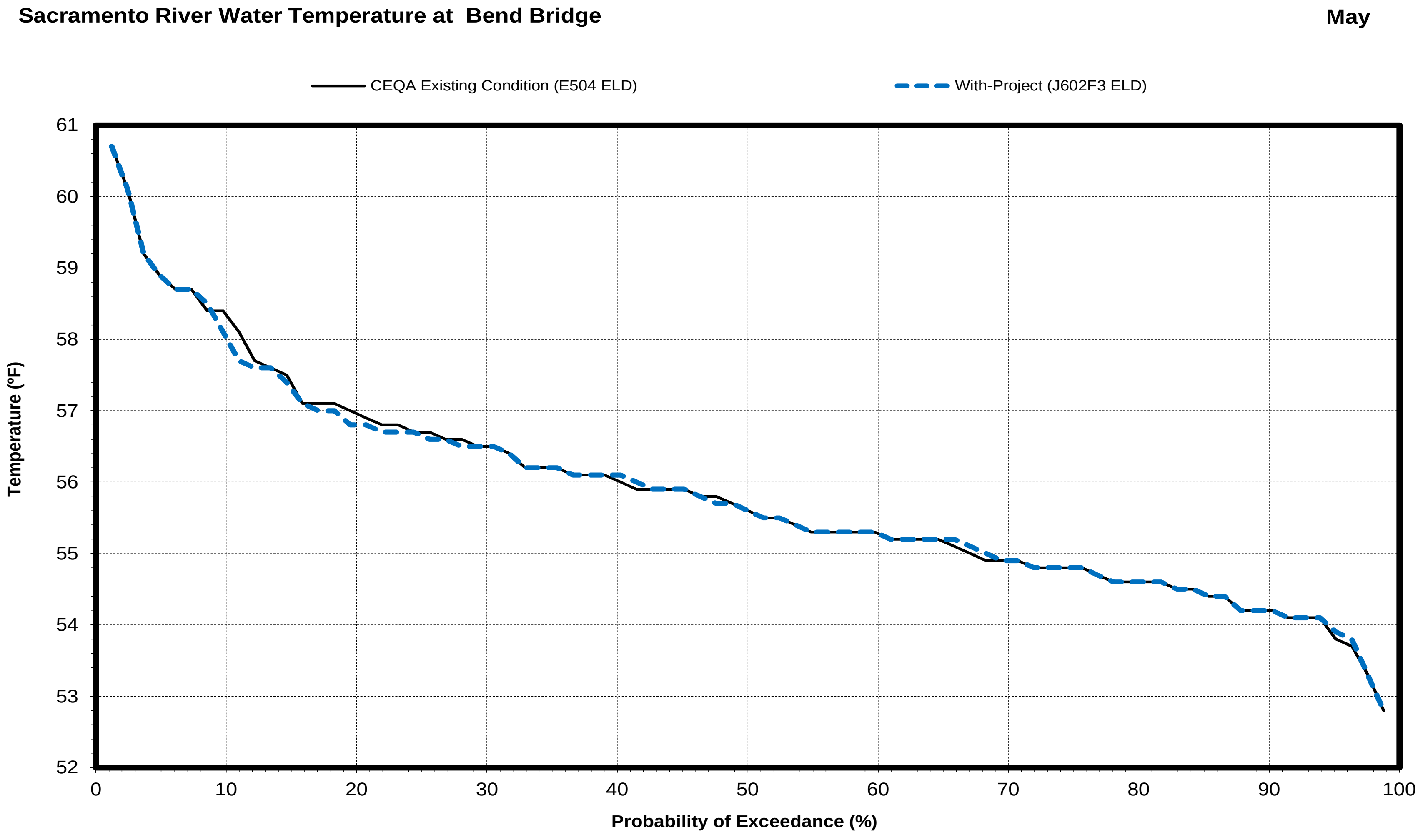
Figure 58 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

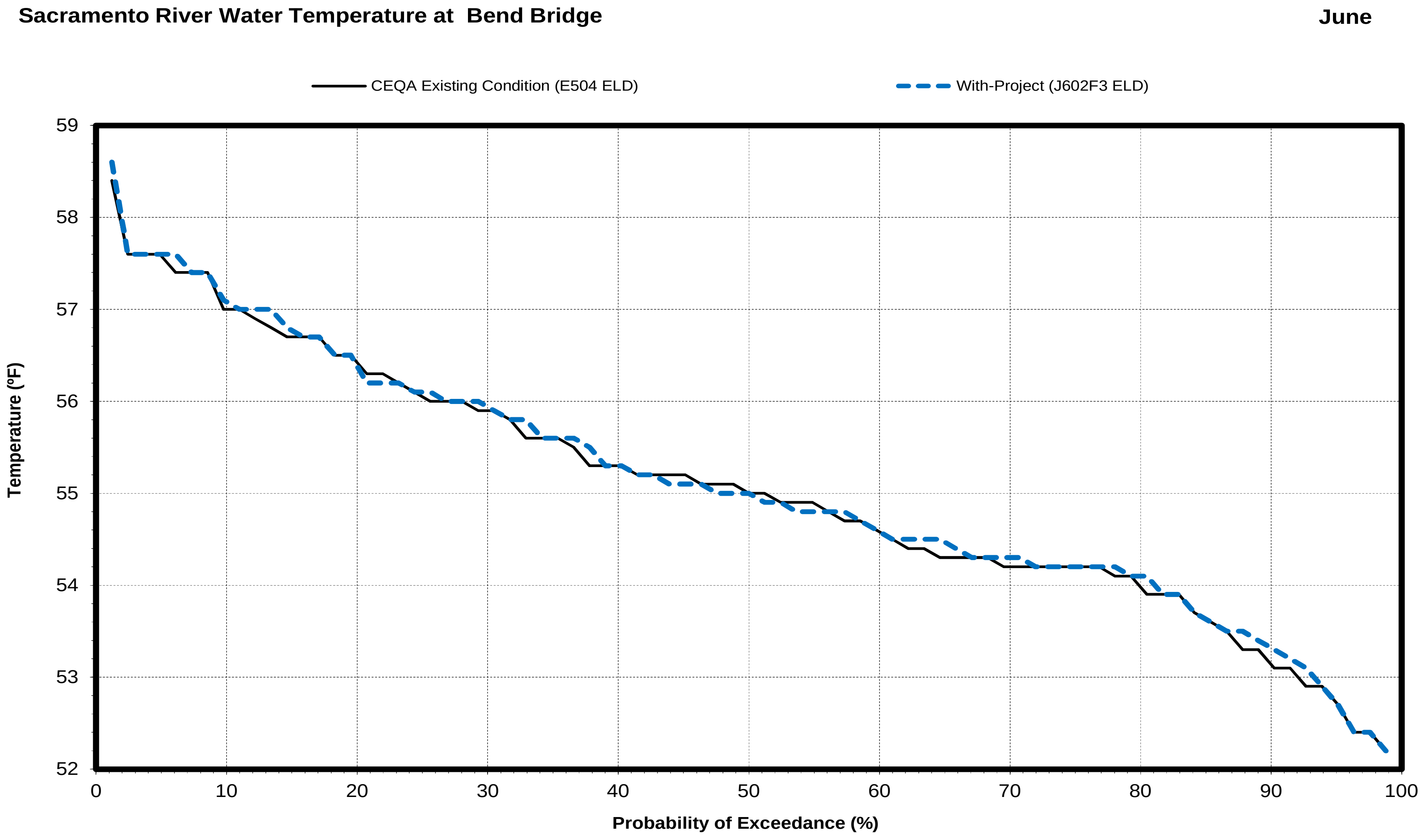
Figure 59 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

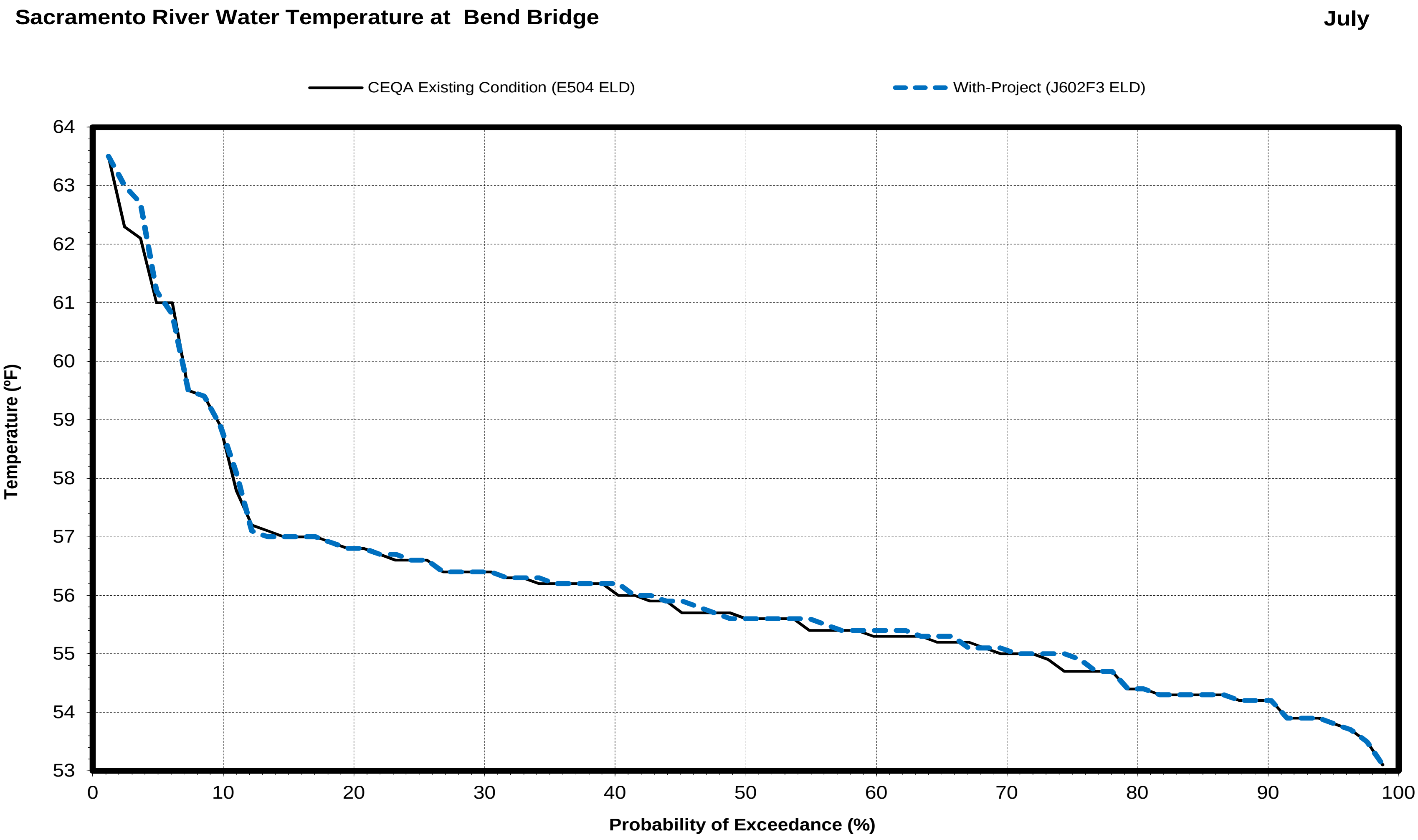
Figure 60 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

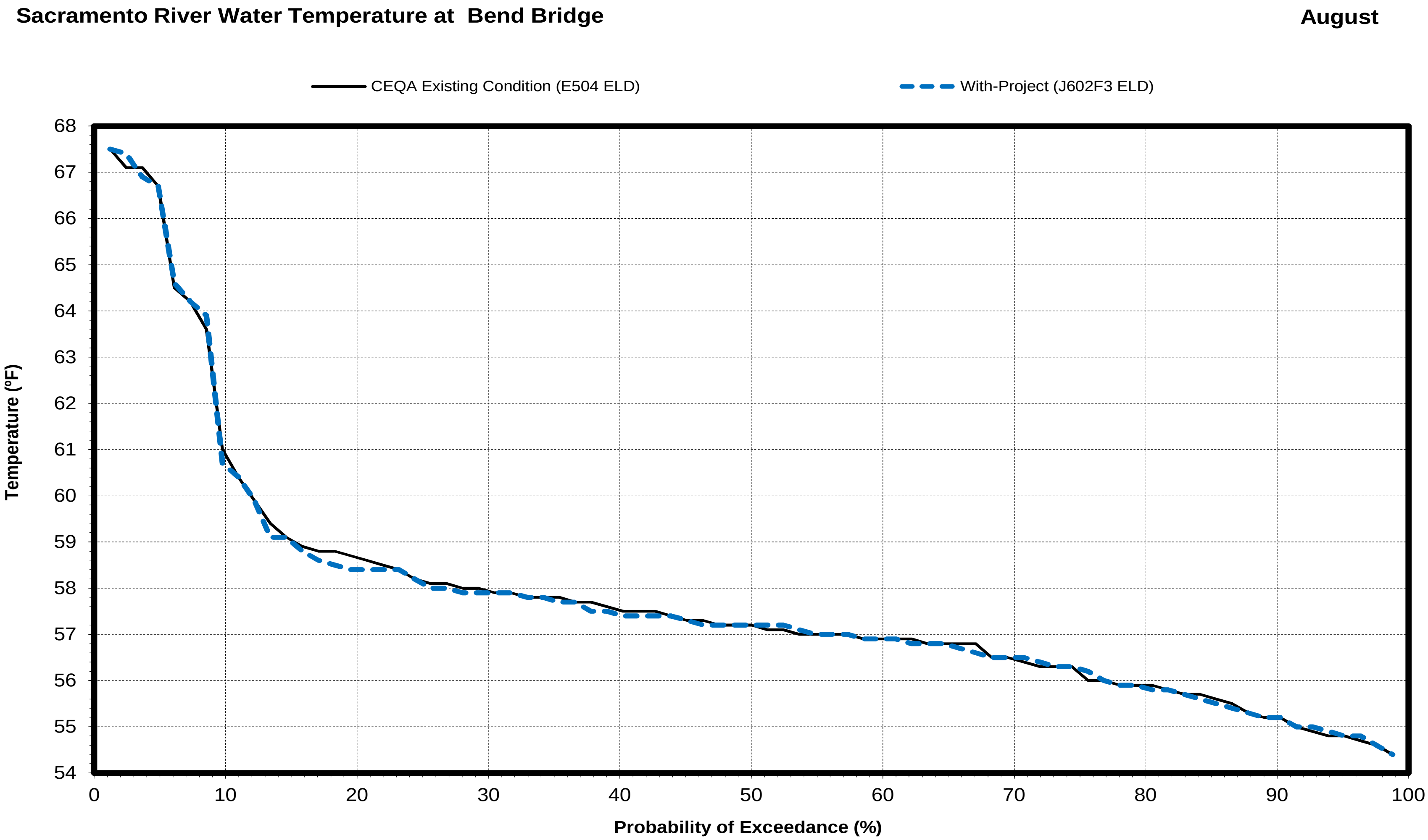
Figure 61 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

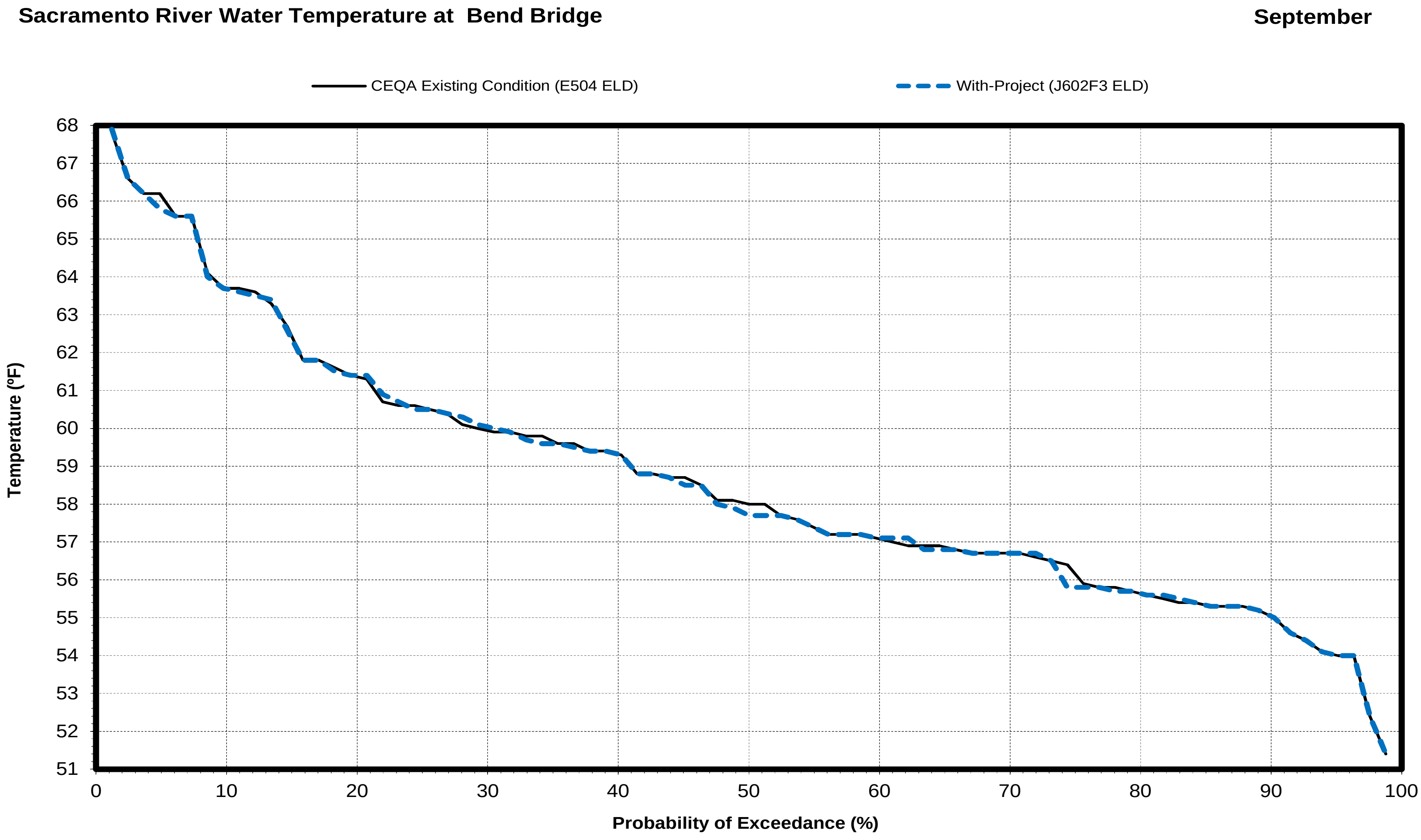
Figure 62 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 63 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 68 E504ELD-J602F3ELD

Long-term and Water Year Type Average Sacramento River Water Temperature below Confluence with the Feather River Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Temperature (ºF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	60.5	52.5	45.6	44.8	49.5	54.2	60.5	66.0	70.3	72.3	71.7	67.4
With-Project (J602F3 ELD)	60.5	52.5	45.6	44.8	49.5	54.2	60.5	66.0	70.4	72.3	71.7	67.4
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	60.1	52.2	46.2	45.7	49.5	53.1	58.4	64.3	69.3	72.4	71.5	65.0
With-Project (J602F3 ELD)	60.1	52.2	46.2	45.7	49.5	53.1	58.4	64.3	69.3	72.4	71.5	65.0
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	60.5	52.8	46.3	44.9	49.3	53.9	60.5	66.3	70.5	71.2	70.6	66.3
With-Project (J602F3 ELD)	60.5	52.8	46.3	44.9	49.3	53.9	60.5	66.3	70.6	71.2	70.6	66.2
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	-0.1
Below Normal												
CEQA Existing Condition (E504 ELD)	60.8	52.5	45.4	44.2	48.9	54.4	61.0	66.3	70.5	72.2	71.5	68.6
With-Project (J602F3 ELD)	60.8	52.5	45.4	44.2	48.9	54.4	61.0	66.3	70.6	72.2	71.5	68.6
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Dry												
CEQA Existing Condition (E504 ELD)	60.2	52.1	45.4	44.0	49.4	54.9	61.8	67.0	71.4	71.6	71.9	69.0
With-Project (J602F3 ELD)	60.2	52.1	45.4	44.0	49.4	54.9	61.8	67.0	71.4	71.7	71.9	69.0
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Critical												
CEQA Existing Condition (E504 ELD)	61.6	53.2	44.5	44.5	50.4	55.5	62.5	67.3	70.6	73.9	73.2	69.9
With-Project (J602F3 ELD)	61.6	53.2	44.5	44.5	50.4	55.5	62.5	67.3	70.6	74.0	73.3	69.9
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	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

Table 69 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

October			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	65.8	65.8	0.0
2.4	64.7	64.7	0.0
3.7	64.2	64.2	0.0
4.9	63.8	63.9	0.1
6.1	63.3	63.3	0.0
7.3	63.1	63.1	0.0
8.5	62.5	62.5	0.0
9.8	62.5	62.5	0.0
11.0	62.3	62.3	0.0
12.2	62.3	62.3	0.0
13.4	62.3	62.3	0.0
14.6	62.2	62.2	0.0
15.9	62.1	62.1	0.0
17.1	62.1	62.1	0.0
18.3	62.0	62.0	0.0
19.5	61.9	61.9	0.0
20.7	61.9	61.9	0.0
22.0	61.9	61.9	0.0
23.2	61.8	61.8	0.0
24.4	61.6	61.6	0.0
25.6	61.5	61.5	0.0
26.8	61.4	61.4	0.0
28.0	61.2	61.2	0.0
29.3	61.1	61.1	0.0
30.5	61.0	61.1	0.1
31.7	61.0	61.0	0.0
32.9	61.0	61.0	0.0
34.1	60.9	60.9	0.0
35.4	60.9	60.9	0.0
36.6	60.9	60.9	0.0
37.8	60.8	60.9	0.1
39.0	60.8	60.8	0.0
40.2	60.7	60.8	0.1
41.5	60.6	60.7	0.1
42.7	60.6	60.7	0.1
43.9	60.6	60.6	0.0
45.1	60.6	60.6	0.0
46.3	60.5	60.6	0.1
47.6	60.5	60.5	0.0
48.8	60.5	60.5	0.0
50.0	60.5	60.5	0.0
51.2	60.5	60.4	-0.1
52.4	60.4	60.4	0.0
53.7	60.4	60.4	0.0
54.9	60.3	60.4	0.1
56.1	60.3	60.3	0.0
57.3	60.3	60.2	-0.1
58.5	60.2	60.2	0.0
59.8	60.1	60.1	0.0
61.0	59.9	59.8	-0.1
62.2	59.8	59.8	0.0
63.4	59.8	59.7	-0.1
64.6	59.7	59.7	0.0
65.9	59.7	59.6	-0.1
67.1	59.7	59.6	-0.1
68.3	59.6	59.6	0.0
69.5	59.6	59.6	0.0
70.7	59.6	59.5	-0.1
72.0	59.5	59.5	0.0
73.2	59.5	59.5	0.0
74.4	59.4	59.4	0.0
75.6	59.3	59.3	0.0
76.8	59.2	59.2	0.0
78.0	59.2	59.2	0.0
79.3	59.1	59.1	0.0
80.5	59.1	59.0	-0.1
81.7	59.0	59.0	0.0
82.9	58.9	58.9	0.0
84.1	58.9	58.8	-0.1
85.4	58.7	58.7	0.0
86.6	58.6	58.6	0.0
87.8	58.5	58.5	0.0
89.0	58.4	58.4	0.0
90.2	58.4	58.4	0.0
91.5	58.4	58.4	0.0
92.7	58.3	58.3	0.0
93.9	58.3	58.3	0.0
95.1	58.3	58.3	0.0
96.3	58.1	58.1	0.0
97.6	57.9	57.9	0.0
98.8	57.7	57.7	0.0
Min	57.7	57.7	-0.1
Max	65.8	65.8	0.1
Mean	60.5	60.5	0.0
Median	60.5	60.5	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 70 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

November			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	56.2	56.2	0.0
2.4	55.7	55.7	0.0
3.7	55.4	55.4	0.0
4.9	55.0	55.0	0.0
6.1	54.7	54.7	0.0
7.3	54.7	54.7	0.0
8.5	54.6	54.6	0.0
9.8	54.4	54.4	0.0
11.0	54.3	54.4	0.1
12.2	54.3	54.3	0.0
13.4	54.3	54.2	-0.1
14.6	54.2	54.2	0.0
15.9	54.2	54.2	0.0
17.1	54.2	54.2	0.0
18.3	54.2	54.2	0.0
19.5	54.1	54.2	0.1
20.7	54.1	54.1	0.0
22.0	53.9	53.9	0.0
23.2	53.6	53.7	0.1
24.4	53.6	53.6	0.0
25.6	53.5	53.5	0.0
26.8	53.5	53.5	0.0
28.0	53.5	53.5	0.0
29.3	53.2	53.2	0.0
30.5	53.2	53.2	0.0
31.7	53.1	53.1	0.0
32.9	53.0	53.1	0.1
34.1	53.0	53.0	0.0
35.4	53.0	53.0	0.0
36.6	52.8	52.8	0.0
37.8	52.8	52.8	0.0
39.0	52.7	52.7	0.0
40.2	52.7	52.7	0.0
41.5	52.7	52.7	0.0
42.7	52.6	52.7	0.1
43.9	52.6	52.6	0.0
45.1	52.5	52.6	0.1
46.3	52.5	52.5	0.0
47.6	52.5	52.5	0.0
48.8	52.5	52.5	0.0
50.0	52.4	52.4	0.0
51.2	52.4	52.4	0.0
52.4	52.4	52.4	0.0
53.7	52.3	52.3	0.0
54.9	52.2	52.2	0.0
56.1	52.2	52.2	0.0
57.3	52.1	52.1	0.0
58.5	52.1	52.1	0.0
59.8	52.1	52.1	0.0
61.0	52.0	52.0	0.0
62.2	52.0	52.0	0.0
63.4	51.9	51.9	0.0
64.6	51.9	51.9	0.0
65.9	51.8	51.8	0.0
67.1	51.6	51.6	0.0
68.3	51.5	51.5	0.0
69.5	51.5	51.5	0.0
70.7	51.5	51.5	0.0
72.0	51.5	51.5	0.0
73.2	51.5	51.4	-0.1
74.4	51.5	51.4	-0.1
75.6	51.4	51.4	0.0
76.8	51.3	51.3	0.0
78.0	51.2	51.2	0.0
79.3	51.2	51.2	0.0
80.5	51.1	51.1	0.0
81.7	51.1	51.1	0.0
82.9	51.1	51.0	-0.1
84.1	51.0	51.0	0.0
85.4	50.9	50.9	0.0
86.6	50.8	50.8	0.0
87.8	50.8	50.8	0.0
89.0	50.8	50.8	0.0
90.2	50.7	50.7	0.0
91.5	50.3	50.3	0.0
92.7	50.3	50.3	0.0
93.9	50.2	50.3	0.1
95.1	50.1	50.1	0.0
96.3	50.0	50.0	0.0
97.6	49.4	49.4	0.0
98.8	48.2	48.2	0.0
Min	48.2	48.2	-0.1
Max	56.2	56.2	0.1
Mean	52.5	52.5	0.0
Median	52.4	52.4	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 71 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

December			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	50.4	50.4	0.0
2.4	48.1	48.1	0.0
3.7	48.0	48.0	0.0
4.9	48.0	48.0	0.0
6.1	48.0	48.0	0.0
7.3	48.0	47.9	-0.1
8.5	47.9	47.9	0.0
9.8	47.9	47.9	0.0
11.0	47.5	47.5	0.0
12.2	47.5	47.5	0.0
13.4	47.5	47.5	0.0
14.6	47.5	47.5	0.0
15.9	47.5	47.5	0.0
17.1	47.5	47.5	0.0
18.3	47.4	47.4	0.0
19.5	47.4	47.4	0.0
20.7	47.3	47.3	0.0
22.0	47.2	47.2	0.0
23.2	47.2	47.2	0.0
24.4	47.1	47.1	0.0
25.6	47.0	47.0	0.0
26.8	46.8	46.8	0.0
28.0	46.8	46.8	0.0
29.3	46.8	46.8	0.0
30.5	46.7	46.7	0.0
31.7	46.7	46.7	0.0
32.9	46.7	46.7	0.0
34.1	46.5	46.5	0.0
35.4	46.5	46.5	0.0
36.6	46.3	46.3	0.0
37.8	46.3	46.3	0.0
39.0	46.2	46.2	0.0
40.2	46.2	46.2	0.0
41.5	46.1	46.1	0.0
42.7	46.1	46.1	0.0
43.9	46.0	46.1	0.1
45.1	46.0	46.0	0.0
46.3	45.9	45.9	0.0
47.6	45.8	45.8	0.0
48.8	45.8	45.8	0.0
50.0	45.7	45.7	0.0
51.2	45.7	45.7	0.0
52.4	45.6	45.6	0.0
53.7	45.6	45.6	0.0
54.9	45.5	45.5	0.0
56.1	45.4	45.5	0.1
57.3	45.4	45.4	0.0
58.5	45.4	45.4	0.0
59.8	45.3	45.4	0.1
61.0	45.3	45.3	0.0
62.2	45.3	45.3	0.0
63.4	45.2	45.2	0.0
64.6	45.0	45.0	0.0
65.9	45.0	45.0	0.0
67.1	45.0	45.0	0.0
68.3	45.0	45.0	0.0
69.5	44.9	44.9	0.0
70.7	44.8	44.8	0.0
72.0	44.8	44.8	0.0
73.2	44.7	44.8	0.1
74.4	44.6	44.6	0.0
75.6	44.6	44.6	0.0
76.8	44.5	44.5	0.0
78.0	44.4	44.4	0.0
79.3	44.2	44.2	0.0
80.5	44.2	44.2	0.0
81.7	44.1	44.1	0.0
82.9	44.1	44.1	0.0
84.1	43.8	43.8	0.0
85.4	43.6	43.6	0.0
86.6	43.5	43.5	0.0
87.8	43.3	43.3	0.0
89.0	43.3	43.3	0.0
90.2	43.0	43.0	0.0
91.5	43.0	43.0	0.0
92.7	43.0	43.0	0.0
93.9	42.9	42.9	0.0
95.1	42.5	42.5	0.0
96.3	41.9	41.9	0.0
97.6	41.6	41.6	0.0
98.8	40.5	40.5	0.0
Min	40.5	40.5	-0.1
Max	50.4	50.4	0.1
Mean	45.6	45.6	0.0
Median	45.7	45.7	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 72 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

January			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	47.7	47.7	0.0
2.4	47.5	47.5	0.0
3.7	47.4	47.4	0.0
4.9	47.2	47.2	0.0
6.1	47.1	47.1	0.0
7.3	47.0	47.0	0.0
8.5	46.8	46.8	0.0
9.8	46.8	46.8	0.0
11.0	46.6	46.6	0.0
12.2	46.5	46.6	0.1
13.4	46.5	46.5	0.0
14.6	46.5	46.5	0.0
15.9	46.4	46.4	0.0
17.1	46.3	46.3	0.0
18.3	46.2	46.2	0.0
19.5	46.2	46.2	0.0
20.7	46.2	46.2	0.0
22.0	46.1	46.1	0.0
23.2	46.1	46.1	0.0
24.4	46.0	46.0	0.0
25.6	45.9	45.9	0.0
26.8	45.9	45.9	0.0
28.0	45.8	45.8	0.0
29.3	45.8	45.8	0.0
30.5	45.8	45.8	0.0
31.7	45.7	45.7	0.0
32.9	45.5	45.5	0.0
34.1	45.5	45.5	0.0
35.4	45.4	45.4	0.0
36.6	45.4	45.4	0.0
37.8	45.3	45.3	0.0
39.0	45.3	45.3	0.0
40.2	45.3	45.3	0.0
41.5	45.2	45.2	0.0
42.7	45.2	45.2	0.0
43.9	45.2	45.2	0.0
45.1	45.2	45.2	0.0
46.3	45.2	45.2	0.0
47.6	45.2	45.2	0.0
48.8	45.1	45.1	0.0
50.0	45.1	45.1	0.0
51.2	45.0	45.0	0.0
52.4	45.0	45.0	0.0
53.7	45.0	45.0	0.0
54.9	45.0	45.0	0.0
56.1	44.8	44.8	0.0
57.3	44.7	44.7	0.0
58.5	44.7	44.7	0.0
59.8	44.6	44.6	0.0
61.0	44.5	44.5	0.0
62.2	44.5	44.5	0.0
63.4	44.4	44.4	0.0
64.6	44.4	44.4	0.0
65.9	44.4	44.4	0.0
67.1	44.4	44.4	0.0
68.3	44.3	44.3	0.0
69.5	44.2	44.2	0.0
70.7	44.2	44.1	-0.1
72.0	44.1	44.1	0.0
73.2	44.1	44.1	0.0
74.4	43.9	43.9	0.0
75.6	43.7	43.7	0.0
76.8	43.5	43.5	0.0
78.0	43.4	43.4	0.0
79.3	43.4	43.4	0.0
80.5	43.4	43.4	0.0
81.7	43.3	43.3	0.0
82.9	43.2	43.2	0.0
84.1	43.2	43.2	0.0
85.4	42.9	42.9	0.0
86.6	42.9	42.9	0.0
87.8	42.8	42.8	0.0
89.0	42.8	42.8	0.0
90.2	42.8	42.8	0.0
91.5	42.4	42.4	0.0
92.7	42.3	42.3	0.0
93.9	41.9	41.9	0.0
95.1	41.6	41.6	0.0
96.3	41.5	41.5	0.0
97.6	39.7	39.7	0.0
98.8	39.1	39.1	0.0
Min	39.1	39.1	-0.1
Max	47.7	47.7	0.1
Mean	44.8	44.8	0.0
Median	45.1	45.1	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 73 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

February			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	53.0	53.0	0.0
2.4	52.9	52.9	0.0
3.7	52.5	52.5	0.0
4.9	51.9	51.9	0.0
6.1	51.9	51.9	0.0
7.3	51.6	51.6	0.0
8.5	51.6	51.6	0.0
9.8	51.4	51.4	0.0
11.0	51.4	51.4	0.0
12.2	51.3	51.3	0.0
13.4	51.2	51.2	0.0
14.6	51.1	51.1	0.0
15.9	51.0	51.0	0.0
17.1	51.0	50.9	-0.1
18.3	50.9	50.9	0.0
19.5	50.9	50.9	0.0
20.7	50.9	50.9	0.0
22.0	50.9	50.9	0.0
23.2	50.8	50.8	0.0
24.4	50.6	50.6	0.0
25.6	50.5	50.5	0.0
26.8	50.5	50.5	0.0
28.0	50.4	50.4	0.0
29.3	50.4	50.4	0.0
30.5	50.2	50.3	0.1
31.7	50.2	50.2	0.0
32.9	50.1	50.1	0.0
34.1	50.0	50.0	0.0
35.4	49.9	49.9	0.0
36.6	49.9	49.9	0.0
37.8	49.8	49.8	0.0
39.0	49.7	49.7	0.0
40.2	49.6	49.6	0.0
41.5	49.6	49.6	0.0
42.7	49.5	49.5	0.0
43.9	49.5	49.5	0.0
45.1	49.4	49.4	0.0
46.3	49.4	49.4	0.0
47.6	49.4	49.4	0.0
48.8	49.3	49.3	0.0
50.0	49.3	49.3	0.0
51.2	49.3	49.3	0.0
52.4	49.2	49.2	0.0
53.7	49.2	49.2	0.0
54.9	49.2	49.2	0.0
56.1	49.1	49.1	0.0
57.3	49.1	49.1	0.0
58.5	49.1	49.1	0.0
59.8	49.0	49.0	0.0
61.0	48.9	48.9	0.0
62.2	48.9	48.9	0.0
63.4	48.9	48.9	0.0
64.6	48.8	48.8	0.0
65.9	48.8	48.8	0.0
67.1	48.7	48.7	0.0
68.3	48.7	48.7	0.0
69.5	48.7	48.7	0.0
70.7	48.6	48.6	0.0
72.0	48.6	48.6	0.0
73.2	48.6	48.6	0.0
74.4	48.5	48.5	0.0
75.6	48.4	48.4	0.0
76.8	48.3	48.3	0.0
78.0	48.3	48.3	0.0
79.3	48.3	48.3	0.0
80.5	48.3	48.3	0.0
81.7	48.1	48.1	0.0
82.9	48.0	48.0	0.0
84.1	48.0	48.0	0.0
85.4	48.0	48.0	0.0
86.6	48.0	48.0	0.0
87.8	47.9	47.9	0.0
89.0	47.7	47.7	0.0
90.2	47.6	47.6	0.0
91.5	47.5	47.5	0.0
92.7	47.4	47.4	0.0
93.9	47.2	47.2	0.0
95.1	47.2	47.2	0.0
96.3	47.1	47.1	0.0
97.6	47.0	47.0	0.0
98.8	46.3	46.3	0.0
Min	46.3	46.3	-0.1
Max	53.0	53.0	0.1
Mean	49.5	49.5	0.0
Median	49.3	49.3	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 74 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	60.0	60.0	0.0
2.4	58.8	58.8	0.0
3.7	57.2	57.2	0.0
4.9	57.1	57.1	0.0
6.1	57.1	57.0	-0.1
7.3	57.0	57.0	0.0
8.5	57.0	57.0	0.0
9.8	57.0	56.9	-0.1
11.0	56.9	56.9	0.0
12.2	56.8	56.8	0.0
13.4	56.5	56.5	0.0
14.6	56.0	56.0	0.0
15.9	56.0	56.0	0.0
17.1	56.0	56.0	0.0
18.3	56.0	56.0	0.0
19.5	55.9	55.9	0.0
20.7	55.8	55.8	0.0
22.0	55.8	55.8	0.0
23.2	55.7	55.7	0.0
24.4	55.6	55.6	0.0
25.6	55.6	55.6	0.0
26.8	55.4	55.4	0.0
28.0	55.2	55.2	0.0
29.3	55.1	55.1	0.0
30.5	55.1	55.1	0.0
31.7	55.0	55.0	0.0
32.9	54.9	54.9	0.0
34.1	54.9	54.9	0.0
35.4	54.8	54.8	0.0
36.6	54.8	54.8	0.0
37.8	54.8	54.8	0.0
39.0	54.7	54.7	0.0
40.2	54.6	54.6	0.0
41.5	54.5	54.5	0.0
42.7	54.5	54.5	0.0
43.9	54.5	54.5	0.0
45.1	54.4	54.4	0.0
46.3	54.4	54.4	0.0
47.6	54.2	54.2	0.0
48.8	54.2	54.2	0.0
50.0	54.1	54.1	0.0
51.2	54.1	54.1	0.0
52.4	54.0	54.0	0.0
53.7	54.0	54.0	0.0
54.9	54.0	54.0	0.0
56.1	54.0	54.0	0.0
57.3	53.9	53.9	0.0
58.5	53.9	53.9	0.0
59.8	53.7	53.7	0.0
61.0	53.7	53.7	0.0
62.2	53.7	53.7	0.0
63.4	53.6	53.6	0.0
64.6	53.5	53.5	0.0
65.9	53.5	53.5	0.0
67.1	53.4	53.4	0.0
68.3	53.2	53.2	0.0
69.5	53.0	53.0	0.0
70.7	52.9	52.9	0.0
72.0	52.9	52.9	0.0
73.2	52.8	52.8	0.0
74.4	52.7	52.7	0.0
75.6	52.5	52.5	0.0
76.8	52.4	52.4	0.0
78.0	52.3	52.3	0.0
79.3	52.1	52.1	0.0
80.5	52.1	52.1	0.0
81.7	52.0	52.0	0.0
82.9	51.9	51.9	0.0
84.1	51.9	51.9	0.0
85.4	51.9	51.9	0.0
86.6	51.9	51.9	0.0
87.8	51.8	51.8	0.0
89.0	51.7	51.7	0.0
90.2	51.6	51.6	0.0
91.5	51.6	51.6	0.0
92.7	51.5	51.5	0.0
93.9	51.4	51.4	0.0
95.1	51.3	51.3	0.0
96.3	51.1	51.2	0.1
97.6	51.1	51.1	0.0
98.8	50.8	50.9	0.1
Min	50.8	50.9	-0.1
Max	60.0	60.0	0.1
Mean	54.2	54.2	0.0
Median	54.1	54.1	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 75 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

April			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	65.4	65.4	0.0
2.4	65.0	65.0	0.0
3.7	64.7	64.7	0.0
4.9	64.5	64.6	0.1
6.1	64.4	64.4	0.0
7.3	64.1	64.1	0.0
8.5	64.1	64.1	0.0
9.8	63.9	63.9	0.0
11.0	63.6	63.6	0.0
12.2	63.4	63.4	0.0
13.4	63.4	63.4	0.0
14.6	63.1	63.1	0.0
15.9	62.9	62.9	0.0
17.1	62.9	62.9	0.0
18.3	62.8	62.8	0.0
19.5	62.6	62.7	0.1
20.7	62.5	62.5	0.0
22.0	62.5	62.5	0.0
23.2	62.3	62.3	0.0
24.4	62.2	62.2	0.0
25.6	62.2	62.2	0.0
26.8	62.2	62.2	0.0
28.0	62.1	62.1	0.0
29.3	62.1	62.1	0.0
30.5	62.0	62.0	0.0
31.7	61.8	61.8	0.0
32.9	61.8	61.8	0.0
34.1	61.6	61.6	0.0
35.4	61.6	61.6	0.0
36.6	61.6	61.6	0.0
37.8	61.4	61.4	0.0
39.0	61.3	61.3	0.0
40.2	61.2	61.2	0.0
41.5	61.2	61.2	0.0
42.7	61.2	61.1	-0.1
43.9	61.1	61.1	0.0
45.1	60.9	60.9	0.0
46.3	60.9	60.9	0.0
47.6	60.7	60.7	0.0
48.8	60.6	60.6	0.0
50.0	60.6	60.6	0.0
51.2	60.5	60.5	0.0
52.4	60.5	60.5	0.0
53.7	60.4	60.4	0.0
54.9	60.4	60.4	0.0
56.1	60.3	60.4	0.1
57.3	60.3	60.3	0.0
58.5	60.3	60.3	0.0
59.8	60.1	60.1	0.0
61.0	60.0	60.0	0.0
62.2	59.9	59.9	0.0
63.4	59.9	59.9	0.0
64.6	59.8	59.8	0.0
65.9	59.6	59.6	0.0
67.1	59.3	59.3	0.0
68.3	59.3	59.3	0.0
69.5	59.2	59.2	0.0
70.7	59.2	59.2	0.0
72.0	59.0	59.0	0.0
73.2	59.0	59.0	0.0
74.4	58.8	58.8	0.0
75.6	58.6	58.6	0.0
76.8	58.5	58.5	0.0
78.0	58.4	58.4	0.0
79.3	58.0	58.0	0.0
80.5	57.8	57.8	0.0
81.7	57.7	57.7	0.0
82.9	57.7	57.7	0.0
84.1	57.5	57.5	0.0
85.4	57.4	57.4	0.0
86.6	57.4	57.4	0.0
87.8	57.4	57.3	-0.1
89.0	57.2	57.2	0.0
90.2	57.0	57.0	0.0
91.5	57.0	57.0	0.0
92.7	56.4	56.4	0.0
93.9	56.2	56.2	0.0
95.1	56.2	56.2	0.0
96.3	56.0	56.0	0.0
97.6	54.9	54.9	0.0
98.8	54.3	54.3	0.0
Min	54.3	54.3	-0.1
Max	65.4	65.4	0.1
Mean	60.5	60.5	0.0
Median	60.6	60.6	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 76 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

May			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	72.5	72.5	0.0
2.4	70.9	70.9	0.0
3.7	70.7	70.7	0.0
4.9	70.2	70.2	0.0
6.1	69.9	69.9	0.0
7.3	69.7	69.7	0.0
8.5	69.3	69.3	0.0
9.8	69.1	69.1	0.0
11.0	69.0	69.0	0.0
12.2	68.8	68.8	0.0
13.4	68.5	68.5	0.0
14.6	68.4	68.4	0.0
15.9	68.2	68.2	0.0
17.1	68.2	68.2	0.0
18.3	67.9	67.8	-0.1
19.5	67.8	67.7	-0.1
20.7	67.7	67.7	0.0
22.0	67.5	67.5	0.0
23.2	67.5	67.5	0.0
24.4	67.5	67.5	0.0
25.6	67.5	67.5	0.0
26.8	67.3	67.3	0.0
28.0	67.3	67.3	0.0
29.3	67.3	67.3	0.0
30.5	67.2	67.2	0.0
31.7	67.0	67.0	0.0
32.9	67.0	67.0	0.0
34.1	66.9	66.9	0.0
35.4	66.9	66.9	0.0
36.6	66.9	66.9	0.0
37.8	66.8	66.8	0.0
39.0	66.8	66.8	0.0
40.2	66.7	66.7	0.0
41.5	66.7	66.7	0.0
42.7	66.6	66.6	0.0
43.9	66.6	66.6	0.0
45.1	66.5	66.5	0.0
46.3	66.4	66.4	0.0
47.6	66.4	66.4	0.0
48.8	66.4	66.4	0.0
50.0	66.3	66.3	0.0
51.2	66.1	66.3	0.2
52.4	66.1	66.1	0.0
53.7	66.1	66.1	0.0
54.9	66.0	66.1	0.1
56.1	65.8	65.8	0.0
57.3	65.7	65.7	0.0
58.5	65.6	65.6	0.0
59.8	65.5	65.5	0.0
61.0	65.5	65.5	0.0
62.2	65.4	65.4	0.0
63.4	65.2	65.1	-0.1
64.6	65.1	65.1	0.0
65.9	65.0	65.0	0.0
67.1	65.0	65.0	0.0
68.3	65.0	65.0	0.0
69.5	65.0	65.0	0.0
70.7	64.6	64.6	0.0
72.0	64.5	64.5	0.0
73.2	64.4	64.4	0.0
74.4	64.4	64.3	-0.1
75.6	64.4	64.2	-0.2
76.8	64.1	64.2	0.1
78.0	63.9	63.9	0.0
79.3	63.6	63.6	0.0
80.5	63.6	63.6	0.0
81.7	63.4	63.4	0.0
82.9	63.2	63.2	0.0
84.1	63.0	63.0	0.0
85.4	62.9	62.9	0.0
86.6	62.8	62.8	0.0
87.8	62.8	62.8	0.0
89.0	62.8	62.8	0.0
90.2	62.7	62.7	0.0
91.5	62.5	62.5	0.0
92.7	62.4	62.4	0.0
93.9	62.1	62.1	0.0
95.1	62.1	62.1	0.0
96.3	61.7	61.7	0.0
97.6	61.6	61.6	0.0
98.8	59.4	59.4	0.0
Min	59.4	59.4	-0.2
Max	72.5	72.5	0.2
Mean	66.0	66.0	0.0
Median	66.3	66.3	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 77 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

June			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	73.7	73.7	0.0
2.4	73.4	73.5	0.1
3.7	73.3	73.4	0.1
4.9	73.2	73.2	0.0
6.1	73.1	73.1	0.0
7.3	73.0	73.0	0.0
8.5	72.8	72.8	0.0
9.8	72.5	72.8	0.3
11.0	72.4	72.5	0.1
12.2	72.4	72.3	-0.1
13.4	72.3	72.2	-0.1
14.6	72.2	72.2	0.0
15.9	72.0	72.0	0.0
17.1	72.0	72.0	0.0
18.3	71.9	71.9	0.0
19.5	71.8	71.9	0.1
20.7	71.8	71.8	0.0
22.0	71.7	71.8	0.1
23.2	71.6	71.7	0.1
24.4	71.6	71.6	0.0
25.6	71.5	71.5	0.0
26.8	71.4	71.4	0.0
28.0	71.4	71.4	0.0
29.3	71.3	71.4	0.1
30.5	71.3	71.4	0.1
31.7	71.1	71.1	0.0
32.9	71.1	71.1	0.0
34.1	71.0	71.1	0.1
35.4	71.0	71.0	0.0
36.6	71.0	71.0	0.0
37.8	71.0	71.0	0.0
39.0	70.9	70.9	0.0
40.2	70.9	70.9	0.0
41.5	70.8	70.8	0.0
42.7	70.8	70.8	0.0
43.9	70.8	70.8	0.0
45.1	70.8	70.8	0.0
46.3	70.7	70.7	0.0
47.6	70.7	70.7	0.0
48.8	70.7	70.7	0.0
50.0	70.7	70.7	0.0
51.2	70.7	70.7	0.0
52.4	70.4	70.4	0.0
53.7	70.4	70.4	0.0
54.9	70.3	70.3	0.0
56.1	70.1	70.1	0.0
57.3	70.1	70.1	0.0
58.5	70.1	70.1	0.0
59.8	70.1	70.1	0.0
61.0	70.0	70.0	0.0
62.2	69.9	70.0	0.1
63.4	69.8	69.9	0.1
64.6	69.8	69.9	0.1
65.9	69.7	69.8	0.1
67.1	69.6	69.8	0.2
68.3	69.6	69.6	0.0
69.5	69.5	69.6	0.1
70.7	69.5	69.5	0.0
72.0	69.3	69.3	0.0
73.2	69.2	69.2	0.0
74.4	69.2	69.2	0.0
75.6	69.1	69.2	0.1
76.8	69.0	69.0	0.0
78.0	69.0	69.0	0.0
79.3	69.0	69.0	0.0
80.5	69.0	69.0	0.0
81.7	68.8	68.8	0.0
82.9	68.8	68.8	0.0
84.1	68.8	68.8	0.0
85.4	68.7	68.7	0.0
86.6	68.2	68.2	0.0
87.8	68.2	68.2	0.0
89.0	67.8	67.8	0.0
90.2	67.7	67.7	0.0
91.5	67.3	67.3	0.0
92.7	67.3	67.3	0.0
93.9	67.2	67.2	0.0
95.1	66.9	66.9	0.0
96.3	66.4	66.4	0.0
97.6	66.3	66.3	0.0
98.8	66.3	66.3	0.0
Min	66.3	66.3	-0.1
Max	73.7	73.7	0.3
Mean	70.3	70.4	0.0
Median	70.7	70.7	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 78 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

July			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	78.3	79.0	0.7
2.4	77.9	77.9	0.0
3.7	75.9	75.9	0.0
4.9	75.2	75.3	0.1
6.1	74.7	74.9	0.2
7.3	74.7	74.7	0.0
8.5	74.3	74.7	0.4
9.8	74.2	74.2	0.0
11.0	74.0	74.0	0.0
12.2	73.8	73.9	0.1
13.4	73.8	73.8	0.0
14.6	73.8	73.8	0.0
15.9	73.8	73.7	-0.1
17.1	73.8	73.7	-0.1
18.3	73.7	73.7	0.0
19.5	73.6	73.6	0.0
20.7	73.6	73.6	0.0
22.0	73.5	73.5	0.0
23.2	73.4	73.5	0.1
24.4	73.3	73.4	0.1
25.6	73.3	73.3	0.0
26.8	73.2	73.2	0.0
28.0	73.2	73.2	0.0
29.3	73.2	73.2	0.0
30.5	73.1	73.2	0.1
31.7	73.0	73.1	0.1
32.9	72.9	73.0	0.1
34.1	72.9	73.0	0.1
35.4	72.9	72.9	0.0
36.6	72.9	72.9	0.0
37.8	72.9	72.9	0.0
39.0	72.9	72.9	0.0
40.2	72.8	72.9	0.1
41.5	72.7	72.8	0.1
42.7	72.3	72.3	0.0
43.9	72.3	72.3	0.0
45.1	72.1	72.3	0.2
46.3	72.1	72.2	0.1
47.6	72.1	72.1	0.0
48.8	72.1	72.1	0.0
50.0	72.1	72.1	0.0
51.2	72.1	72.1	0.0
52.4	72.1	72.1	0.0
53.7	72.0	72.0	0.0
54.9	72.0	72.0	0.0
56.1	72.0	72.0	0.0
57.3	71.9	71.9	0.0
58.5	71.8	71.9	0.1
59.8	71.8	71.8	0.0
61.0	71.8	71.8	0.0
62.2	71.8	71.8	0.0
63.4	71.6	71.8	0.2
64.6	71.6	71.8	0.2
65.9	71.6	71.6	0.0
67.1	71.5	71.6	0.1
68.3	71.5	71.5	0.0
69.5	71.5	71.5	0.0
70.7	71.5	71.5	0.0
72.0	71.5	71.5	0.0
73.2	71.3	71.5	0.2
74.4	71.3	71.3	0.0
75.6	71.2	71.3	0.1
76.8	71.2	71.2	0.0
78.0	71.1	71.1	0.0
79.3	71.0	71.0	0.0
80.5	70.9	70.9	0.0
81.7	70.8	70.9	0.1
82.9	70.8	70.8	0.0
84.1	70.7	70.7	0.0
85.4	70.6	70.5	-0.1
86.6	70.5	70.5	0.0
87.8	70.2	70.2	0.0
89.0	69.9	70.0	0.1
90.2	69.8	69.8	0.0
91.5	69.7	69.7	0.0
92.7	69.6	69.7	0.1
93.9	69.6	69.6	0.0
95.1	69.6	69.6	0.0
96.3	69.2	69.3	0.1
97.6	68.9	68.9	0.0
98.8	67.5	67.3	-0.2
Min	67.5	67.3	-0.2
Max	78.3	79.0	0.7
Mean	72.3	72.3	0.0
Median	72.1	72.1	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		97.5
X > 0.30			2.5
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**2.5**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		90.0
X > 0.30			10.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**10.0**

Table 79 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

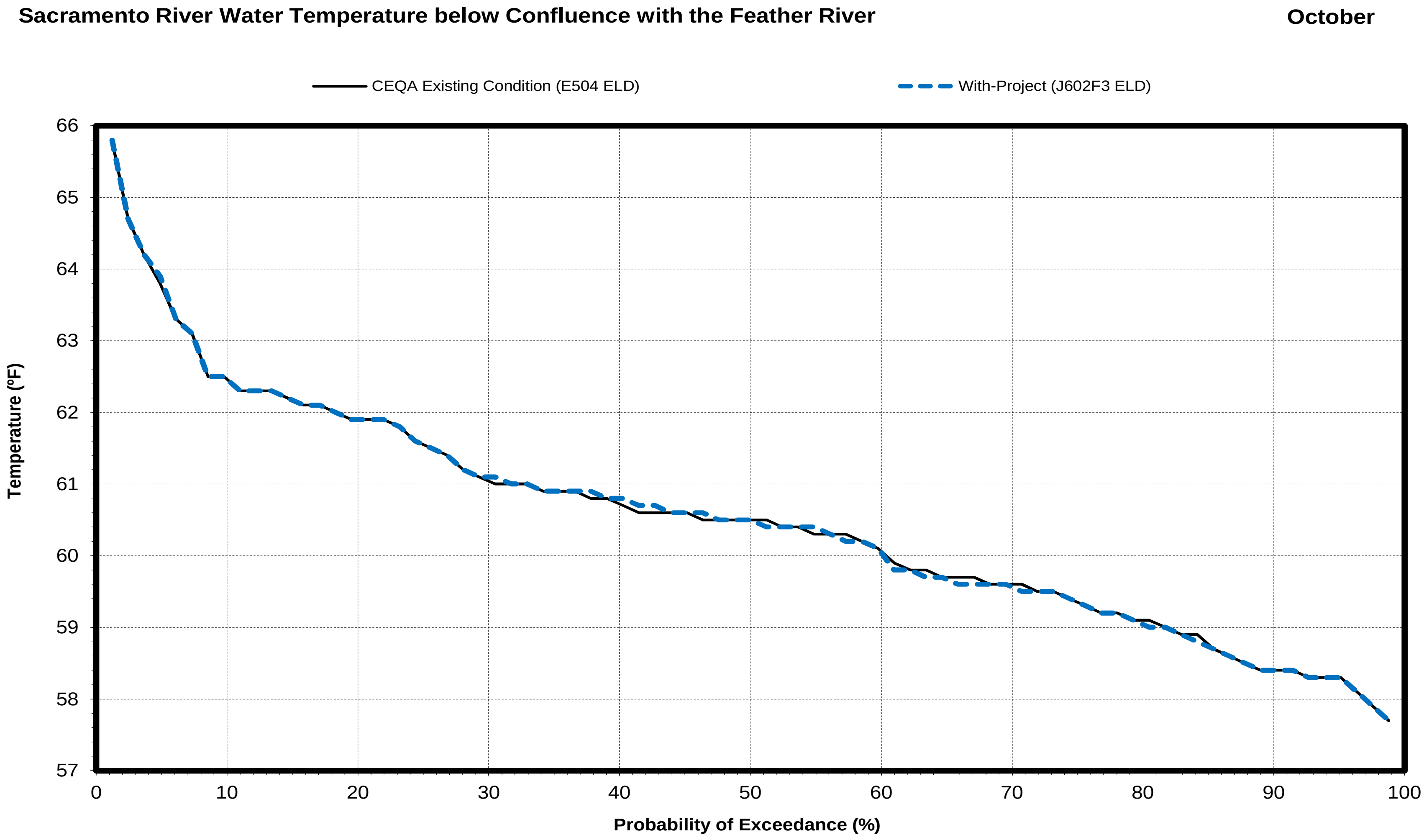
August			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	75.0	75.2	0.2
2.4	74.4	74.4	0.0
3.7	74.3	74.3	0.0
4.9	74.1	74.1	0.0
6.1	74.0	74.1	0.1
7.3	73.8	74.0	0.2
8.5	73.8	73.8	0.0
9.8	73.7	73.8	0.1
11.0	73.7	73.7	0.0
12.2	73.7	73.7	0.0
13.4	73.6	73.6	0.0
14.6	73.6	73.6	0.0
15.9	73.5	73.5	0.0
17.1	73.5	73.5	0.0
18.3	73.4	73.4	0.0
19.5	73.3	73.3	0.0
20.7	73.3	73.3	0.0
22.0	73.2	73.2	0.0
23.2	73.2	73.1	-0.1
24.4	73.2	73.0	-0.2
25.6	72.9	72.9	0.0
26.8	72.9	72.9	0.0
28.0	72.9	72.9	0.0
29.3	72.9	72.8	-0.1
30.5	72.8	72.8	0.0
31.7	72.8	72.7	-0.1
32.9	72.7	72.6	-0.1
34.1	72.6	72.6	0.0
35.4	72.5	72.5	0.0
36.6	72.5	72.5	0.0
37.8	72.4	72.4	0.0
39.0	72.4	72.4	0.0
40.2	72.3	72.3	0.0
41.5	72.2	72.3	0.1
42.7	72.2	72.2	0.0
43.9	72.2	72.2	0.0
45.1	72.1	72.2	0.1
46.3	72.1	72.1	0.0
47.6	71.9	71.9	0.0
48.8	71.9	71.9	0.0
50.0	71.9	71.9	0.0
51.2	71.8	71.8	0.0
52.4	71.8	71.8	0.0
53.7	71.8	71.8	0.0
54.9	71.4	71.4	0.0
56.1	71.4	71.4	0.0
57.3	71.2	71.2	0.0
58.5	71.2	71.2	0.0
59.8	71.0	71.0	0.0
61.0	71.0	71.0	0.0
62.2	71.0	71.0	0.0
63.4	71.0	70.9	-0.1
64.6	70.8	70.8	0.0
65.9	70.8	70.8	0.0
67.1	70.8	70.6	-0.2
68.3	70.7	70.6	-0.1
69.5	70.6	70.5	-0.1
70.7	70.5	70.5	0.0
72.0	70.5	70.5	0.0
73.2	70.5	70.5	0.0
74.4	70.5	70.5	0.0
75.6	70.5	70.5	0.0
76.8	70.4	70.4	0.0
78.0	70.3	70.3	0.0
79.3	70.2	70.3	0.1
80.5	70.2	70.2	0.0
81.7	70.2	70.1	-0.1
82.9	70.0	70.0	0.0
84.1	69.9	69.9	0.0
85.4	69.8	69.8	0.0
86.6	69.8	69.8	0.0
87.8	69.7	69.7	0.0
89.0	69.7	69.7	0.0
90.2	69.6	69.5	-0.1
91.5	69.5	69.4	-0.1
92.7	69.4	69.4	0.0
93.9	69.3	69.3	0.0
95.1	69.3	69.3	0.0
96.3	69.1	69.1	0.0
97.6	69.0	69.0	0.0
98.8	68.2	68.3	0.1
Min	68.2	68.3	-0.2
Max	75.0	75.2	0.2
Mean	71.7	71.7	0.0
Median	71.9	71.9	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 80 E504ELD-J602F3ELD

Sacramento River Water Temperature below Confluence with the Feather River - Probability of Exceedance

September			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	73.4	73.4	0.0
2.4	72.9	73.0	0.1
3.7	72.3	72.3	0.0
4.9	72.2	72.2	0.0
6.1	71.4	71.4	0.0
7.3	71.0	71.0	0.0
8.5	70.9	70.9	0.0
9.8	70.8	70.9	0.1
11.0	70.8	70.7	-0.1
12.2	70.8	70.7	-0.1
13.4	70.5	70.5	0.0
14.6	70.4	70.2	-0.2
15.9	70.2	70.2	0.0
17.1	70.2	70.1	-0.1
18.3	69.9	69.9	0.0
19.5	69.9	69.8	-0.1
20.7	69.6	69.6	0.0
22.0	69.6	69.6	0.0
23.2	69.5	69.5	0.0
24.4	69.4	69.4	0.0
25.6	69.3	69.3	0.0
26.8	69.1	69.1	0.0
28.0	69.0	69.0	0.0
29.3	68.9	68.9	0.0
30.5	68.7	68.9	0.2
31.7	68.7	68.7	0.0
32.9	68.6	68.7	0.1
34.1	68.5	68.6	0.1
35.4	68.5	68.5	0.0
36.6	68.5	68.5	0.0
37.8	68.2	68.3	0.1
39.0	68.1	68.1	0.0
40.2	68.1	68.1	0.0
41.5	67.9	67.9	0.0
42.7	67.9	67.9	0.0
43.9	67.9	67.9	0.0
45.1	67.7	67.7	0.0
46.3	67.6	67.6	0.0
47.6	67.6	67.6	0.0
48.8	67.6	67.6	0.0
50.0	67.5	67.5	0.0
51.2	67.1	67.1	0.0
52.4	66.9	66.9	0.0
53.7	66.8	66.6	-0.2
54.9	66.6	66.6	0.0
56.1	66.6	66.5	-0.1
57.3	66.6	66.5	-0.1
58.5	66.5	66.5	0.0
59.8	66.4	66.4	0.0
61.0	66.4	66.4	0.0
62.2	66.2	66.2	0.0
63.4	66.2	66.2	0.0
64.6	66.2	66.2	0.0
65.9	66.1	66.2	0.1
67.1	65.9	66.1	0.2
68.3	65.8	65.9	0.1
69.5	65.8	65.8	0.0
70.7	65.8	65.7	-0.1
72.0	65.7	65.7	0.0
73.2	65.7	65.6	-0.1
74.4	65.6	65.6	0.0
75.6	65.6	65.6	0.0
76.8	65.6	65.6	0.0
78.0	65.6	65.5	-0.1
79.3	65.4	65.4	0.0
80.5	65.4	65.4	0.0
81.7	65.4	65.1	-0.3
82.9	65.1	65.0	-0.1
84.1	65.0	65.0	0.0
85.4	65.0	64.9	-0.1
86.6	64.8	64.9	0.1
87.8	64.8	64.8	0.0
89.0	64.5	64.5	0.0
90.2	64.3	64.3	0.0
91.5	64.1	64.3	0.2
92.7	63.1	63.1	0.0
93.9	63.0	63.0	0.0
95.1	62.6	62.6	0.0
96.3	62.6	62.6	0.0
97.6	62.2	62.2	0.0
98.8	61.7	61.7	0.0
Min	61.7	61.7	-0.3
Max	73.4	73.4	0.2
Mean	67.4	67.4	0.0
Median	67.5	67.5	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Figure 64 E504ELD-J602F3ELD

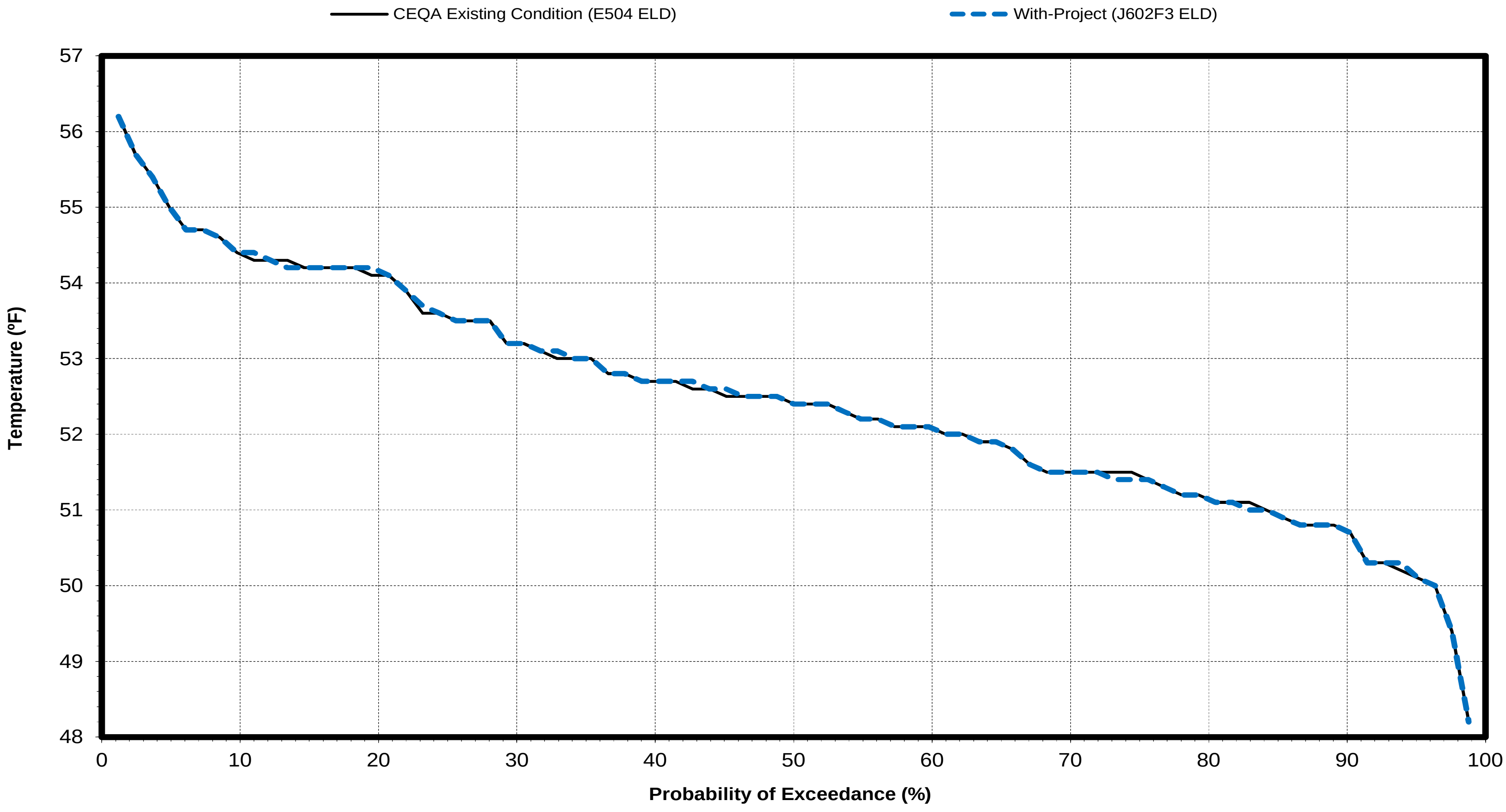


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 65 E504ELD-J602F3ELD

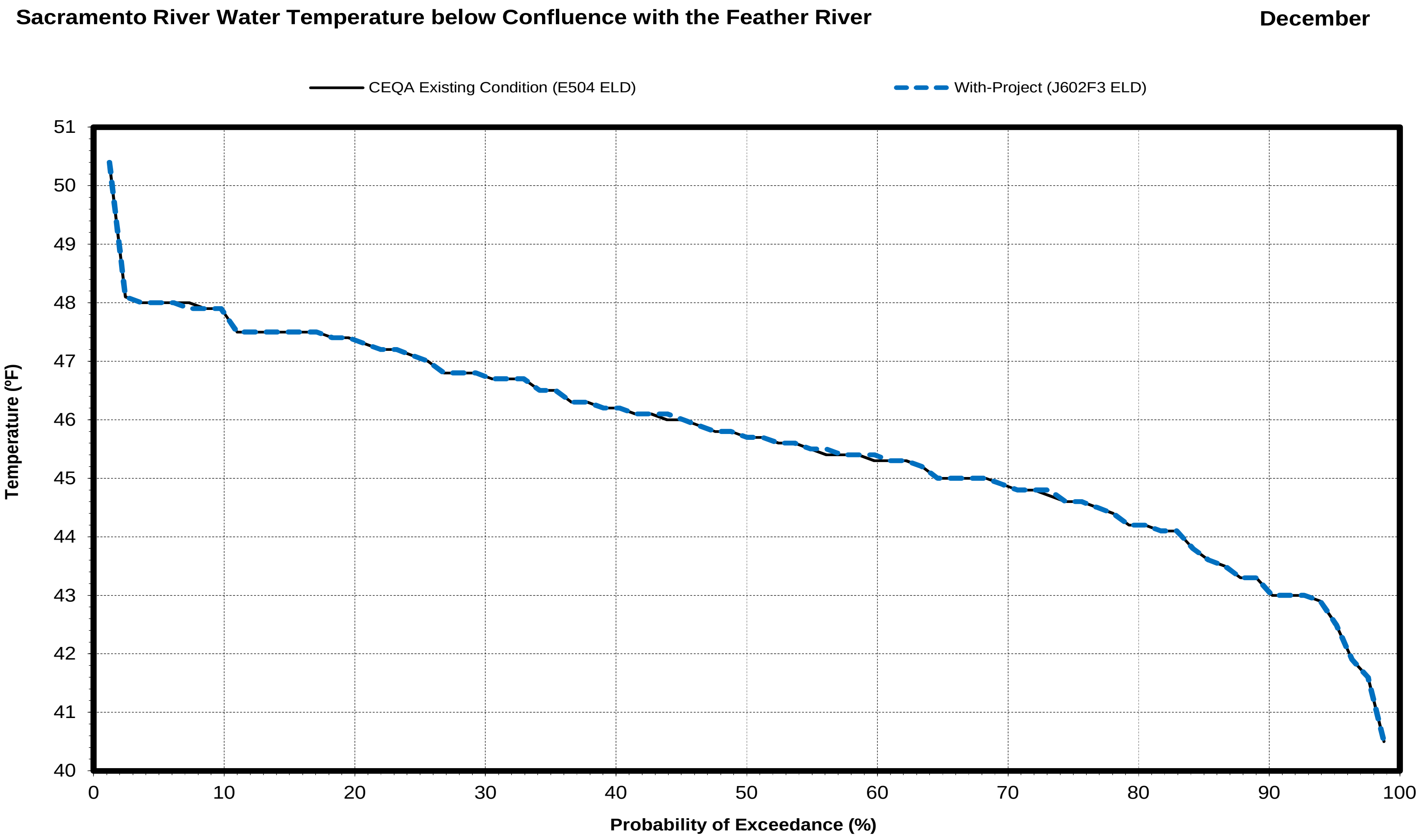
Sacramento River Water Temperature below Confluence with the Feather River **November**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

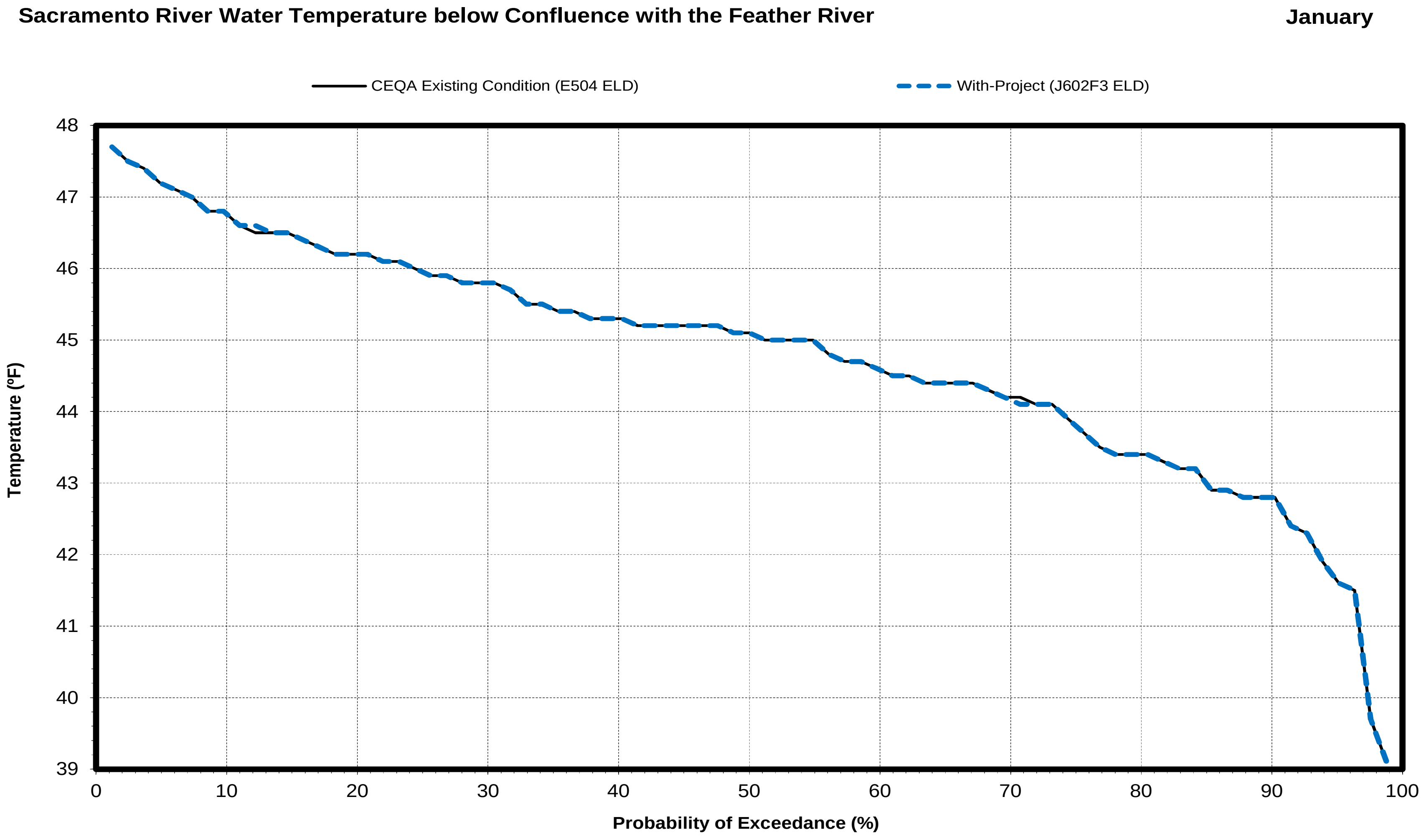
Figure 66 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

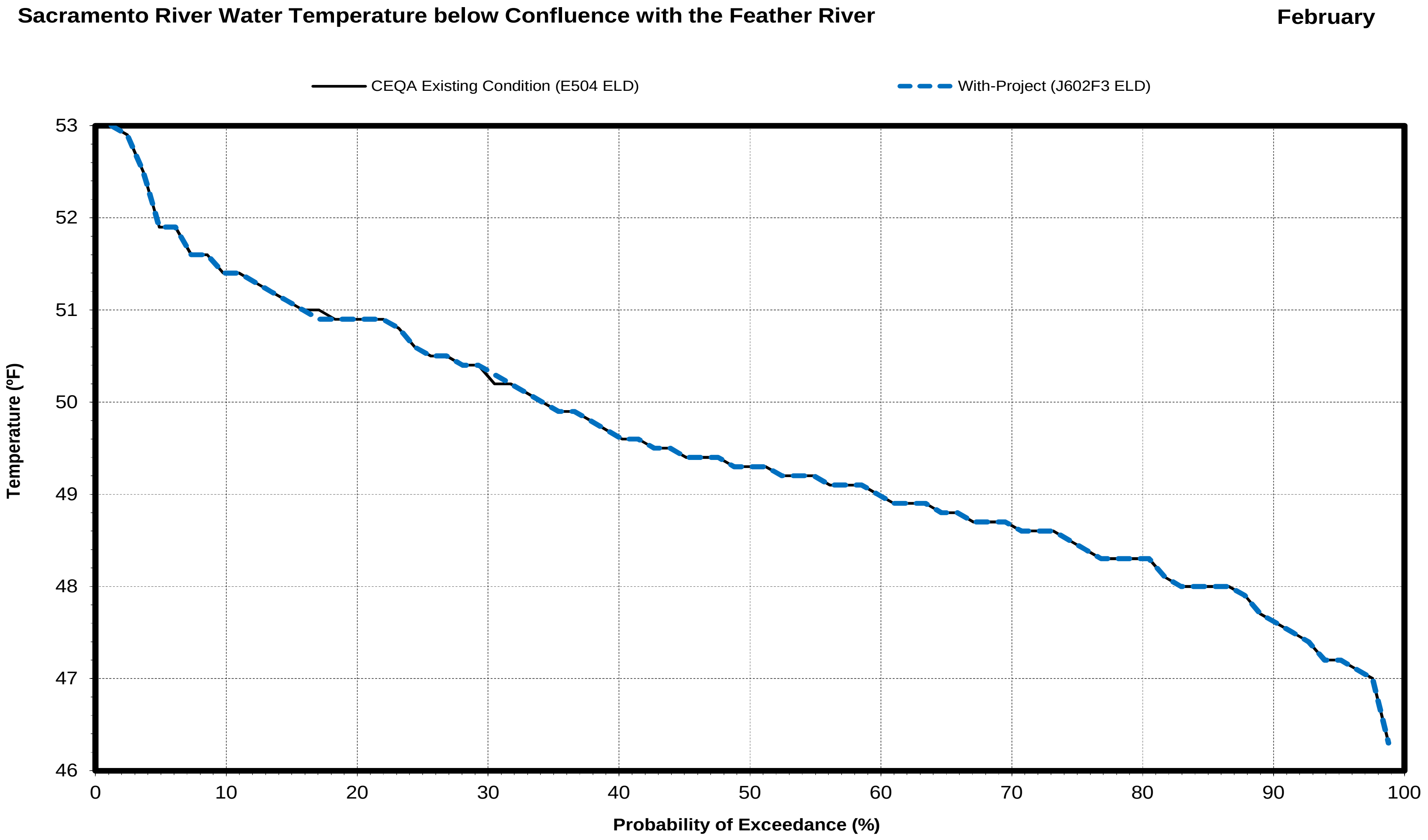
Figure 67 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

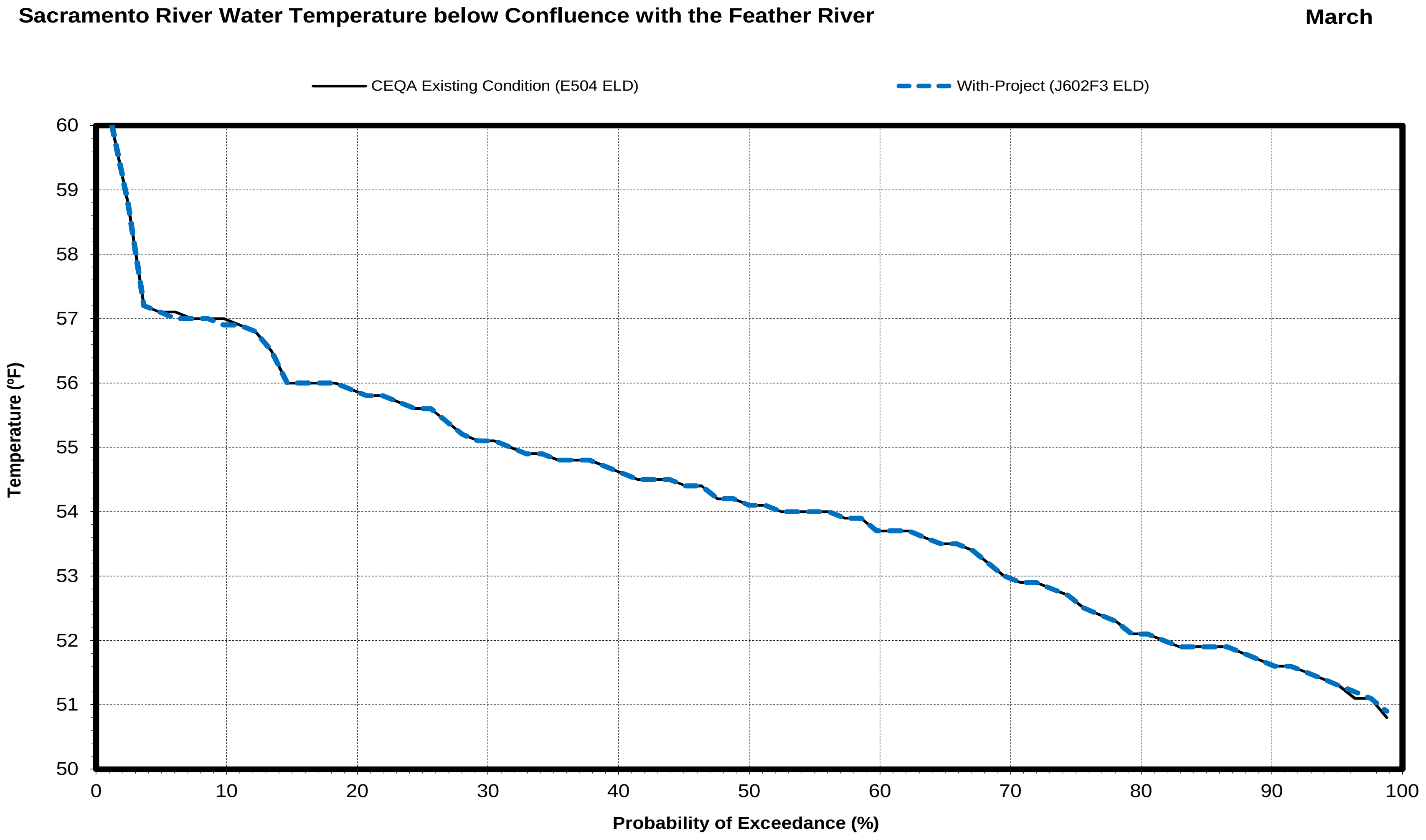
Figure 68 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

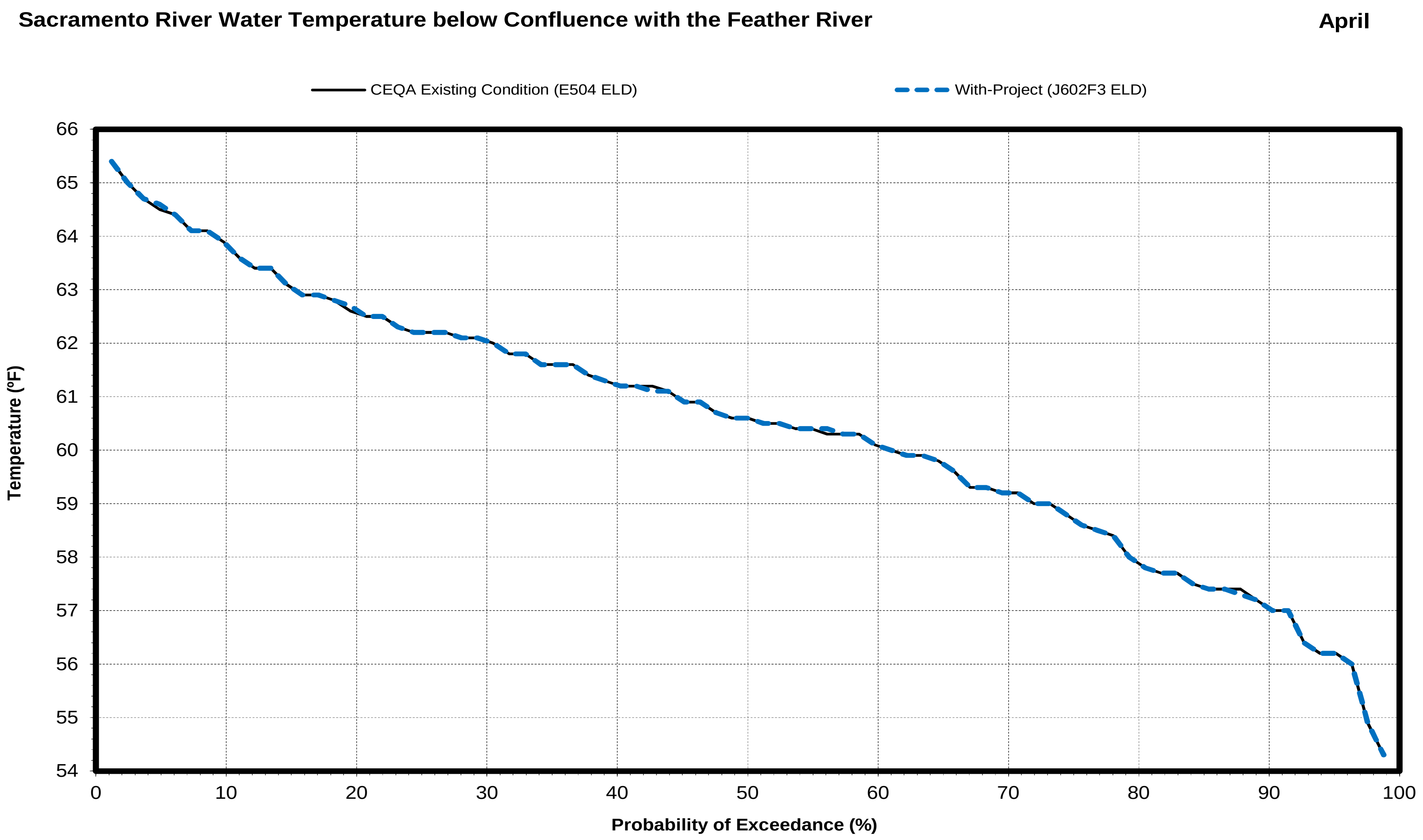
Figure 69 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

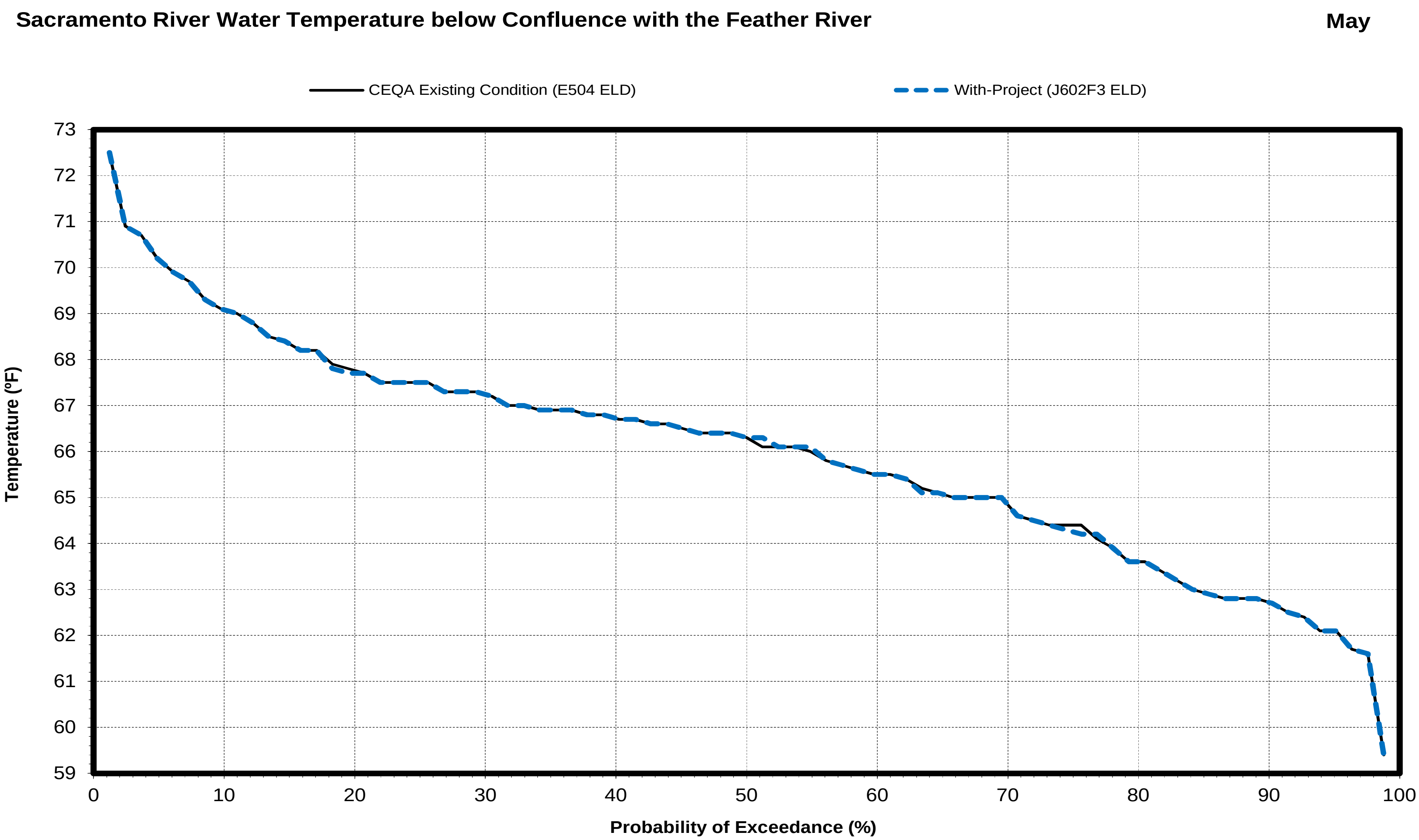
Figure 70 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

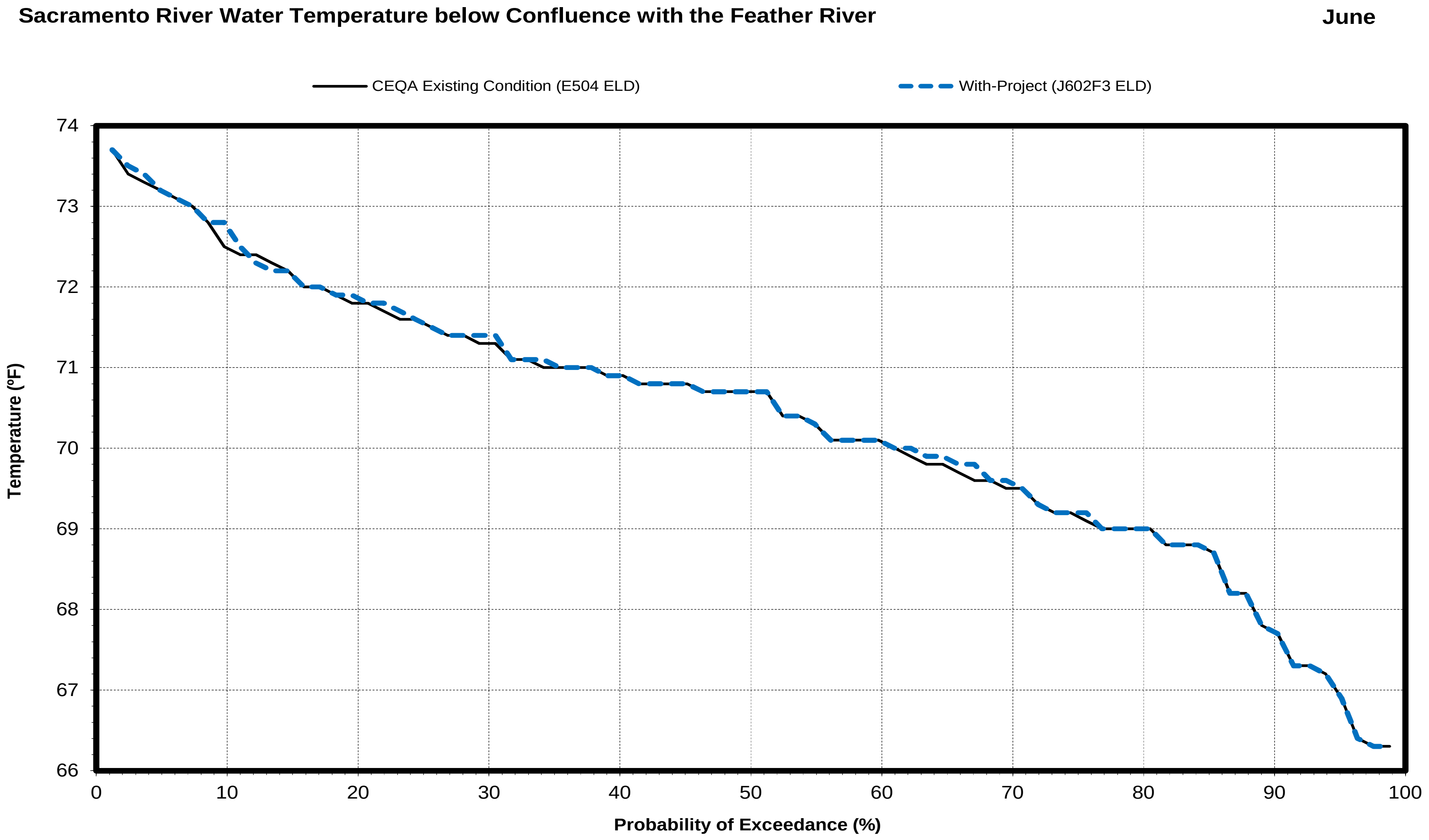
Figure 71 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

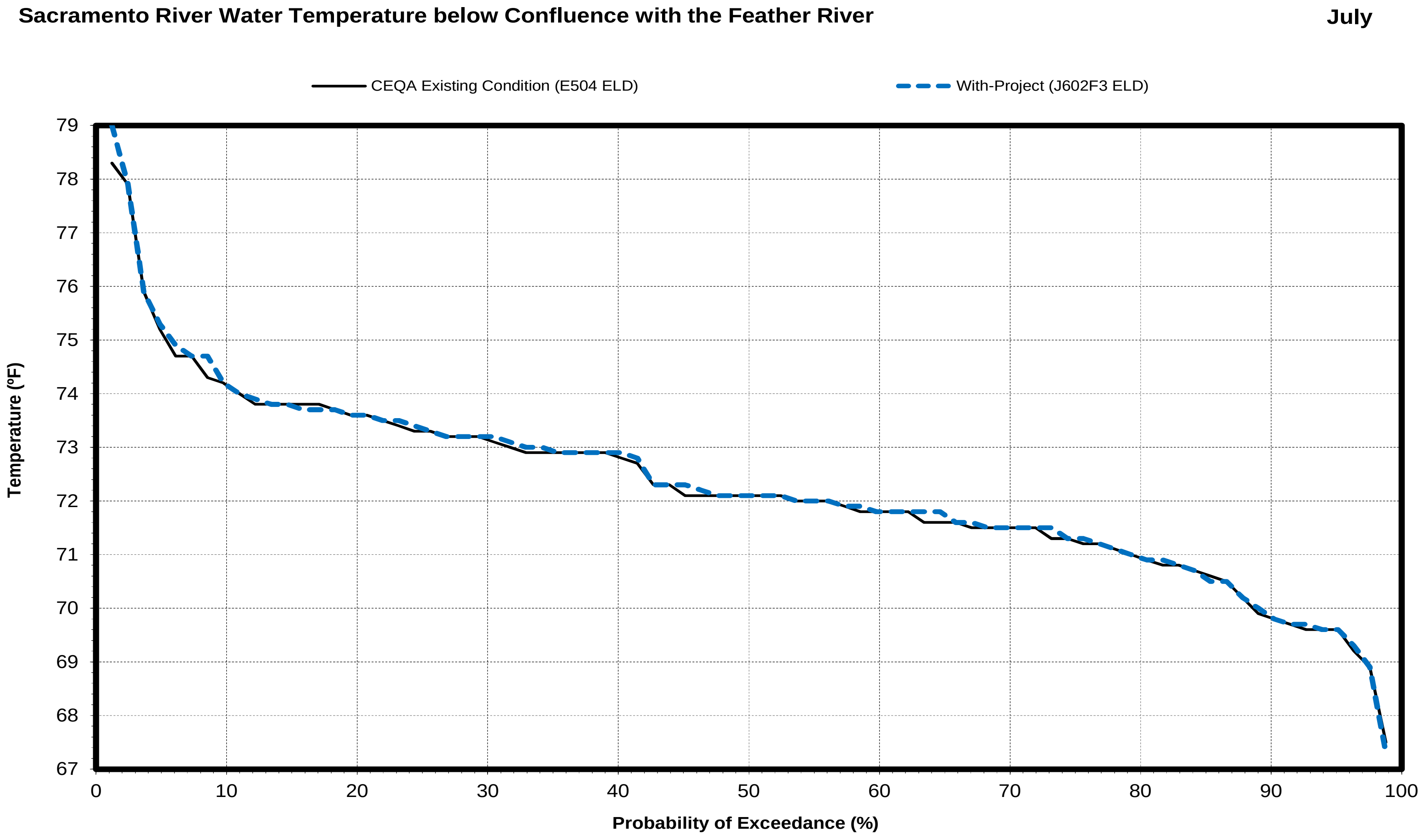
Figure 72 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

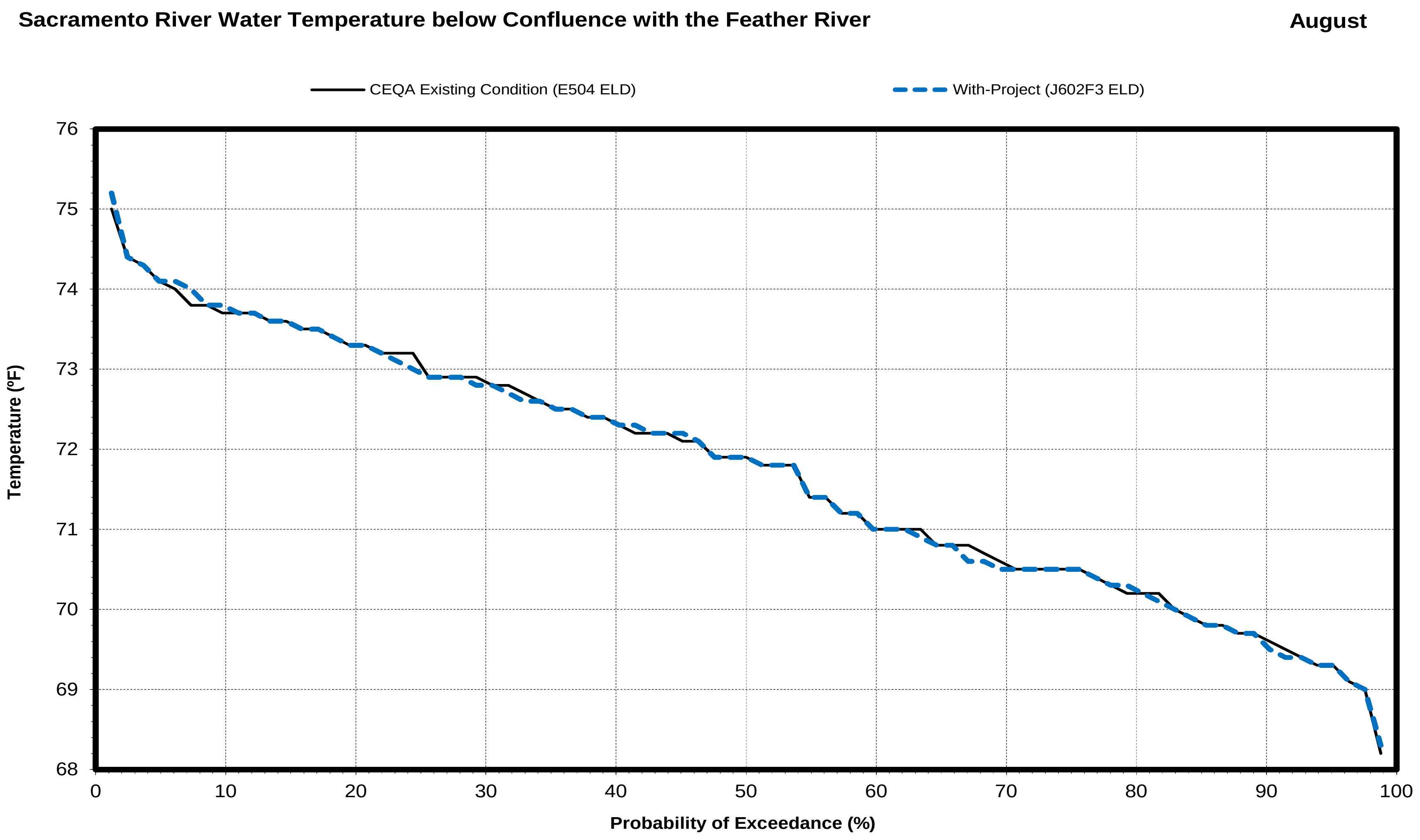
Figure 73 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

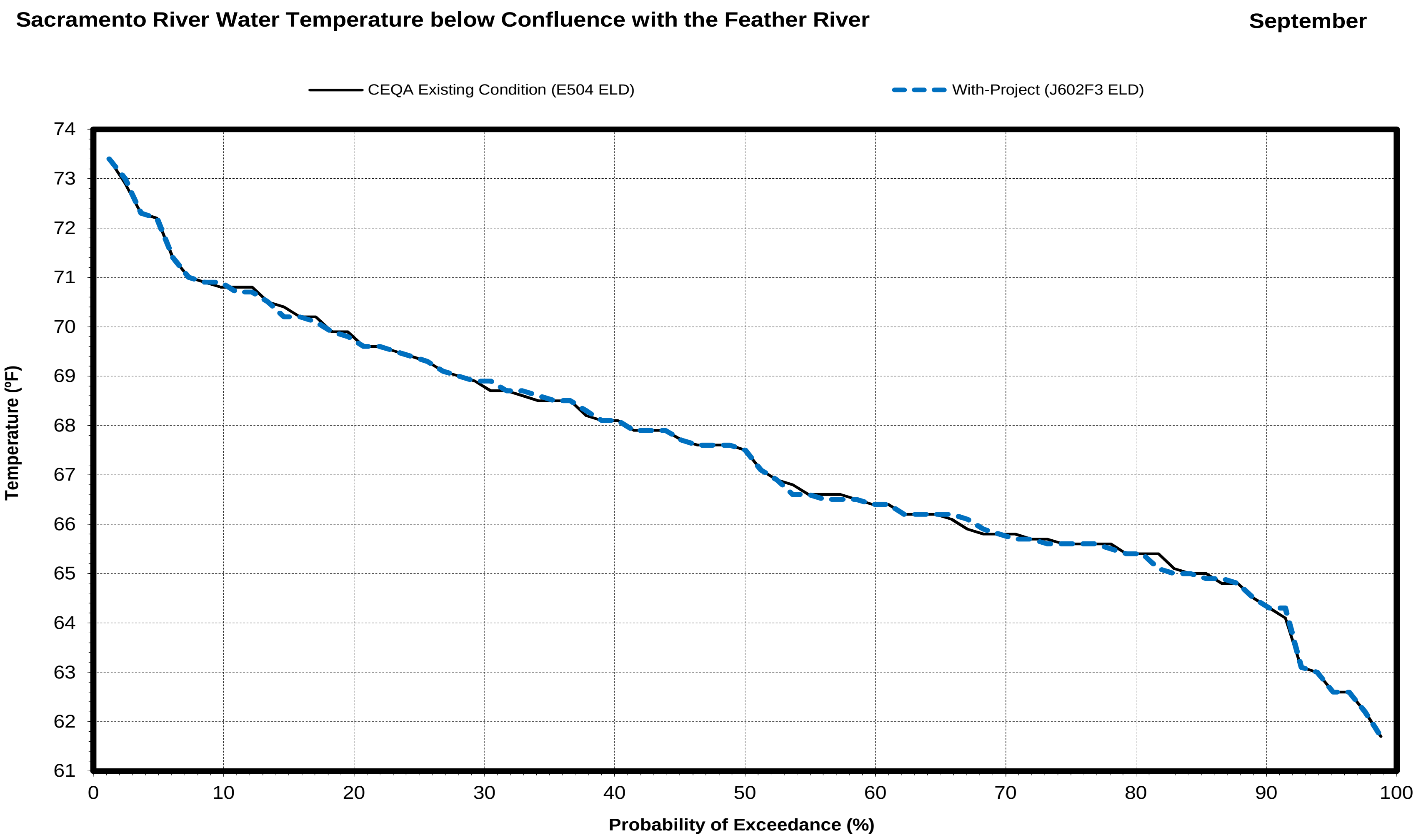
Figure 74 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 75 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 81 E504ELD-J602F3ELD

Long-term and Water Year Type Average Sacramento River Water Temperature at Freeport Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Temperature (ºF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	61.4	53.3	45.9	44.9	49.5	54.3	60.5	65.7	70.0	72.0	71.7	67.7
With-Project (J602F3 ELD)	61.3	53.3	45.9	44.9	49.6	54.3	60.4	65.7	70.0	72.0	71.7	67.7
Difference	-0.1	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	60.9	53.1	46.5	45.8	49.4	53.2	58.4	64.0	68.5	72.1	71.3	65.8
With-Project (J602F3 ELD)	60.9	53.1	46.5	45.8	49.5	53.2	58.3	64.0	68.5	72.0	71.3	65.7
Difference	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	0.0	-0.1	0.0	-0.1
Above Normal												
CEQA Existing Condition (E504 ELD)	61.4	53.6	46.5	45.1	49.3	53.9	60.4	65.9	70.1	71.0	70.7	66.6
With-Project (J602F3 ELD)	61.3	53.6	46.6	45.1	49.4	53.9	60.2	65.8	70.1	71.0	70.6	66.6
Difference	-0.1	0.0	0.1	0.0	0.1	0.0	-0.2	-0.1	0.0	0.0	-0.1	0.0
Below Normal												
CEQA Existing Condition (E504 ELD)	61.4	53.2	45.6	44.3	48.8	54.4	60.8	65.7	70.1	71.5	71.7	68.7
With-Project (J602F3 ELD)	61.4	53.2	45.6	44.3	48.9	54.4	60.7	65.6	70.1	71.6	71.7	68.7
Difference	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	-0.1	0.0	0.1	0.0	0.0
Dry												
CEQA Existing Condition (E504 ELD)	61.1	52.9	45.6	44.1	49.5	55.1	61.8	67.0	71.3	71.6	71.8	69.0
With-Project (J602F3 ELD)	61.0	53.0	45.6	44.1	49.5	55.2	61.8	66.9	71.3	71.6	71.8	69.0
Difference	-0.1	0.1	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	0.0	0.0	0.0
Critical												
CEQA Existing Condition (E504 ELD)	62.6	54.2	44.9	44.8	50.9	56.0	62.8	67.5	70.9	73.9	73.3	70.1
With-Project (J602F3 ELD)	62.5	54.2	44.9	44.8	50.8	56.0	62.8	67.5	70.8	73.9	73.3	70.1
Difference	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	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

Table 82 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	66.2	66.2	0.0
2.4	65.5	65.4	-0.1
3.7	64.7	64.8	0.1
4.9	64.5	64.5	0.0
6.1	64.4	64.3	-0.1
7.3	63.9	63.9	0.0
8.5	63.6	63.6	0.0
9.8	63.3	63.3	0.0
11.0	63.3	63.3	0.0
12.2	63.3	63.2	-0.1
13.4	63.2	63.2	0.0
14.6	63.2	63.2	0.0
15.9	63.2	63.2	0.0
17.1	63.0	63.0	0.0
18.3	63.0	63.0	0.0
19.5	62.8	62.7	-0.1
20.7	62.4	62.3	-0.1
22.0	62.4	62.3	-0.1
23.2	62.3	62.3	0.0
24.4	62.3	62.2	-0.1
25.6	62.2	62.2	0.0
26.8	62.1	62.2	0.1
28.0	62.1	62.1	0.0
29.3	62.1	62.1	0.0
30.5	62.0	62.1	0.1
31.7	61.9	62.0	0.1
32.9	61.9	61.9	0.0
34.1	61.9	61.9	0.0
35.4	61.9	61.8	-0.1
36.6	61.9	61.8	-0.1
37.8	61.9	61.7	-0.2
39.0	61.7	61.7	0.0
40.2	61.6	61.6	0.0
41.5	61.4	61.5	0.1
42.7	61.4	61.4	0.0
43.9	61.4	61.4	0.0
45.1	61.3	61.3	0.0
46.3	61.3	61.3	0.0
47.6	61.3	61.2	-0.1
48.8	61.3	61.2	-0.1
50.0	61.2	61.1	-0.1
51.2	61.2	61.1	-0.1
52.4	61.0	61.0	0.0
53.7	61.0	61.0	0.0
54.9	61.0	61.0	0.0
56.1	61.0	61.0	0.0
57.3	61.0	61.0	0.0
58.5	61.0	60.9	-0.1
59.8	61.0	60.8	-0.2
61.0	60.9	60.7	-0.2
62.2	60.8	60.7	-0.1
63.4	60.7	60.7	0.0
64.6	60.6	60.6	0.0
65.9	60.5	60.4	-0.1
67.1	60.5	60.3	-0.2
68.3	60.4	60.3	-0.1
69.5	60.4	60.3	-0.1
70.7	60.3	60.2	-0.1
72.0	60.3	60.1	-0.2
73.2	60.3	60.1	-0.2
74.4	60.2	60.1	-0.1
75.6	60.1	60.1	0.0
76.8	60.1	60.0	-0.1
78.0	60.1	60.0	-0.1
79.3	60.0	60.0	0.0
80.5	60.0	59.9	-0.1
81.7	60.0	59.9	-0.1
82.9	59.9	59.9	0.0
84.1	59.9	59.8	-0.1
85.4	59.8	59.8	0.0
86.6	59.8	59.8	0.0
87.8	59.6	59.6	0.0
89.0	59.3	59.3	0.0
90.2	59.3	59.3	0.0
91.5	59.1	59.1	0.0
92.7	59.0	59.1	0.1
93.9	59.0	58.9	-0.1
95.1	58.8	58.8	0.0
96.3	58.8	58.8	0.0
97.6	58.6	58.5	-0.1
98.8	58.5	58.5	0.0
Min	58.5	58.5	-0.2
Max	66.2	66.2	0.1
Mean	61.4	61.3	0.0
Median	61.2	61.1	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 83 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	57.1	57.1	0.0
2.4	57.0	56.9	-0.1
3.7	56.2	56.1	-0.1
4.9	55.7	55.7	0.0
6.1	55.7	55.7	0.0
7.3	55.4	55.4	0.0
8.5	55.3	55.3	0.0
9.8	55.3	55.3	0.0
11.0	55.1	55.2	0.1
12.2	55.1	55.1	0.0
13.4	55.1	55.1	0.0
14.6	55.1	55.0	-0.1
15.9	55.0	54.9	-0.1
17.1	54.9	54.9	0.0
18.3	54.9	54.9	0.0
19.5	54.9	54.9	0.0
20.7	54.8	54.7	-0.1
22.0	54.7	54.7	0.0
23.2	54.7	54.7	0.0
24.4	54.6	54.6	0.0
25.6	54.6	54.6	0.0
26.8	54.4	54.4	0.0
28.0	54.4	54.4	0.0
29.3	54.4	54.4	0.0
30.5	54.3	54.3	0.0
31.7	54.3	54.3	0.0
32.9	54.1	54.0	-0.1
34.1	54.0	53.9	-0.1
35.4	53.9	53.9	0.0
36.6	53.8	53.8	0.0
37.8	53.8	53.8	0.0
39.0	53.8	53.7	-0.1
40.2	53.7	53.6	-0.1
41.5	53.6	53.6	0.0
42.7	53.6	53.6	0.0
43.9	53.4	53.4	0.0
45.1	53.4	53.4	0.0
46.3	53.4	53.4	0.0
47.6	53.4	53.4	0.0
48.8	53.4	53.3	-0.1
50.0	53.3	53.3	0.0
51.2	53.2	53.2	0.0
52.4	53.2	53.2	0.0
53.7	53.2	53.2	0.0
54.9	53.2	53.1	-0.1
56.1	53.1	53.1	0.0
57.3	53.1	53.1	0.0
58.5	53.1	53.0	-0.1
59.8	53.0	53.0	0.0
61.0	53.0	52.9	-0.1
62.2	52.9	52.9	0.0
63.4	52.8	52.8	0.0
64.6	52.7	52.8	0.1
65.9	52.7	52.8	0.1
67.1	52.7	52.7	0.0
68.3	52.7	52.7	0.0
69.5	52.7	52.7	0.0
70.7	52.4	52.4	0.0
72.0	52.3	52.3	0.0
73.2	52.3	52.3	0.0
74.4	52.2	52.2	0.0
75.6	52.2	52.2	0.0
76.8	52.2	52.2	0.0
78.0	52.2	52.2	0.0
79.3	52.1	52.1	0.0
80.5	52.0	52.0	0.0
81.7	52.0	52.0	0.0
82.9	51.9	51.9	0.0
84.1	51.8	51.8	0.0
85.4	51.4	51.4	0.0
86.6	51.3	51.3	0.0
87.8	51.2	51.2	0.0
89.0	51.2	51.2	0.0
90.2	51.2	51.2	0.0
91.5	51.1	51.1	0.0
92.7	50.9	50.9	0.0
93.9	50.7	50.7	0.0
95.1	50.6	50.6	0.0
96.3	50.5	50.5	0.0
97.6	50.1	50.1	0.0
98.8	48.3	48.3	0.0
Min	48.3	48.3	-0.1
Max	57.1	57.1	0.1
Mean	53.3	53.3	0.0
Median	53.3	53.3	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 84 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	50.6	50.6	0.0
2.4	48.6	48.6	0.0
3.7	48.5	48.5	0.0
4.9	48.4	48.4	0.0
6.1	48.3	48.4	0.1
7.3	48.3	48.3	0.0
8.5	48.1	48.3	0.2
9.8	48.1	48.1	0.0
11.0	48.0	48.1	0.1
12.2	47.9	48.0	0.1
13.4	47.9	47.9	0.0
14.6	47.9	47.9	0.0
15.9	47.8	47.9	0.1
17.1	47.8	47.8	0.0
18.3	47.7	47.8	0.1
19.5	47.6	47.6	0.0
20.7	47.5	47.5	0.0
22.0	47.5	47.5	0.0
23.2	47.4	47.5	0.1
24.4	47.4	47.5	0.1
25.6	47.3	47.4	0.1
26.8	47.3	47.3	0.0
28.0	47.1	47.1	0.0
29.3	47.1	47.1	0.0
30.5	47.1	47.1	0.0
31.7	46.9	46.9	0.0
32.9	46.9	46.9	0.0
34.1	46.8	46.8	0.0
35.4	46.8	46.8	0.0
36.6	46.7	46.7	0.0
37.8	46.6	46.7	0.1
39.0	46.6	46.6	0.0
40.2	46.6	46.6	0.0
41.5	46.5	46.5	0.0
42.7	46.2	46.2	0.0
43.9	46.2	46.2	0.0
45.1	46.2	46.2	0.0
46.3	46.2	46.2	0.0
47.6	46.2	46.1	-0.1
48.8	46.1	46.1	0.0
50.0	45.8	46.0	0.2
51.2	45.8	45.8	0.0
52.4	45.8	45.8	0.0
53.7	45.7	45.7	0.0
54.9	45.7	45.7	0.0
56.1	45.7	45.7	0.0
57.3	45.7	45.7	0.0
58.5	45.7	45.7	0.0
59.8	45.6	45.7	0.1
61.0	45.6	45.6	0.0
62.2	45.5	45.5	0.0
63.4	45.5	45.5	0.0
64.6	45.5	45.5	0.0
65.9	45.5	45.5	0.0
67.1	45.4	45.4	0.0
68.3	45.3	45.3	0.0
69.5	45.3	45.3	0.0
70.7	45.2	45.2	0.0
72.0	45.1	45.2	0.1
73.2	45.1	45.1	0.0
74.4	45.0	45.0	0.0
75.6	44.8	44.8	0.0
76.8	44.6	44.5	-0.1
78.0	44.5	44.5	0.0
79.3	44.3	44.3	0.0
80.5	44.3	44.3	0.0
81.7	44.2	44.2	0.0
82.9	44.1	44.1	0.0
84.1	44.1	44.1	0.0
85.4	43.7	43.7	0.0
86.6	43.6	43.7	0.1
87.8	43.5	43.5	0.0
89.0	43.2	43.2	0.0
90.2	43.1	43.1	0.0
91.5	43.0	43.0	0.0
92.7	43.0	43.0	0.0
93.9	42.7	42.7	0.0
95.1	42.7	42.7	0.0
96.3	42.6	42.6	0.0
97.6	41.5	41.5	0.0
98.8	41.4	41.4	0.0
Min	41.4	41.4	-0.1
Max	50.6	50.6	0.2
Mean	45.9	45.9	0.0
Median	45.8	46.0	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 85 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	47.7	47.7	0.0
2.4	47.5	47.6	0.1
3.7	47.5	47.6	0.1
4.9	47.4	47.5	0.1
6.1	47.1	47.1	0.0
7.3	47.1	47.1	0.0
8.5	47.0	47.0	0.0
9.8	47.0	47.0	0.0
11.0	47.0	47.0	0.0
12.2	47.0	47.0	0.0
13.4	46.8	47.0	0.2
14.6	46.8	46.8	0.0
15.9	46.6	46.6	0.0
17.1	46.6	46.6	0.0
18.3	46.5	46.5	0.0
19.5	46.2	46.3	0.1
20.7	46.2	46.3	0.1
22.0	46.2	46.3	0.1
23.2	46.2	46.2	0.0
24.4	46.2	46.2	0.0
25.6	46.2	46.2	0.0
26.8	46.1	46.1	0.0
28.0	46.1	46.1	0.0
29.3	46.1	46.1	0.0
30.5	46.0	46.0	0.0
31.7	45.9	45.9	0.0
32.9	45.8	45.8	0.0
34.1	45.8	45.7	-0.1
35.4	45.7	45.7	0.0
36.6	45.7	45.7	0.0
37.8	45.6	45.6	0.0
39.0	45.5	45.5	0.0
40.2	45.5	45.5	0.0
41.5	45.5	45.5	0.0
42.7	45.5	45.5	0.0
43.9	45.4	45.4	0.0
45.1	45.4	45.4	0.0
46.3	45.3	45.4	0.1
47.6	45.3	45.3	0.0
48.8	45.3	45.3	0.0
50.0	45.2	45.2	0.0
51.2	45.2	45.2	0.0
52.4	45.2	45.2	0.0
53.7	45.1	45.2	0.1
54.9	45.1	45.1	0.0
56.1	45.0	45.1	0.1
57.3	45.0	45.0	0.0
58.5	44.9	44.9	0.0
59.8	44.7	44.7	0.0
61.0	44.6	44.6	0.0
62.2	44.6	44.6	0.0
63.4	44.6	44.6	0.0
64.6	44.4	44.4	0.0
65.9	44.3	44.3	0.0
67.1	44.3	44.3	0.0
68.3	44.3	44.3	0.0
69.5	44.2	44.2	0.0
70.7	44.2	44.2	0.0
72.0	44.2	44.2	0.0
73.2	44.1	44.1	0.0
74.4	43.9	43.9	0.0
75.6	43.8	43.9	0.1
76.8	43.7	43.7	0.0
78.0	43.6	43.6	0.0
79.3	43.5	43.5	0.0
80.5	43.5	43.5	0.0
81.7	43.4	43.4	0.0
82.9	43.3	43.4	0.1
84.1	43.3	43.3	0.0
85.4	43.1	43.1	0.0
86.6	43.1	43.1	0.0
87.8	42.9	42.9	0.0
89.0	42.7	42.7	0.0
90.2	42.7	42.7	0.0
91.5	42.4	42.4	0.0
92.7	42.3	42.3	0.0
93.9	42.1	42.1	0.0
95.1	41.6	41.6	0.0
96.3	41.4	41.4	0.0
97.6	39.7	39.7	0.0
98.8	39.3	39.3	0.0
Min	39.3	39.3	-0.1
Max	47.7	47.7	0.2
Mean	44.9	44.9	0.0
Median	45.2	45.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 86 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	53.8	53.8	0.0
2.4	52.9	52.9	0.0
3.7	52.7	52.7	0.0
4.9	52.1	52.5	0.4
6.1	52.1	52.1	0.0
7.3	52.1	52.0	-0.1
8.5	51.8	51.8	0.0
9.8	51.6	51.6	0.0
11.0	51.4	51.4	0.0
12.2	51.4	51.4	0.0
13.4	51.3	51.3	0.0
14.6	51.2	51.3	0.1
15.9	51.0	51.1	0.1
17.1	51.0	51.0	0.0
18.3	51.0	50.9	-0.1
19.5	50.9	50.9	0.0
20.7	50.8	50.8	0.0
22.0	50.8	50.8	0.0
23.2	50.6	50.7	0.1
24.4	50.5	50.5	0.0
25.6	50.5	50.5	0.0
26.8	50.5	50.5	0.0
28.0	50.5	50.5	0.0
29.3	50.4	50.4	0.0
30.5	50.2	50.3	0.1
31.7	50.2	50.2	0.0
32.9	50.1	50.2	0.1
34.1	50.1	50.2	0.1
35.4	50.1	50.1	0.0
36.6	49.9	49.9	0.0
37.8	49.8	49.9	0.1
39.0	49.8	49.9	0.1
40.2	49.7	49.7	0.0
41.5	49.6	49.6	0.0
42.7	49.5	49.6	0.1
43.9	49.5	49.5	0.0
45.1	49.4	49.5	0.1
46.3	49.4	49.5	0.1
47.6	49.4	49.4	0.0
48.8	49.3	49.4	0.1
50.0	49.3	49.3	0.0
51.2	49.3	49.3	0.0
52.4	49.2	49.3	0.1
53.7	49.2	49.2	0.0
54.9	49.2	49.2	0.0
56.1	49.0	49.1	0.1
57.3	49.0	49.1	0.1
58.5	49.0	49.0	0.0
59.8	49.0	49.0	0.0
61.0	49.0	49.0	0.0
62.2	48.9	48.9	0.0
63.4	48.9	48.9	0.0
64.6	48.9	48.9	0.0
65.9	48.8	48.9	0.1
67.1	48.8	48.8	0.0
68.3	48.7	48.8	0.1
69.5	48.7	48.8	0.1
70.7	48.6	48.7	0.1
72.0	48.6	48.7	0.1
73.2	48.5	48.6	0.1
74.4	48.4	48.5	0.1
75.6	48.4	48.5	0.1
76.8	48.4	48.4	0.0
78.0	48.4	48.4	0.0
79.3	48.3	48.4	0.1
80.5	48.3	48.4	0.1
81.7	48.3	48.3	0.0
82.9	48.2	48.2	0.0
84.1	48.1	48.1	0.0
85.4	48.1	48.1	0.0
86.6	48.0	48.1	0.1
87.8	47.9	47.9	0.0
89.0	47.9	47.9	0.0
90.2	47.7	47.8	0.1
91.5	47.6	47.6	0.0
92.7	47.4	47.4	0.0
93.9	47.3	47.4	0.1
95.1	47.3	47.3	0.0
96.3	47.1	47.1	0.0
97.6	46.8	46.9	0.1
98.8	46.3	46.3	0.0
Min	46.3	46.3	-0.1
Max	53.8	53.8	0.4
Mean	49.5	49.6	0.0
Median	49.3	49.3	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	98.8
X > 0.30		1.2
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**1.2**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	95.0
X > 0.30		5.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**5.0**

Table 87 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

March			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	60.6	60.6	0.0
2.4	59.4	59.4	0.0
3.7	58.0	57.9	-0.1
4.9	58.0	57.9	-0.1
6.1	57.9	57.8	-0.1
7.3	57.6	57.6	0.0
8.5	57.3	57.3	0.0
9.8	57.3	57.3	0.0
11.0	57.1	56.9	-0.2
12.2	56.6	56.6	0.0
13.4	56.6	56.6	0.0
14.6	56.4	56.4	0.0
15.9	56.1	56.4	0.3
17.1	56.1	56.3	0.2
18.3	56.1	56.2	0.1
19.5	56.1	56.1	0.0
20.7	56.0	56.1	0.1
22.0	56.0	56.1	0.1
23.2	56.0	56.0	0.0
24.4	55.9	55.9	0.0
25.6	55.8	55.7	-0.1
26.8	55.3	55.3	0.0
28.0	55.2	55.3	0.1
29.3	55.2	55.2	0.0
30.5	55.2	55.2	0.0
31.7	55.1	55.2	0.1
32.9	55.0	55.2	0.2
34.1	55.0	55.0	0.0
35.4	55.0	55.0	0.0
36.6	54.9	54.9	0.0
37.8	54.9	54.9	0.0
39.0	54.9	54.9	0.0
40.2	54.8	54.9	0.1
41.5	54.7	54.7	0.0
42.7	54.7	54.7	0.0
43.9	54.6	54.6	0.0
45.1	54.4	54.4	0.0
46.3	54.4	54.3	-0.1
47.6	54.2	54.3	0.1
48.8	54.2	54.2	0.0
50.0	54.2	54.2	0.0
51.2	54.2	54.1	-0.1
52.4	54.1	54.1	0.0
53.7	54.1	54.0	-0.1
54.9	54.0	54.0	0.0
56.1	54.0	53.9	-0.1
57.3	53.9	53.9	0.0
58.5	53.9	53.8	-0.1
59.8	53.8	53.8	0.0
61.0	53.8	53.8	0.0
62.2	53.8	53.8	0.0
63.4	53.7	53.7	0.0
64.6	53.6	53.6	0.0
65.9	53.5	53.4	-0.1
67.1	53.4	53.4	0.0
68.3	53.3	53.3	0.0
69.5	53.1	53.0	-0.1
70.7	53.0	53.0	0.0
72.0	52.9	52.9	0.0
73.2	52.9	52.8	-0.1
74.4	52.8	52.7	-0.1
75.6	52.5	52.6	0.1
76.8	52.5	52.5	0.0
78.0	52.4	52.4	0.0
79.3	52.3	52.4	0.1
80.5	52.3	52.3	0.0
81.7	52.1	52.2	0.1
82.9	52.1	52.1	0.0
84.1	52.1	52.0	-0.1
85.4	52.0	52.0	0.0
86.6	51.9	52.0	0.1
87.8	51.9	51.9	0.0
89.0	51.8	51.8	0.0
90.2	51.8	51.8	0.0
91.5	51.7	51.6	-0.1
92.7	51.6	51.6	0.0
93.9	51.5	51.5	0.0
95.1	51.3	51.3	0.0
96.3	51.3	51.3	0.0
97.6	51.2	51.2	0.0
98.8	50.8	50.8	0.0
Min	50.8	50.8	-0.2
Max	60.6	60.6	0.3
Mean	54.3	54.3	0.0
Median	54.2	54.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 88 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	65.6	65.6	0.0
2.4	65.4	65.4	0.0
3.7	65.1	65.1	0.0
4.9	65.1	65.0	-0.1
6.1	64.6	64.5	-0.1
7.3	64.5	64.5	0.0
8.5	64.5	64.3	-0.2
9.8	64.3	64.1	-0.2
11.0	64.0	63.9	-0.1
12.2	63.9	63.9	0.0
13.4	63.6	63.8	0.2
14.6	63.2	63.2	0.0
15.9	63.1	63.0	-0.1
17.1	62.9	62.9	0.0
18.3	62.9	62.8	-0.1
19.5	62.8	62.8	0.0
20.7	62.8	62.7	-0.1
22.0	62.7	62.7	0.0
23.2	62.5	62.6	0.1
24.4	62.4	62.5	0.1
25.6	62.3	62.3	0.0
26.8	62.1	62.0	-0.1
28.0	62.1	62.0	-0.1
29.3	62.0	61.9	-0.1
30.5	62.0	61.8	-0.2
31.7	62.0	61.7	-0.3
32.9	61.7	61.5	-0.2
34.1	61.5	61.4	-0.1
35.4	61.4	61.4	0.0
36.6	61.4	61.3	-0.1
37.8	61.2	61.2	0.0
39.0	61.2	61.0	-0.2
40.2	61.2	60.9	-0.3
41.5	61.1	60.9	-0.2
42.7	60.9	60.7	-0.2
43.9	60.9	60.7	-0.2
45.1	60.8	60.7	-0.1
46.3	60.8	60.6	-0.2
47.6	60.8	60.6	-0.2
48.8	60.8	60.5	-0.3
50.0	60.7	60.5	-0.2
51.2	60.6	60.5	-0.1
52.4	60.5	60.4	-0.1
53.7	60.5	60.4	-0.1
54.9	60.4	60.3	-0.1
56.1	60.4	60.2	-0.2
57.3	60.4	60.0	-0.4
58.5	60.4	59.9	-0.5
59.8	59.9	59.7	-0.2
61.0	59.9	59.6	-0.3
62.2	59.6	59.4	-0.2
63.4	59.5	59.4	-0.1
64.6	59.5	59.4	-0.1
65.9	59.4	59.3	-0.1
67.1	59.4	59.2	-0.2
68.3	59.2	59.2	0.0
69.5	59.2	59.1	-0.1
70.7	59.1	59.1	0.0
72.0	59.0	58.8	-0.2
73.2	58.8	58.7	-0.1
74.4	58.8	58.7	-0.1
75.6	58.4	58.4	0.0
76.8	58.4	58.4	0.0
78.0	58.3	58.2	-0.1
79.3	58.3	58.2	-0.1
80.5	57.8	57.8	0.0
81.7	57.6	57.5	-0.1
82.9	57.6	57.5	-0.1
84.1	57.4	57.4	0.0
85.4	57.4	57.4	0.0
86.6	57.4	57.3	-0.1
87.8	57.2	57.2	0.0
89.0	57.2	57.2	0.0
90.2	57.2	57.1	-0.1
91.5	57.1	57.1	0.0
92.7	56.5	56.5	0.0
93.9	56.2	56.2	0.0
95.1	56.1	56.0	-0.1
96.3	55.9	55.9	0.0
97.6	55.0	54.9	-0.1
98.8	54.2	54.2	0.0
Min	54.2	54.2	-0.5
Max	65.6	65.6	0.2
Mean	60.5	60.4	-0.1
Median	60.7	60.5	-0.1

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	97.5
X > 0.30		0.0
X < -0.30		2.5
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-2.5**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 89 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

May			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD) Temperature (ºF)**	**With-Project (J602F3 ELD) Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	73.5	73.6	0.1
2.4	71.9	71.9	0.0
3.7	70.9	70.9	0.0
4.9	70.9	70.9	0.0
6.1	70.1	70.2	0.1
7.3	69.9	69.9	0.0
8.5	69.7	69.7	0.0
9.8	69.4	69.4	0.0
11.0	68.8	68.5	-0.3
12.2	68.6	68.4	-0.2
13.4	68.1	68.2	0.1
14.6	68.0	67.9	-0.1
15.9	68.0	67.9	-0.1
17.1	67.9	67.9	0.0
18.3	67.9	67.8	-0.1
19.5	67.9	67.8	-0.1
20.7	67.9	67.3	-0.6
22.0	67.6	67.3	-0.3
23.2	67.4	67.3	-0.1
24.4	67.3	67.1	-0.2
25.6	67.3	67.1	-0.2
26.8	67.3	67.0	-0.3
28.0	67.2	66.9	-0.3
29.3	67.0	66.9	-0.1
30.5	67.0	66.9	-0.1
31.7	66.9	66.9	0.0
32.9	66.9	66.8	-0.1
34.1	66.9	66.8	-0.1
35.4	66.7	66.7	0.0
36.6	66.7	66.7	0.0
37.8	66.7	66.6	-0.1
39.0	66.6	66.6	0.0
40.2	66.5	66.5	0.0
41.5	66.3	66.3	0.0
42.7	66.2	66.2	0.0
43.9	66.2	66.2	0.0
45.1	66.1	66.1	0.0
46.3	66.1	66.0	-0.1
47.6	65.8	65.8	0.0
48.8	65.8	65.8	0.0
50.0	65.8	65.7	-0.1
51.2	65.7	65.7	0.0
52.4	65.6	65.5	-0.1
53.7	65.5	65.5	0.0
54.9	65.5	65.5	0.0
56.1	65.5	65.3	-0.2
57.3	65.3	65.0	-0.3
58.5	65.0	65.0	0.0
59.8	64.9	64.8	-0.1
61.0	64.8	64.8	0.0
62.2	64.7	64.8	0.1
63.4	64.7	64.7	0.0
64.6	64.6	64.5	-0.1
65.9	64.6	64.5	-0.1
67.1	64.4	64.3	-0.1
68.3	64.2	64.2	0.0
69.5	64.2	64.1	-0.1
70.7	64.0	63.9	-0.1
72.0	63.9	63.8	-0.1
73.2	63.9	63.8	-0.1
74.4	63.7	63.7	0.0
75.6	63.5	63.5	0.0
76.8	63.5	63.5	0.0
78.0	63.4	63.4	0.0
79.3	63.3	63.3	0.0
80.5	63.3	63.3	0.0
81.7	63.2	63.1	-0.1
82.9	63.1	63.0	-0.1
84.1	62.9	62.8	-0.1
85.4	62.8	62.8	0.0
86.6	62.8	62.8	0.0
87.8	62.6	62.6	0.0
89.0	62.5	62.5	0.0
90.2	62.4	62.4	0.0
91.5	62.4	62.4	0.0
92.7	62.4	62.3	-0.1
93.9	62.0	62.0	0.0
95.1	62.0	61.9	-0.1
96.3	61.2	61.2	0.0
97.6	61.1	61.1	0.0
98.8	60.1	60.1	0.0
Min	60.1	60.1	-0.6
Max	73.5	73.6	0.1
Mean	65.7	65.7	-0.1
Median	65.8	65.7	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		98.8
X > 0.30			0.0
X < -0.30			1.2
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**-1.2**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		95.0
X > 0.30			0.0
X < -0.30			5.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**-5.0**

Table 90 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

June			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	74.5	74.5	0.0
2.4	73.9	73.9	0.0
3.7	73.2	73.2	0.0
4.9	73.0	72.9	-0.1
6.1	72.7	72.7	0.0
7.3	72.6	72.6	0.0
8.5	72.6	72.6	0.0
9.8	72.6	72.6	0.0
11.0	72.4	72.4	0.0
12.2	72.3	72.3	0.0
13.4	72.3	72.3	0.0
14.6	72.3	72.3	0.0
15.9	72.2	72.2	0.0
17.1	72.2	72.2	0.0
18.3	72.0	72.0	0.0
19.5	71.9	71.9	0.0
20.7	71.7	71.7	0.0
22.0	71.5	71.6	0.1
23.2	71.5	71.5	0.0
24.4	71.5	71.4	-0.1
25.6	71.5	71.4	-0.1
26.8	71.4	71.2	-0.2
28.0	71.2	71.2	0.0
29.3	71.1	71.1	0.0
30.5	71.1	71.1	0.0
31.7	71.0	71.0	0.0
32.9	71.0	70.9	-0.1
34.1	70.9	70.8	-0.1
35.4	70.7	70.8	0.1
36.6	70.6	70.7	0.1
37.8	70.5	70.5	0.0
39.0	70.5	70.5	0.0
40.2	70.5	70.5	0.0
41.5	70.5	70.4	-0.1
42.7	70.4	70.4	0.0
43.9	70.4	70.3	-0.1
45.1	70.4	70.3	-0.1
46.3	70.3	70.2	-0.1
47.6	70.2	70.2	0.0
48.8	70.2	70.1	-0.1
50.0	70.1	70.1	0.0
51.2	70.1	70.0	-0.1
52.4	70.0	70.0	0.0
53.7	69.9	69.9	0.0
54.9	69.9	69.9	0.0
56.1	69.9	69.9	0.0
57.3	69.9	69.9	0.0
58.5	69.7	69.7	0.0
59.8	69.5	69.5	0.0
61.0	69.5	69.5	0.0
62.2	69.5	69.5	0.0
63.4	69.4	69.4	0.0
64.6	69.3	69.3	0.0
65.9	69.3	69.3	0.0
67.1	69.2	69.1	-0.1
68.3	69.1	69.1	0.0
69.5	69.0	69.0	0.0
70.7	68.9	68.9	0.0
72.0	68.9	68.9	0.0
73.2	68.8	68.8	0.0
74.4	68.8	68.8	0.0
75.6	68.7	68.6	-0.1
76.8	68.4	68.4	0.0
78.0	68.3	68.3	0.0
79.3	68.2	68.2	0.0
80.5	68.2	68.2	0.0
81.7	68.1	68.1	0.0
82.9	68.0	68.0	0.0
84.1	67.7	67.7	0.0
85.4	67.7	67.7	0.0
86.6	67.5	67.5	0.0
87.8	67.1	67.1	0.0
89.0	67.1	67.1	0.0
90.2	67.0	67.0	0.0
91.5	66.9	66.9	0.0
92.7	66.4	66.4	0.0
93.9	66.4	66.4	0.0
95.1	66.3	66.3	0.0
96.3	66.3	66.3	0.0
97.6	66.1	66.1	0.0
98.8	65.3	65.3	0.0
Min	65.3	65.3	-0.2
Max	74.5	74.5	0.1
Mean	70.0	70.0	0.0
Median	70.1	70.1	0.0

Entire 81-Year Simulation Period		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 91 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

July			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD) Temperature (ºF)**	**With-Project (J602F3 ELD) Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	77.2	77.2	0.0
2.4	76.3	76.4	0.1
3.7	75.2	75.2	0.0
4.9	74.9	74.9	0.0
6.1	74.6	74.4	-0.2
7.3	74.4	74.4	0.0
8.5	73.9	73.9	0.0
9.8	73.8	73.8	0.0
11.0	73.7	73.7	0.0
12.2	73.7	73.7	0.0
13.4	73.5	73.5	0.0
14.6	73.4	73.3	-0.1
15.9	73.3	73.3	0.0
17.1	73.3	73.2	-0.1
18.3	73.2	73.0	-0.2
19.5	73.0	73.0	0.0
20.7	72.9	72.9	0.0
22.0	72.9	72.9	0.0
23.2	72.9	72.8	-0.1
24.4	72.8	72.8	0.0
25.6	72.7	72.7	0.0
26.8	72.7	72.7	0.0
28.0	72.6	72.7	0.1
29.3	72.6	72.6	0.0
30.5	72.6	72.6	0.0
31.7	72.6	72.6	0.0
32.9	72.6	72.6	0.0
34.1	72.6	72.6	0.0
35.4	72.5	72.5	0.0
36.6	72.5	72.5	0.0
37.8	72.5	72.5	0.0
39.0	72.4	72.4	0.0
40.2	72.4	72.4	0.0
41.5	72.4	72.4	0.0
42.7	72.4	72.4	0.0
43.9	72.3	72.4	0.1
45.1	72.3	72.3	0.0
46.3	72.3	72.3	0.0
47.6	72.3	72.2	-0.1
48.8	72.1	72.1	0.0
50.0	72.1	72.0	-0.1
51.2	72.0	72.0	0.0
52.4	72.0	71.9	-0.1
53.7	71.9	71.9	0.0
54.9	71.9	71.9	0.0
56.1	71.8	71.7	-0.1
57.3	71.7	71.7	0.0
58.5	71.6	71.5	-0.1
59.8	71.4	71.5	0.1
61.0	71.4	71.5	0.1
62.2	71.4	71.4	0.0
63.4	71.3	71.3	0.0
64.6	71.3	71.3	0.0
65.9	71.3	71.3	0.0
67.1	71.3	71.3	0.0
68.3	71.2	71.2	0.0
69.5	71.2	71.2	0.0
70.7	71.2	71.1	-0.1
72.0	71.1	71.1	0.0
73.2	71.1	71.1	0.0
74.4	71.0	71.0	0.0
75.6	71.0	71.0	0.0
76.8	71.0	70.9	-0.1
78.0	70.9	70.9	0.0
79.3	70.9	70.8	-0.1
80.5	70.8	70.8	0.0
81.7	70.7	70.7	0.0
82.9	70.7	70.6	-0.1
84.1	70.5	70.5	0.0
85.4	70.5	70.5	0.0
86.6	70.5	70.4	-0.1
87.8	70.1	70.1	0.0
89.0	70.0	70.0	0.0
90.2	70.0	69.8	-0.2
91.5	69.8	69.8	0.0
92.7	69.8	69.7	-0.1
93.9	69.5	69.5	0.0
95.1	69.4	69.5	0.1
96.3	69.2	69.2	0.0
97.6	69.0	69.0	0.0
98.8	69.0	68.9	-0.1
Min	69.0	68.9	-0.2
Max	77.2	77.2	0.1
Mean	72.0	72.0	0.0
Median	72.1	72.0	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 92 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

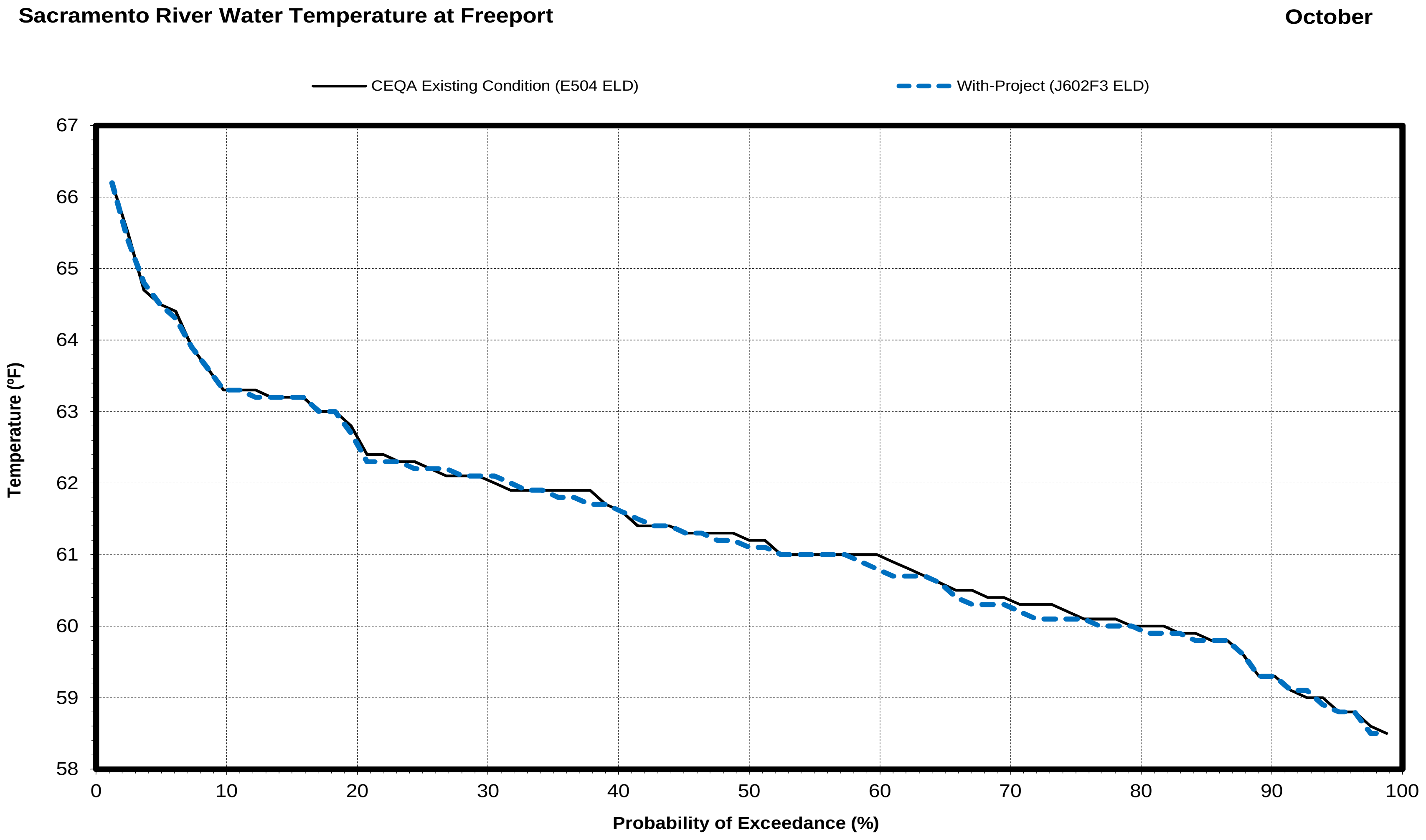
August			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	74.8	74.9	0.1
2.4	74.8	74.8	0.0
3.7	74.8	74.8	0.0
4.9	74.5	74.4	-0.1
6.1	74.3	74.3	0.0
7.3	74.1	74.0	-0.1
8.5	73.9	73.9	0.0
9.8	73.6	73.6	0.0
11.0	73.6	73.6	0.0
12.2	73.6	73.5	-0.1
13.4	73.5	73.3	-0.2
14.6	73.3	73.3	0.0
15.9	73.3	73.3	0.0
17.1	73.3	73.3	0.0
18.3	73.2	73.2	0.0
19.5	73.2	73.2	0.0
20.7	73.2	73.2	0.0
22.0	73.0	73.0	0.0
23.2	72.9	72.9	0.0
24.4	72.9	72.9	0.0
25.6	72.9	72.9	0.0
26.8	72.9	72.9	0.0
28.0	72.8	72.8	0.0
29.3	72.8	72.8	0.0
30.5	72.8	72.8	0.0
31.7	72.7	72.7	0.0
32.9	72.6	72.6	0.0
34.1	72.5	72.5	0.0
35.4	72.5	72.5	0.0
36.6	72.5	72.4	-0.1
37.8	72.4	72.4	0.0
39.0	72.4	72.3	-0.1
40.2	72.4	72.3	-0.1
41.5	72.3	72.3	0.0
42.7	72.3	72.3	0.0
43.9	72.2	72.2	0.0
45.1	72.1	72.1	0.0
46.3	72.0	72.0	0.0
47.6	71.9	71.9	0.0
48.8	71.9	71.8	-0.1
50.0	71.8	71.8	0.0
51.2	71.7	71.7	0.0
52.4	71.7	71.5	-0.2
53.7	71.5	71.5	0.0
54.9	71.4	71.5	0.1
56.1	71.3	71.3	0.0
57.3	71.2	71.3	0.1
58.5	71.2	71.2	0.0
59.8	71.0	71.2	0.2
61.0	71.0	71.0	0.0
62.2	71.0	70.9	-0.1
63.4	70.9	70.9	0.0
64.6	70.9	70.8	-0.1
65.9	70.8	70.7	-0.1
67.1	70.7	70.7	0.0
68.3	70.7	70.6	-0.1
69.5	70.6	70.6	0.0
70.7	70.6	70.5	-0.1
72.0	70.6	70.5	-0.1
73.2	70.5	70.5	0.0
74.4	70.4	70.4	0.0
75.6	70.3	70.3	0.0
76.8	70.2	70.2	0.0
78.0	70.2	70.2	0.0
79.3	70.1	70.0	-0.1
80.5	70.0	70.0	0.0
81.7	70.0	69.9	-0.1
82.9	69.9	69.8	-0.1
84.1	69.9	69.8	-0.1
85.4	69.8	69.8	0.0
86.6	69.8	69.8	0.0
87.8	69.7	69.7	0.0
89.0	69.7	69.7	0.0
90.2	69.6	69.6	0.0
91.5	69.6	69.6	0.0
92.7	69.6	69.6	0.0
93.9	69.5	69.5	0.0
95.1	69.3	69.3	0.0
96.3	68.9	68.9	0.0
97.6	68.9	68.9	0.0
98.8	68.6	68.5	-0.1
Min	68.6	68.5	-0.2
Max	74.8	74.9	0.2
Mean	71.7	71.7	0.0
Median	71.8	71.8	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 93 E504ELD-J602F3ELD

Sacramento River Water Temperature at Freeport - Probability of Exceedance

September			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	72.8	72.8	0.0
2.4	71.7	71.7	0.0
3.7	71.7	71.7	0.0
4.9	71.3	71.2	-0.1
6.1	71.2	71.2	0.0
7.3	71.1	71.2	0.1
8.5	71.0	71.0	0.0
9.8	71.0	71.0	0.0
11.0	71.0	70.9	-0.1
12.2	70.9	70.9	0.0
13.4	70.8	70.8	0.0
14.6	70.5	70.5	0.0
15.9	70.4	70.4	0.0
17.1	70.3	70.3	0.0
18.3	69.9	69.8	-0.1
19.5	69.8	69.8	0.0
20.7	69.8	69.7	-0.1
22.0	69.7	69.6	-0.1
23.2	69.6	69.5	-0.1
24.4	69.4	69.4	0.0
25.6	69.2	69.2	0.0
26.8	69.2	69.1	-0.1
28.0	69.1	69.1	0.0
29.3	69.1	69.1	0.0
30.5	69.1	69.1	0.0
31.7	68.9	68.9	0.0
32.9	68.7	68.8	0.1
34.1	68.7	68.7	0.0
35.4	68.7	68.6	-0.1
36.6	68.6	68.6	0.0
37.8	68.6	68.5	-0.1
39.0	68.4	68.5	0.1
40.2	68.4	68.4	0.0
41.5	68.3	68.3	0.0
42.7	68.2	68.2	0.0
43.9	67.9	67.9	0.0
45.1	67.9	67.9	0.0
46.3	67.9	67.9	0.0
47.6	67.9	67.9	0.0
48.8	67.8	67.6	-0.2
50.0	67.6	67.6	0.0
51.2	67.5	67.5	0.0
52.4	67.5	67.5	0.0
53.7	67.3	67.3	0.0
54.9	67.3	67.3	0.0
56.1	67.1	67.1	0.0
57.3	67.0	67.0	0.0
58.5	66.8	66.8	0.0
59.8	66.8	66.7	-0.1
61.0	66.7	66.7	0.0
62.2	66.7	66.5	-0.2
63.4	66.5	66.5	0.0
64.6	66.5	66.5	0.0
65.9	66.5	66.5	0.0
67.1	66.5	66.4	-0.1
68.3	66.5	66.4	-0.1
69.5	66.4	66.4	0.0
70.7	66.4	66.4	0.0
72.0	66.4	66.4	0.0
73.2	66.3	66.4	0.1
74.4	66.3	66.3	0.0
75.6	66.3	66.2	-0.1
76.8	66.2	66.2	0.0
78.0	66.2	66.2	0.0
79.3	66.2	66.1	-0.1
80.5	66.0	66.0	0.0
81.7	65.8	65.8	0.0
82.9	65.8	65.7	-0.1
84.1	65.8	65.6	-0.2
85.4	65.6	65.4	-0.2
86.6	65.4	65.3	-0.1
87.8	65.3	65.3	0.0
89.0	65.3	65.3	0.0
90.2	64.8	64.8	0.0
91.5	64.6	64.7	0.1
92.7	64.1	64.1	0.0
93.9	63.8	63.8	0.0
95.1	63.5	63.5	0.0
96.3	63.5	63.5	0.0
97.6	63.0	62.9	-0.1
98.8	62.6	62.6	0.0
Min	62.6	62.6	-0.2
Max	72.8	72.8	0.1
Mean	67.7	67.7	0.0
Median	67.6	67.6	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

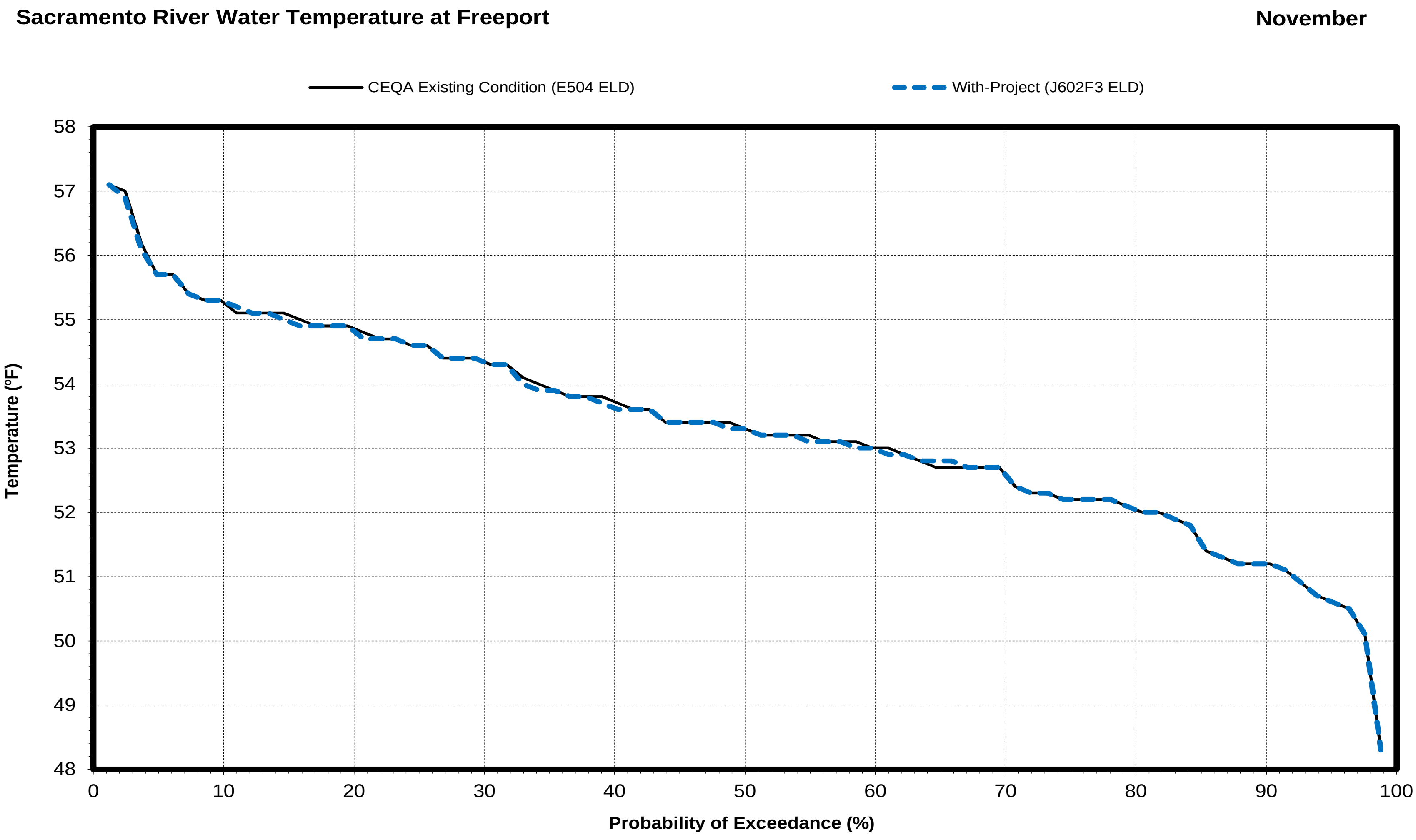
Figure 76 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

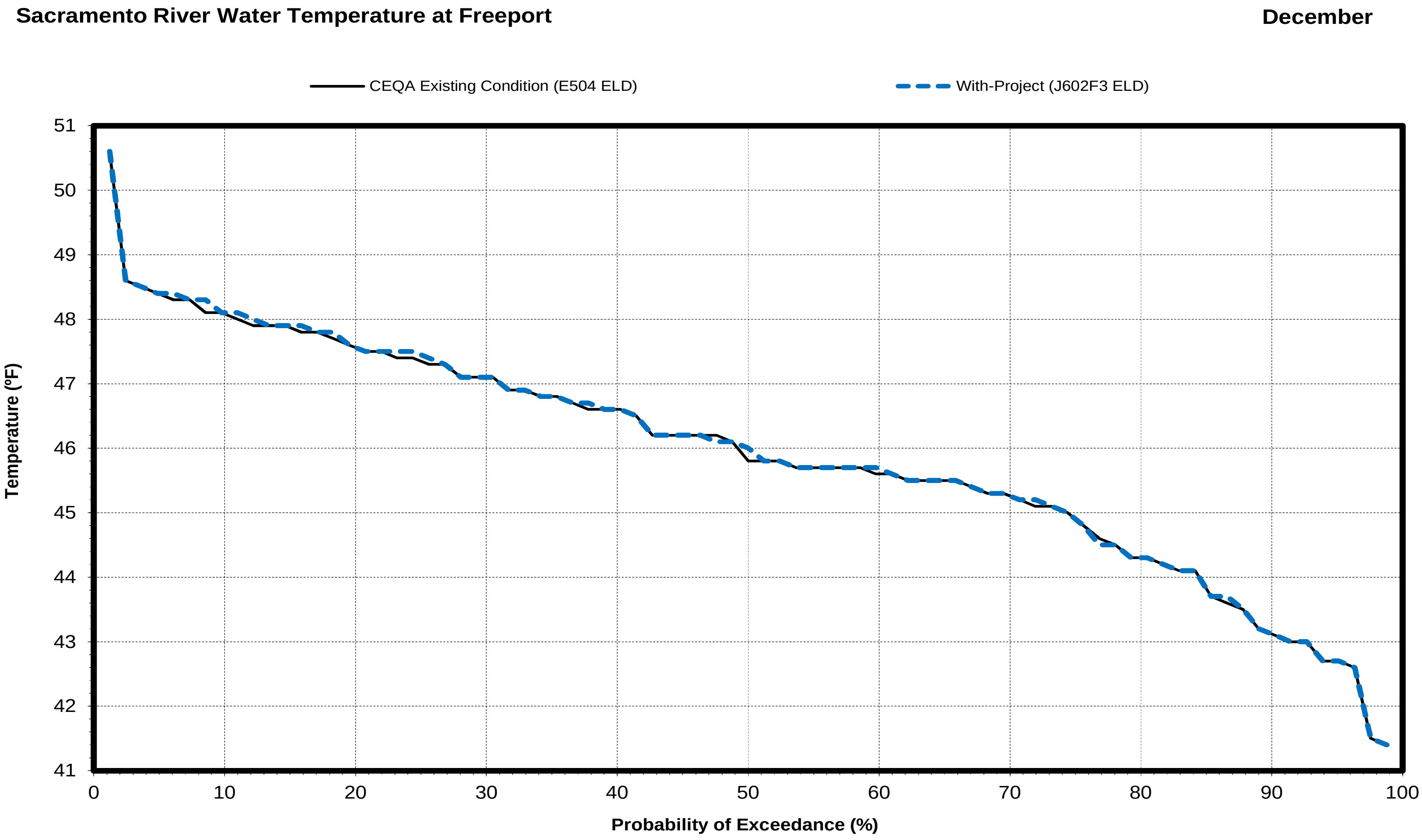
Figure 77 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

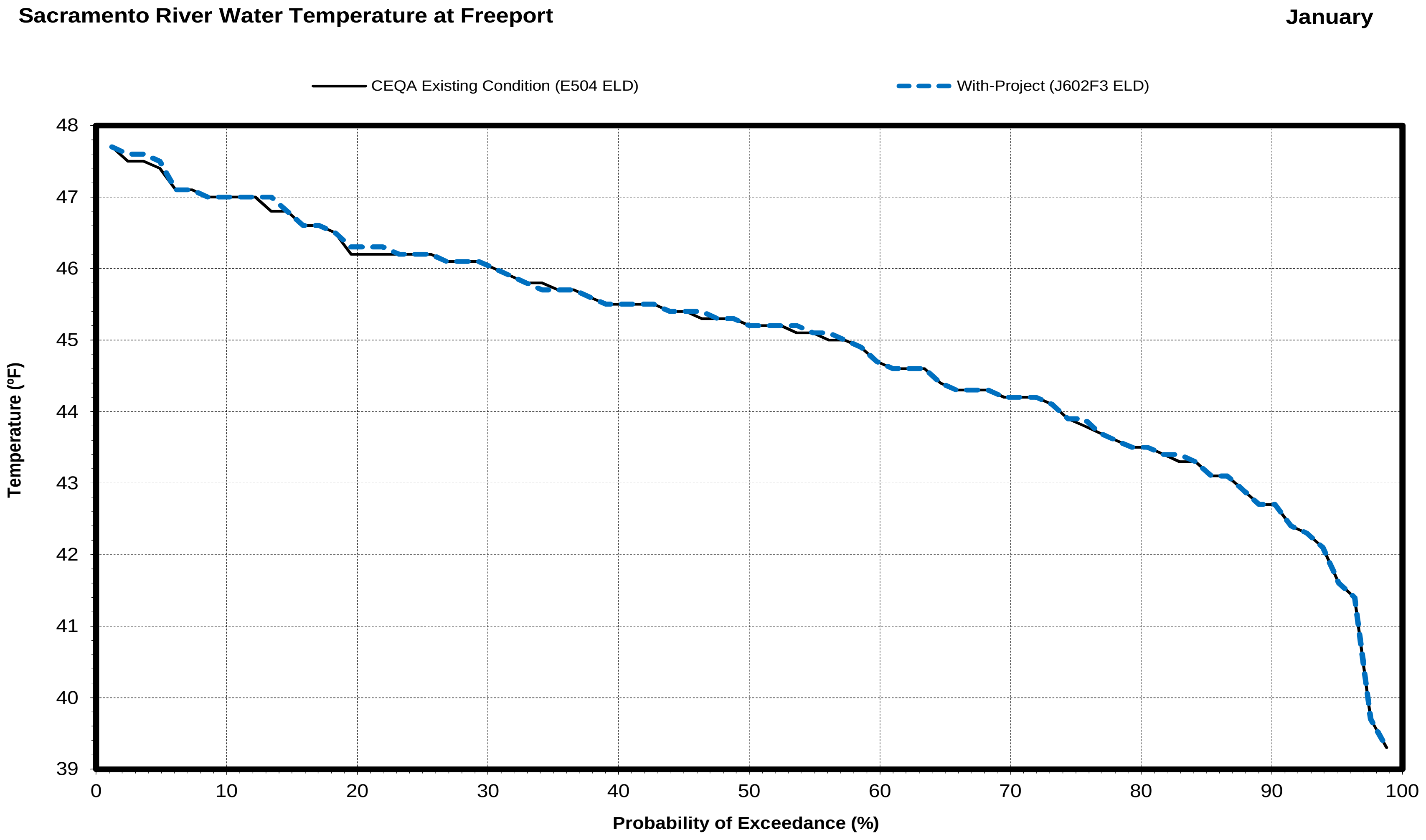
Figure 78 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

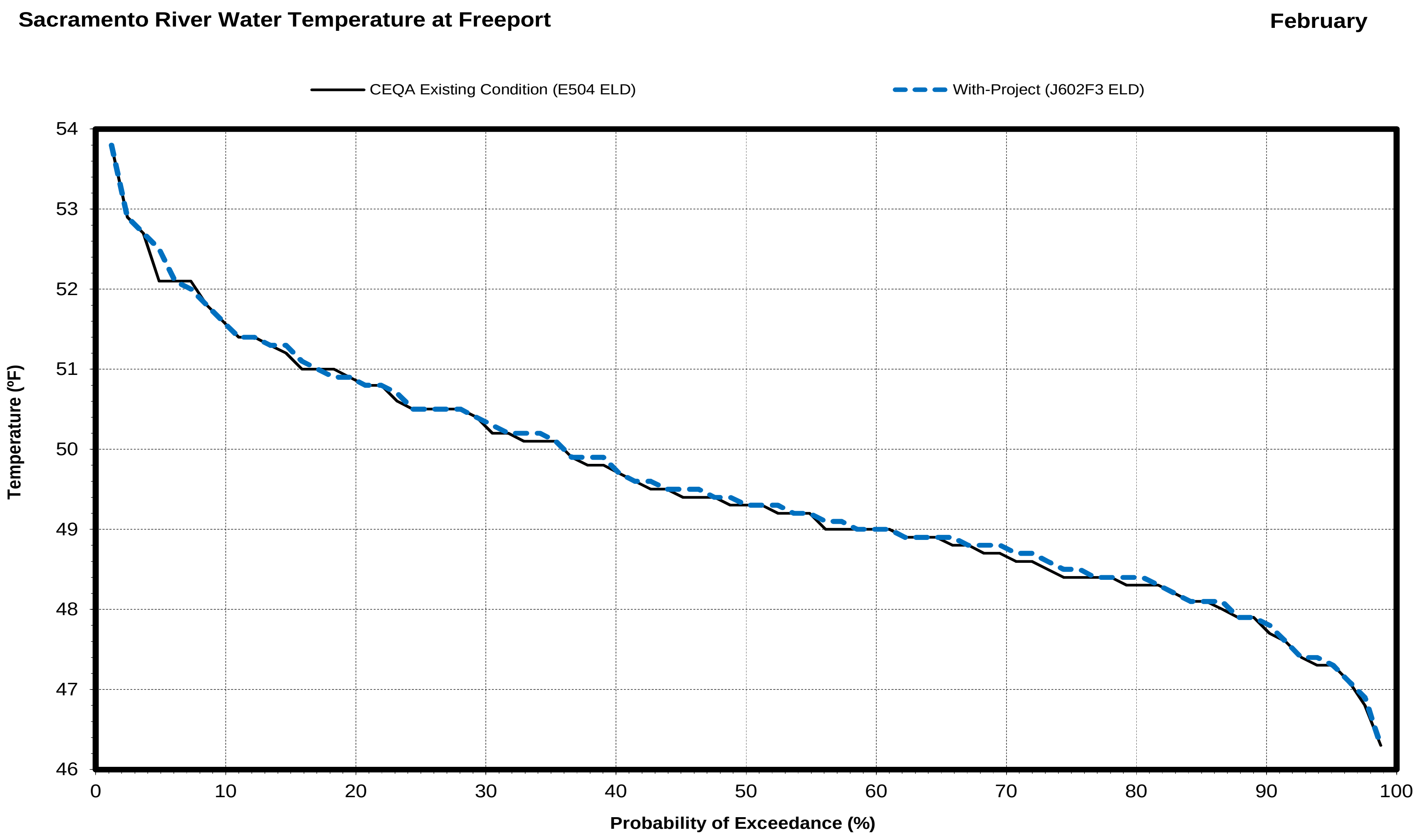
Figure 79 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

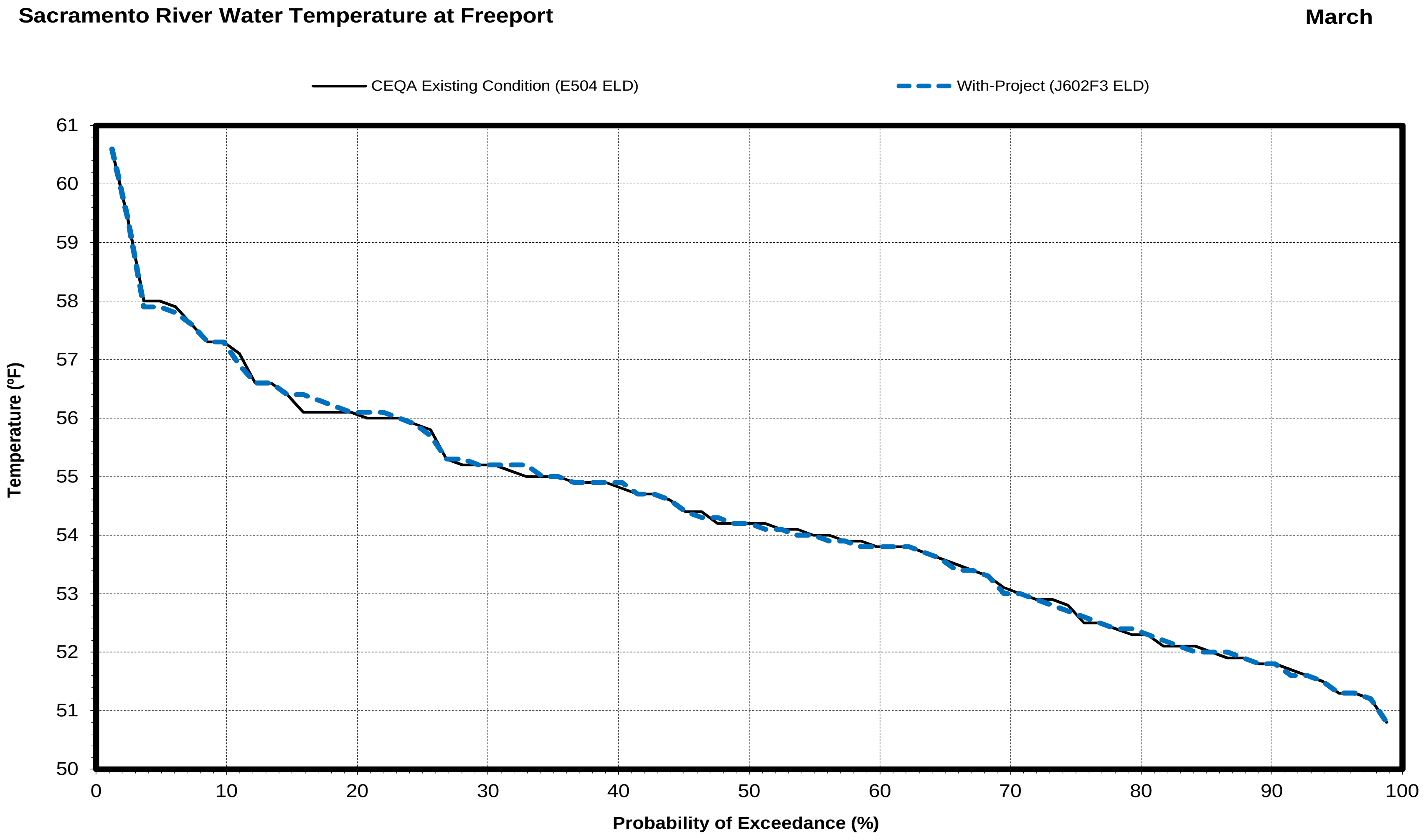
Figure 80 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

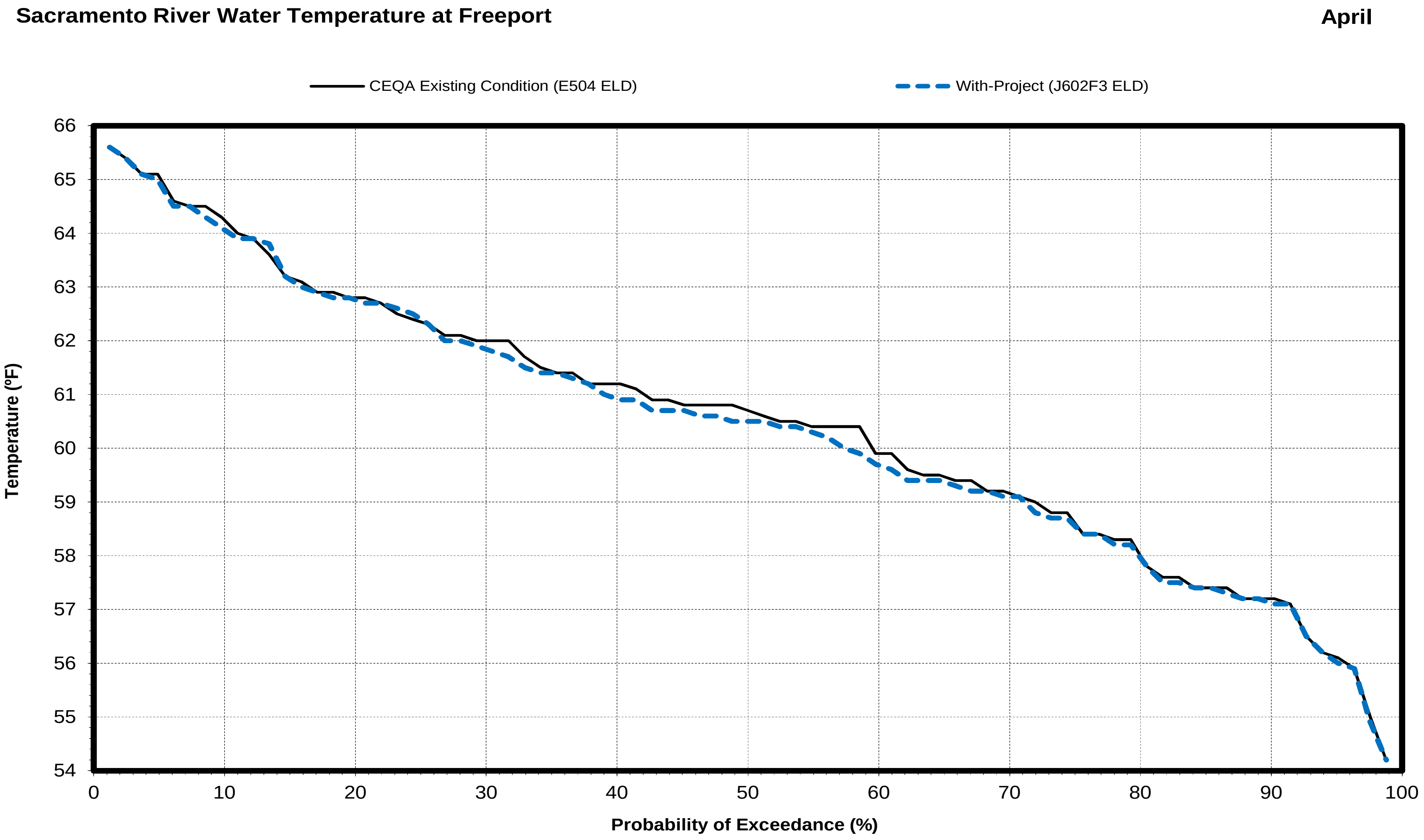
Figure 81 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

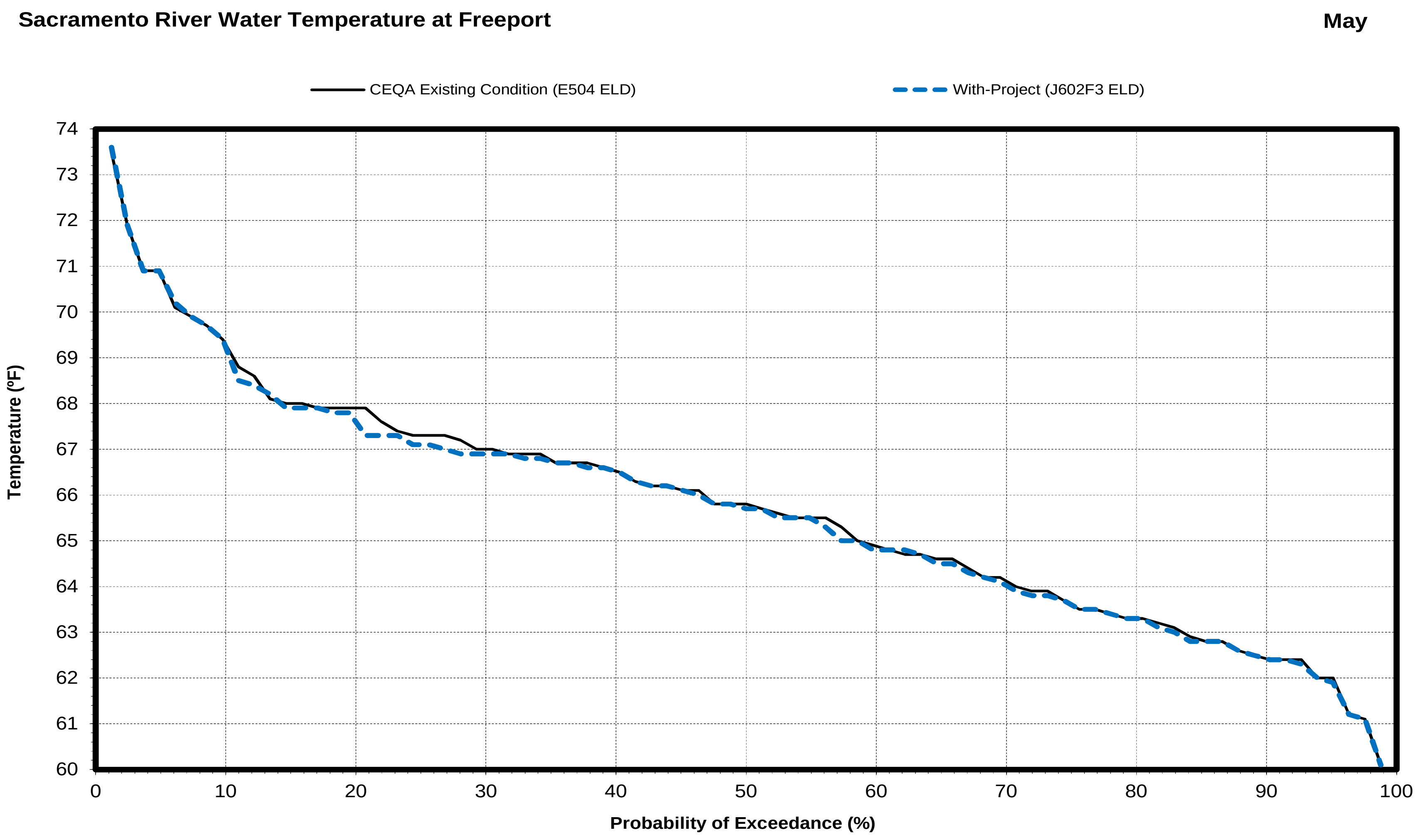
Figure 82 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

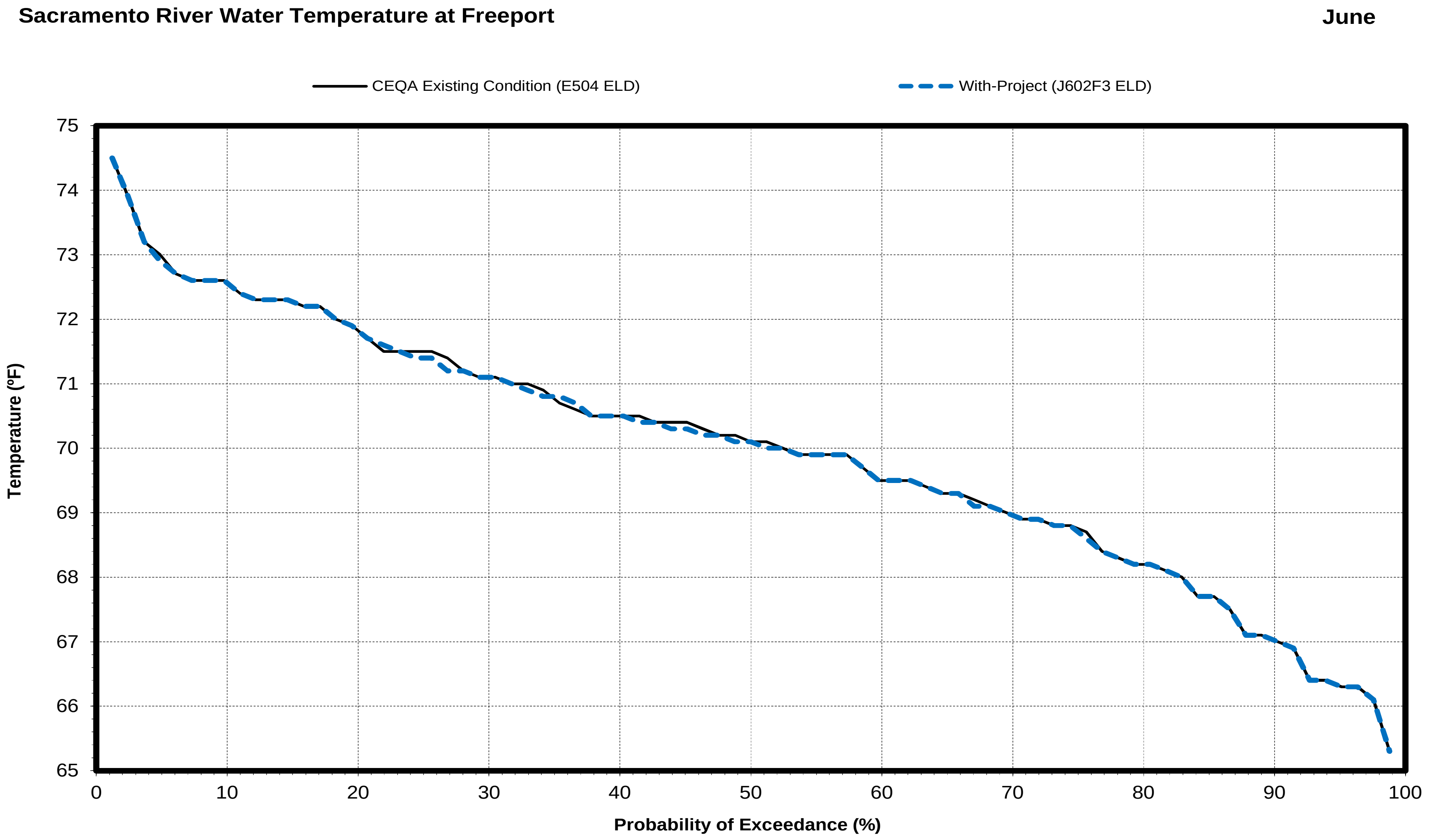
Figure 83 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

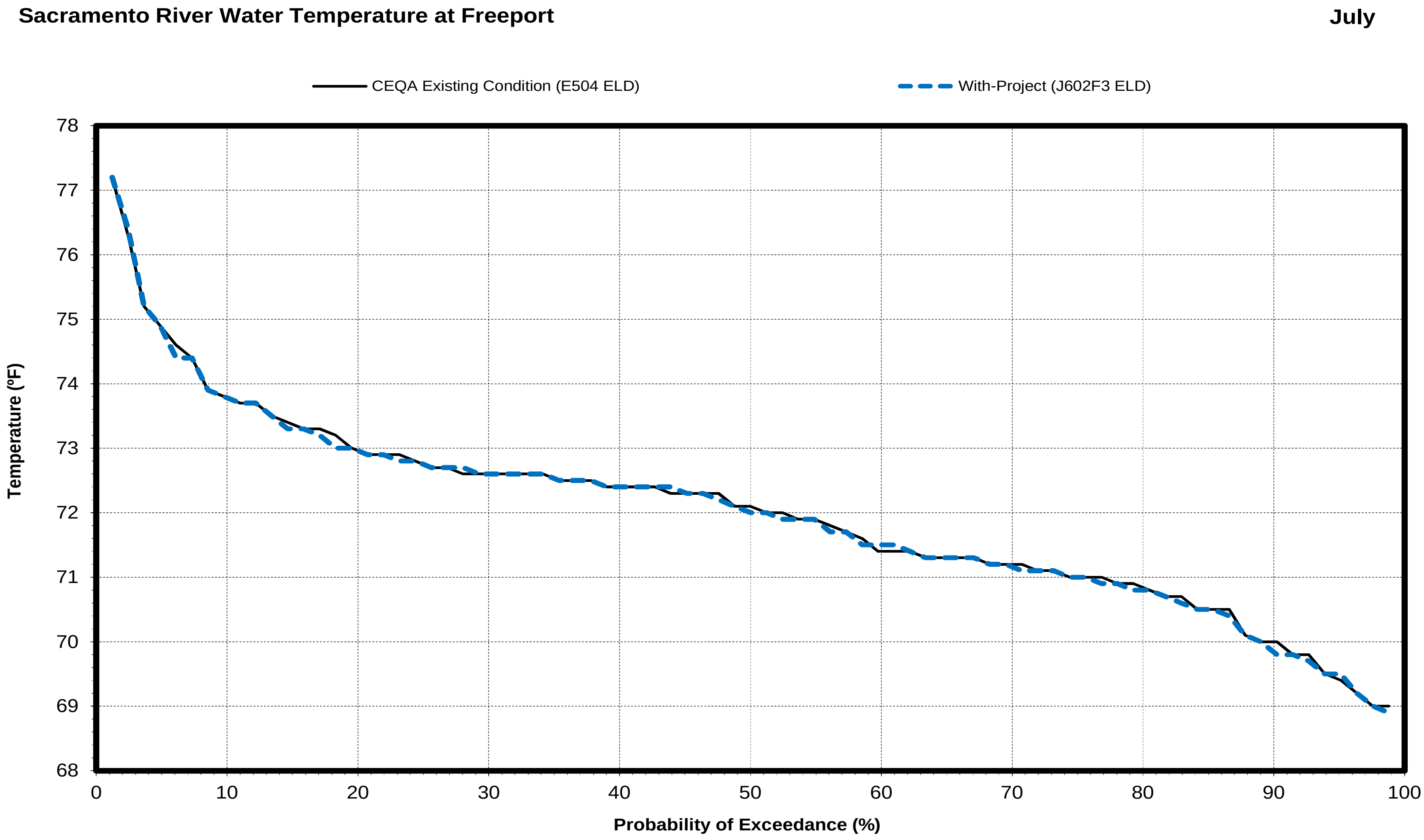
Figure 84 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

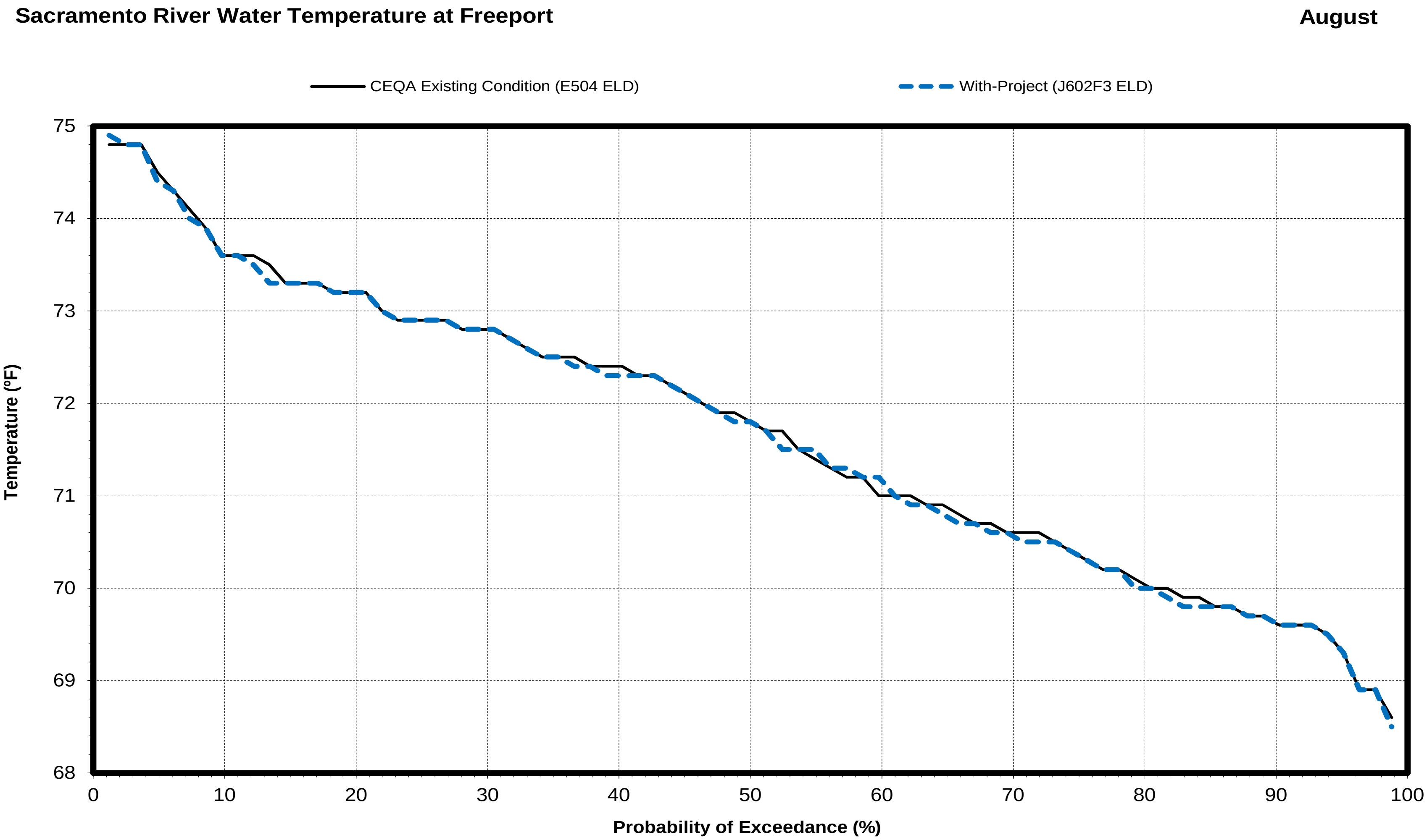
Figure 85 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

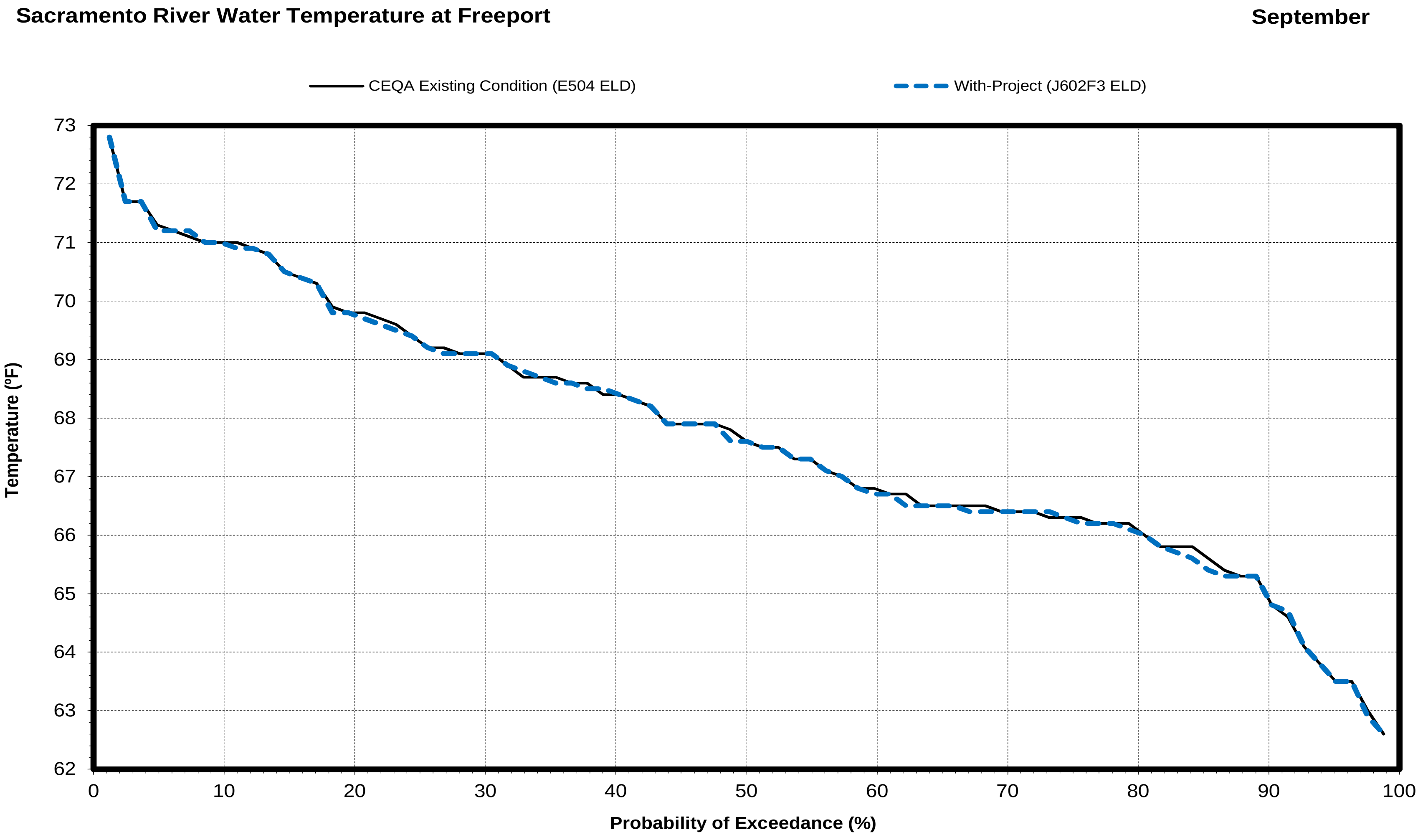
Figure 86 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 87 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 94 E504ELD-J602F3ELD

Long-term and Water Year Type Average Feather River Water Temperature below Thermalito Afterbay Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Temperature (ºF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period²												
CEQA Existing Condition (E504 ELD)	57.8	53.1	48.0	46.6	49.7	53.0	56.5	62.1	67.0	69.2	69.0	62.3
With-Project (J602F3 ELD)	57.8	53.1	48.1	46.6	49.8	53.0	56.5	62.0	67.1	69.2	69.0	62.3
Difference	0.0	0.0	0.1	0.0	0.1	0.0	0.0	-0.1	0.1	0.0	0.0	0.0
Water Year Types¹												
Wet												
CEQA Existing Condition (E504 ELD)	57.6	52.6	47.9	47.1	49.1	51.3	55.0	60.5	65.6	69.5	69.5	60.4
With-Project (J602F3 ELD)	57.6	52.6	47.9	47.1	49.1	51.3	55.0	60.5	65.6	69.5	69.5	60.4
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	58.6	53.8	48.8	46.6	49.9	53.3	57.1	62.7	67.4	67.7	67.1	60.8
With-Project (J602F3 ELD)	58.6	53.8	48.8	46.6	49.9	53.3	57.1	62.7	67.4	67.7	67.1	60.8
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below Normal												
CEQA Existing Condition (E504 ELD)	58.1	53.0	48.1	46.4	49.6	53.9	57.4	62.4	67.2	68.0	67.4	63.5
With-Project (J602F3 ELD)	58.1	53.0	48.1	46.4	49.6	53.9	57.4	62.4	67.2	68.0	67.4	63.7
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Dry												
CEQA Existing Condition (E504 ELD)	57.4	53.1	48.0	46.0	50.0	54.3	57.4	62.8	68.1	68.6	69.6	63.6
With-Project (J602F3 ELD)	57.5	53.1	48.0	46.0	50.0	54.3	57.4	62.8	68.2	68.6	69.6	63.5
Difference	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	-0.1
Critical												
CEQA Existing Condition (E504 ELD)	57.8	53.3	47.7	46.8	50.8	53.6	57.3	63.1	68.1	72.1	70.5	64.2
With-Project (J602F3 ELD)	57.8	53.3	47.7	46.8	50.8	53.5	57.2	63.1	68.1	72.1	70.5	64.2
Difference	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	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

Table 95 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

October			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD) Temperature (ºF)**	**With-Project (J602F3 ELD) Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	64.3	64.2	-0.1
2.4	62.6	62.6	0.0
3.7	61.7	61.7	0.0
4.9	61.5	61.5	0.0
6.1	60.7	60.7	0.0
7.3	60.7	60.6	-0.1
8.5	60.3	60.3	0.0
9.8	60.1	60.3	0.2
11.0	59.5	59.9	0.4
12.2	59.4	59.4	0.0
13.4	59.4	59.3	-0.1
14.6	59.3	59.3	0.0
15.9	59.3	59.2	-0.1
17.1	59.2	59.2	0.0
18.3	59.2	59.2	0.0
19.5	59.0	59.1	0.1
20.7	59.0	59.0	0.0
22.0	58.8	58.8	0.0
23.2	58.7	58.7	0.0
24.4	58.6	58.6	0.0
25.6	58.5	58.5	0.0
26.8	58.4	58.4	0.0
28.0	58.4	58.4	0.0
29.3	58.3	58.3	0.0
30.5	58.3	58.3	0.0
31.7	58.2	58.3	0.1
32.9	58.2	58.3	0.1
34.1	58.2	58.2	0.0
35.4	58.1	58.1	0.0
36.6	58.1	58.0	-0.1
37.8	58.0	58.0	0.0
39.0	58.0	57.9	-0.1
40.2	57.9	57.9	0.0
41.5	57.9	57.9	0.0
42.7	57.9	57.9	0.0
43.9	57.9	57.9	0.0
45.1	57.9	57.8	-0.1
46.3	57.8	57.7	-0.1
47.6	57.7	57.7	0.0
48.8	57.7	57.7	0.0
50.0	57.7	57.7	0.0
51.2	57.7	57.7	0.0
52.4	57.7	57.6	-0.1
53.7	57.6	57.6	0.0
54.9	57.5	57.5	0.0
56.1	57.5	57.5	0.0
57.3	57.5	57.5	0.0
58.5	57.4	57.4	0.0
59.8	57.3	57.3	0.0
61.0	57.1	57.1	0.0
62.2	57.0	57.0	0.0
63.4	57.0	57.0	0.0
64.6	57.0	57.0	0.0
65.9	57.0	57.0	0.0
67.1	57.0	57.0	0.0
68.3	56.9	56.9	0.0
69.5	56.9	56.9	0.0
70.7	56.8	56.8	0.0
72.0	56.8	56.8	0.0
73.2	56.7	56.7	0.0
74.4	56.6	56.6	0.0
75.6	56.6	56.6	0.0
76.8	56.6	56.6	0.0
78.0	56.5	56.5	0.0
79.3	56.5	56.5	0.0
80.5	56.5	56.5	0.0
81.7	56.5	56.5	0.0
82.9	56.4	56.4	0.0
84.1	56.4	56.4	0.0
85.4	56.4	56.4	0.0
86.6	56.3	56.3	0.0
87.8	56.3	56.3	0.0
89.0	56.2	56.2	0.0
90.2	55.9	55.9	0.0
91.5	55.7	55.7	0.0
92.7	55.7	55.7	0.0
93.9	55.7	55.7	0.0
95.1	55.4	55.4	0.0
96.3	55.3	55.3	0.0
97.6	54.7	54.7	0.0
98.8	54.5	54.5	0.0
Min	54.5	54.5	-0.1
Max	64.3	64.2	0.4
Mean	57.8	57.8	0.0
Median	57.7	57.7	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		98.8
X > 0.30			1.2
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**1.2**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		95.0
X > 0.30			5.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**5.0**

Table 96 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

November			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	58.3	58.3	0.0
2.4	57.8	57.8	0.0
3.7	56.3	56.8	0.5
4.9	55.9	55.9	0.0
6.1	55.8	55.7	-0.1
7.3	55.7	55.5	-0.2
8.5	55.3	55.4	0.1
9.8	55.1	55.3	0.2
11.0	54.7	54.7	0.0
12.2	54.6	54.6	0.0
13.4	54.6	54.6	0.0
14.6	54.6	54.6	0.0
15.9	54.6	54.6	0.0
17.1	54.5	54.5	0.0
18.3	54.4	54.5	0.1
19.5	54.4	54.4	0.0
20.7	54.4	54.4	0.0
22.0	54.4	54.4	0.0
23.2	54.2	54.2	0.0
24.4	54.0	54.0	0.0
25.6	54.0	54.0	0.0
26.8	54.0	54.0	0.0
28.0	53.9	53.9	0.0
29.3	53.9	53.8	-0.1
30.5	53.8	53.8	0.0
31.7	53.7	53.7	0.0
32.9	53.6	53.6	0.0
34.1	53.6	53.6	0.0
35.4	53.4	53.4	0.0
36.6	53.4	53.4	0.0
37.8	53.3	53.3	0.0
39.0	53.2	53.2	0.0
40.2	53.1	53.1	0.0
41.5	53.0	53.0	0.0
42.7	53.0	53.0	0.0
43.9	52.9	52.9	0.0
45.1	52.9	52.9	0.0
46.3	52.8	52.8	0.0
47.6	52.8	52.8	0.0
48.8	52.6	52.7	0.1
50.0	52.6	52.6	0.0
51.2	52.6	52.6	0.0
52.4	52.5	52.5	0.0
53.7	52.5	52.5	0.0
54.9	52.5	52.5	0.0
56.1	52.4	52.4	0.0
57.3	52.4	52.4	0.0
58.5	52.4	52.4	0.0
59.8	52.3	52.3	0.0
61.0	52.2	52.2	0.0
62.2	52.2	52.2	0.0
63.4	52.2	52.2	0.0
64.6	52.2	52.2	0.0
65.9	52.2	52.2	0.0
67.1	52.2	52.2	0.0
68.3	52.2	52.1	-0.1
69.5	52.1	52.1	0.0
70.7	52.1	52.1	0.0
72.0	52.1	52.1	0.0
73.2	52.1	52.1	0.0
74.4	52.0	52.0	0.0
75.6	52.0	52.0	0.0
76.8	52.0	52.0	0.0
78.0	52.0	52.0	0.0
79.3	52.0	51.9	-0.1
80.5	51.9	51.9	0.0
81.7	51.9	51.8	-0.1
82.9	51.8	51.8	0.0
84.1	51.7	51.7	0.0
85.4	51.7	51.7	0.0
86.6	51.7	51.7	0.0
87.8	51.7	51.7	0.0
89.0	51.4	51.4	0.0
90.2	51.3	51.3	0.0
91.5	51.3	51.3	0.0
92.7	51.3	51.3	0.0
93.9	51.3	51.3	0.0
95.1	50.8	50.8	0.0
96.3	50.7	50.7	0.0
97.6	50.5	50.5	0.0
98.8	49.7	49.7	0.0
Min	49.7	49.7	-0.2
Max	58.3	58.3	0.5
Mean	53.1	53.1	0.0
Median	52.6	52.6	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		98.8
X > 0.30			1.2
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**1.2**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		95.0
X > 0.30			5.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**5.0**

Table 97 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

December			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	52.7	52.7	0.0
2.4	51.3	51.3	0.0
3.7	51.2	51.1	-0.1
4.9	51.1	51.1	0.0
6.1	50.8	51.0	0.2
7.3	50.7	50.8	0.1
8.5	50.6	50.6	0.0
9.8	50.5	50.5	0.0
11.0	50.5	50.5	0.0
12.2	50.4	50.4	0.0
13.4	49.7	49.8	0.1
14.6	49.6	49.6	0.0
15.9	49.5	49.5	0.0
17.1	49.5	49.5	0.0
18.3	49.5	49.4	-0.1
19.5	49.4	49.4	0.0
20.7	49.4	49.4	0.0
22.0	49.3	49.3	0.0
23.2	49.3	49.3	0.0
24.4	49.3	49.2	-0.1
25.6	49.2	49.2	0.0
26.8	49.2	49.2	0.0
28.0	49.2	49.2	0.0
29.3	49.0	49.0	0.0
30.5	49.0	49.0	0.0
31.7	49.0	49.0	0.0
32.9	49.0	49.0	0.0
34.1	48.9	48.9	0.0
35.4	48.9	48.9	0.0
36.6	48.8	48.9	0.1
37.8	48.8	48.9	0.1
39.0	48.8	48.8	0.0
40.2	48.8	48.8	0.0
41.5	48.7	48.7	0.0
42.7	48.6	48.6	0.0
43.9	48.5	48.5	0.0
45.1	48.5	48.5	0.0
46.3	48.4	48.4	0.0
47.6	48.3	48.3	0.0
48.8	48.3	48.2	-0.1
50.0	48.2	48.2	0.0
51.2	48.0	48.0	0.0
52.4	48.0	48.0	0.0
53.7	48.0	48.0	0.0
54.9	47.8	47.8	0.0
56.1	47.8	47.8	0.0
57.3	47.8	47.6	-0.2
58.5	47.6	47.6	0.0
59.8	47.5	47.5	0.0
61.0	47.5	47.5	0.0
62.2	47.4	47.4	0.0
63.4	47.3	47.4	0.1
64.6	47.2	47.3	0.1
65.9	47.2	47.2	0.0
67.1	47.2	47.2	0.0
68.3	47.0	47.0	0.0
69.5	47.0	47.0	0.0
70.7	46.9	46.9	0.0
72.0	46.8	46.8	0.0
73.2	46.8	46.8	0.0
74.4	46.8	46.8	0.0
75.6	46.7	46.7	0.0
76.8	46.7	46.7	0.0
78.0	46.7	46.7	0.0
79.3	46.7	46.7	0.0
80.5	46.7	46.7	0.0
81.7	46.6	46.6	0.0
82.9	46.5	46.5	0.0
84.1	46.3	46.3	0.0
85.4	46.3	46.3	0.0
86.6	46.3	46.3	0.0
87.8	46.3	46.3	0.0
89.0	46.1	46.1	0.0
90.2	45.4	45.4	0.0
91.5	45.2	45.2	0.0
92.7	45.0	45.0	0.0
93.9	44.9	44.9	0.0
95.1	44.9	44.8	-0.1
96.3	44.7	44.7	0.0
97.6	44.0	44.0	0.0
98.8	44.0	44.0	0.0
Min	44.0	44.0	-0.2
Max	52.7	52.7	0.2
Mean	48.0	48.1	0.0
Median	48.2	48.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 98 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	50.0	50.0	0.0
2.4	49.2	49.2	0.0
3.7	49.2	49.2	0.0
4.9	48.7	48.7	0.0
6.1	48.7	48.7	0.0
7.3	48.7	48.7	0.0
8.5	48.4	48.4	0.0
9.8	48.3	48.3	0.0
11.0	48.2	48.2	0.0
12.2	48.2	48.2	0.0
13.4	48.1	48.1	0.0
14.6	48.1	48.1	0.0
15.9	48.1	48.1	0.0
17.1	48.1	48.1	0.0
18.3	48.1	48.1	0.0
19.5	48.0	48.0	0.0
20.7	48.0	48.0	0.0
22.0	47.9	47.9	0.0
23.2	47.9	47.9	0.0
24.4	47.9	47.9	0.0
25.6	47.8	47.8	0.0
26.8	47.8	47.8	0.0
28.0	47.8	47.8	0.0
29.3	47.8	47.8	0.0
30.5	47.7	47.7	0.0
31.7	47.7	47.7	0.0
32.9	47.5	47.5	0.0
34.1	47.4	47.4	0.0
35.4	47.4	47.4	0.0
36.6	47.3	47.3	0.0
37.8	47.3	47.3	0.0
39.0	47.3	47.3	0.0
40.2	47.2	47.2	0.0
41.5	47.2	47.2	0.0
42.7	47.1	47.1	0.0
43.9	47.1	47.1	0.0
45.1	47.1	47.1	0.0
46.3	47.0	47.0	0.0
47.6	47.0	47.0	0.0
48.8	47.0	47.0	0.0
50.0	46.9	46.9	0.0
51.2	46.8	46.8	0.0
52.4	46.7	46.7	0.0
53.7	46.7	46.7	0.0
54.9	46.7	46.7	0.0
56.1	46.7	46.7	0.0
57.3	46.6	46.6	0.0
58.5	46.6	46.6	0.0
59.8	46.5	46.5	0.0
61.0	46.5	46.5	0.0
62.2	46.4	46.4	0.0
63.4	46.4	46.4	0.0
64.6	46.3	46.3	0.0
65.9	46.2	46.2	0.0
67.1	46.2	46.2	0.0
68.3	46.1	46.1	0.0
69.5	46.1	46.1	0.0
70.7	46.0	46.0	0.0
72.0	46.0	46.0	0.0
73.2	45.9	45.9	0.0
74.4	45.9	45.9	0.0
75.6	45.8	45.8	0.0
76.8	45.6	45.6	0.0
78.0	45.6	45.6	0.0
79.3	45.6	45.6	0.0
80.5	45.0	45.2	0.2
81.7	44.9	45.0	0.1
82.9	44.9	44.9	0.0
84.1	44.9	44.9	0.0
85.4	44.8	44.8	0.0
86.6	44.8	44.8	0.0
87.8	44.7	44.7	0.0
89.0	44.4	44.4	0.0
90.2	44.4	44.4	0.0
91.5	44.2	44.2	0.0
92.7	44.1	44.1	0.0
93.9	43.8	43.8	0.0
95.1	43.7	43.7	0.0
96.3	42.5	42.5	0.0
97.6	41.8	41.8	0.0
98.8	41.7	41.7	0.0
Min	41.7	41.7	0.0
Max	50.0	50.0	0.2
Mean	46.6	46.6	0.0
Median	46.9	46.9	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 99 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

February			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	53.1	53.1	0.0
2.4	52.7	52.7	0.0
3.7	52.7	52.7	0.0
4.9	52.7	52.7	0.0
6.1	52.6	52.6	0.0
7.3	52.5	52.5	0.0
8.5	52.4	52.4	0.0
9.8	52.0	52.1	0.1
11.0	51.8	51.8	0.0
12.2	51.6	51.6	0.0
13.4	51.5	51.5	0.0
14.6	51.4	51.5	0.1
15.9	51.3	51.4	0.1
17.1	51.3	51.3	0.0
18.3	51.3	51.3	0.0
19.5	51.2	51.2	0.0
20.7	51.1	51.2	0.1
22.0	51.1	51.1	0.0
23.2	51.1	51.1	0.0
24.4	51.0	51.1	0.1
25.6	50.9	50.9	0.0
26.8	50.9	50.9	0.0
28.0	50.9	50.9	0.0
29.3	50.7	50.7	0.0
30.5	50.6	50.6	0.0
31.7	50.5	50.5	0.0
32.9	50.5	50.5	0.0
34.1	50.4	50.5	0.1
35.4	50.3	50.5	0.2
36.6	50.3	50.3	0.0
37.8	50.3	50.3	0.0
39.0	50.2	50.3	0.1
40.2	50.2	50.2	0.0
41.5	50.1	50.2	0.1
42.7	49.9	50.1	0.2
43.9	49.9	49.9	0.0
45.1	49.9	49.9	0.0
46.3	49.9	49.9	0.0
47.6	49.9	49.8	-0.1
48.8	49.8	49.8	0.0
50.0	49.7	49.7	0.0
51.2	49.7	49.7	0.0
52.4	49.6	49.6	0.0
53.7	49.6	49.6	0.0
54.9	49.6	49.6	0.0
56.1	49.5	49.5	0.0
57.3	49.4	49.4	0.0
58.5	49.3	49.3	0.0
59.8	49.3	49.2	-0.1
61.0	49.0	49.0	0.0
62.2	49.0	49.0	0.0
63.4	48.9	48.9	0.0
64.6	48.9	48.9	0.0
65.9	48.8	48.8	0.0
67.1	48.8	48.8	0.0
68.3	48.8	48.8	0.0
69.5	48.7	48.7	0.0
70.7	48.7	48.7	0.0
72.0	48.5	48.5	0.0
73.2	48.5	48.5	0.0
74.4	48.5	48.5	0.0
75.6	48.4	48.4	0.0
76.8	48.3	48.3	0.0
78.0	48.3	48.3	0.0
79.3	48.2	48.2	0.0
80.5	48.2	48.2	0.0
81.7	48.2	48.2	0.0
82.9	48.2	48.1	-0.1
84.1	48.1	48.1	0.0
85.4	48.0	48.0	0.0
86.6	48.0	48.0	0.0
87.8	47.9	47.9	0.0
89.0	47.9	47.9	0.0
90.2	47.8	47.8	0.0
91.5	47.8	47.8	0.0
92.7	47.7	47.7	0.0
93.9	47.6	47.6	0.0
95.1	47.5	47.5	0.0
96.3	46.8	46.8	0.0
97.6	46.6	46.6	0.0
98.8	46.5	46.5	0.0
Min	46.5	46.5	-0.1
Max	53.1	53.1	0.2
Mean	49.7	49.8	0.0
Median	49.7	49.7	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 100 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	57.6	57.6	0.0
2.4	57.5	57.5	0.0
3.7	57.2	57.2	0.0
4.9	56.9	56.9	0.0
6.1	56.1	56.1	0.0
7.3	56.1	56.0	-0.1
8.5	55.9	55.9	0.0
9.8	55.8	55.8	0.0
11.0	55.8	55.8	0.0
12.2	55.5	55.5	0.0
13.4	55.4	55.4	0.0
14.6	55.3	55.3	0.0
15.9	55.2	55.2	0.0
17.1	55.1	55.1	0.0
18.3	55.0	55.0	0.0
19.5	54.9	54.9	0.0
20.7	54.8	54.8	0.0
22.0	54.8	54.8	0.0
23.2	54.7	54.7	0.0
24.4	54.7	54.7	0.0
25.6	54.6	54.6	0.0
26.8	54.6	54.6	0.0
28.0	54.5	54.5	0.0
29.3	54.3	54.3	0.0
30.5	54.3	54.3	0.0
31.7	54.3	54.3	0.0
32.9	54.1	54.1	0.0
34.1	54.0	54.0	0.0
35.4	54.0	54.0	0.0
36.6	54.0	54.0	0.0
37.8	54.0	54.0	0.0
39.0	54.0	54.0	0.0
40.2	54.0	53.7	-0.3
41.5	53.7	53.7	0.0
42.7	53.7	53.7	0.0
43.9	53.7	53.7	0.0
45.1	53.7	53.6	-0.1
46.3	53.6	53.6	0.0
47.6	53.6	53.5	-0.1
48.8	53.5	53.4	-0.1
50.0	53.4	53.3	-0.1
51.2	53.3	52.9	-0.4
52.4	52.9	52.9	0.0
53.7	52.9	52.9	0.0
54.9	52.8	52.8	0.0
56.1	52.7	52.7	0.0
57.3	52.7	52.7	0.0
58.5	52.6	52.6	0.0
59.8	52.6	52.6	0.0
61.0	52.5	52.5	0.0
62.2	52.4	52.4	0.0
63.4	52.3	52.3	0.0
64.6	52.2	52.2	0.0
65.9	52.1	52.1	0.0
67.1	52.1	52.1	0.0
68.3	51.8	51.8	0.0
69.5	51.8	51.8	0.0
70.7	51.7	51.7	0.0
72.0	51.7	51.7	0.0
73.2	51.6	51.6	0.0
74.4	51.5	51.5	0.0
75.6	51.4	51.4	0.0
76.8	51.3	51.2	-0.1
78.0	51.1	51.1	0.0
79.3	51.1	51.1	0.0
80.5	51.1	51.0	-0.1
81.7	50.9	50.9	0.0
82.9	50.7	50.7	0.0
84.1	50.6	50.6	0.0
85.4	50.5	50.5	0.0
86.6	50.3	50.3	0.0
87.8	50.3	50.3	0.0
89.0	49.7	49.7	0.0
90.2	49.7	49.7	0.0
91.5	49.6	49.6	0.0
92.7	49.3	49.3	0.0
93.9	49.1	49.1	0.0
95.1	49.0	49.0	0.0
96.3	48.9	48.9	0.0
97.6	48.8	48.9	0.1
98.8	47.9	47.9	0.0
Min	47.9	47.9	-0.4
Max	57.6	57.6	0.1
Mean	53.0	53.0	0.0
Median	53.4	53.3	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	98.8
X > 0.30		0.0
X < -0.30		1.2
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**-1.2**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 101 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	61.6	61.6	0.0
2.4	60.8	60.8	0.0
3.7	60.7	60.7	0.0
4.9	60.1	60.1	0.0
6.1	60.0	60.0	0.0
7.3	59.8	59.8	0.0
8.5	59.7	59.7	0.0
9.8	59.4	59.4	0.0
11.0	59.4	59.4	0.0
12.2	59.4	59.4	0.0
13.4	58.5	58.5	0.0
14.6	58.3	58.3	0.0
15.9	58.2	58.2	0.0
17.1	58.1	58.1	0.0
18.3	58.1	58.1	0.0
19.5	58.1	58.1	0.0
20.7	58.0	58.0	0.0
22.0	58.0	58.0	0.0
23.2	57.9	57.9	0.0
24.4	57.7	57.7	0.0
25.6	57.7	57.7	0.0
26.8	57.7	57.7	0.0
28.0	57.4	57.4	0.0
29.3	57.3	57.3	0.0
30.5	57.3	57.3	0.0
31.7	57.2	57.2	0.0
32.9	57.2	57.2	0.0
34.1	57.2	57.2	0.0
35.4	57.2	57.2	0.0
36.6	57.1	57.1	0.0
37.8	57.1	57.1	0.0
39.0	57.0	57.0	0.0
40.2	56.9	56.9	0.0
41.5	56.9	56.9	0.0
42.7	56.9	56.9	0.0
43.9	56.9	56.9	0.0
45.1	56.8	56.8	0.0
46.3	56.8	56.8	0.0
47.6	56.8	56.8	0.0
48.8	56.7	56.7	0.0
50.0	56.7	56.7	0.0
51.2	56.6	56.6	0.0
52.4	56.5	56.5	0.0
53.7	56.4	56.4	0.0
54.9	56.4	56.4	0.0
56.1	56.3	56.3	0.0
57.3	56.3	56.3	0.0
58.5	56.3	56.3	0.0
59.8	56.2	56.2	0.0
61.0	56.1	56.1	0.0
62.2	56.1	56.1	0.0
63.4	55.9	56.0	0.1
64.6	55.8	55.8	0.0
65.9	55.8	55.8	0.0
67.1	55.8	55.8	0.0
68.3	55.7	55.7	0.0
69.5	55.7	55.7	0.0
70.7	55.7	55.7	0.0
72.0	55.6	55.6	0.0
73.2	55.5	55.5	0.0
74.4	55.4	55.4	0.0
75.6	55.2	55.2	0.0
76.8	55.1	55.1	0.0
78.0	55.0	55.0	0.0
79.3	55.0	55.0	0.0
80.5	55.0	55.0	0.0
81.7	54.9	54.9	0.0
82.9	54.9	54.9	0.0
84.1	54.8	54.8	0.0
85.4	54.7	54.7	0.0
86.6	54.5	54.5	0.0
87.8	54.5	54.5	0.0
89.0	54.4	54.3	-0.1
90.2	54.0	54.0	0.0
91.5	53.5	53.5	0.0
92.7	53.2	53.2	0.0
93.9	52.7	52.7	0.0
95.1	52.5	52.5	0.0
96.3	52.1	52.1	0.0
97.6	52.0	52.0	0.0
98.8	51.7	51.7	0.0
Min	51.7	51.7	-0.1
Max	61.6	61.6	0.1
Mean	56.5	56.5	0.0
Median	56.7	56.7	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 102 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

May			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	69.9	69.9	0.0
2.4	67.4	67.4	0.0
3.7	66.7	66.7	0.0
4.9	66.1	66.1	0.0
6.1	65.8	65.8	0.0
7.3	65.6	65.6	0.0
8.5	65.1	65.1	0.0
9.8	64.9	64.9	0.0
11.0	64.9	64.9	0.0
12.2	64.8	64.8	0.0
13.4	64.7	64.7	0.0
14.6	64.7	64.7	0.0
15.9	64.4	64.4	0.0
17.1	64.0	64.0	0.0
18.3	63.9	63.9	0.0
19.5	63.7	63.7	0.0
20.7	63.6	63.5	-0.1
22.0	63.5	63.5	0.0
23.2	63.5	63.5	0.0
24.4	63.5	63.5	0.0
25.6	63.3	63.3	0.0
26.8	63.3	63.3	0.0
28.0	63.3	63.3	0.0
29.3	63.3	63.3	0.0
30.5	63.2	63.2	0.0
31.7	63.1	63.1	0.0
32.9	63.1	63.1	0.0
34.1	62.9	62.9	0.0
35.4	62.9	62.9	0.0
36.6	62.8	62.8	0.0
37.8	62.8	62.8	0.0
39.0	62.8	62.8	0.0
40.2	62.7	62.7	0.0
41.5	62.7	62.7	0.0
42.7	62.6	62.6	0.0
43.9	62.6	62.6	0.0
45.1	62.6	62.5	-0.1
46.3	62.5	62.4	-0.1
47.6	62.4	62.4	0.0
48.8	62.4	62.2	-0.2
50.0	62.2	62.2	0.0
51.2	62.2	62.1	-0.1
52.4	62.1	62.1	0.0
53.7	62.1	62.1	0.0
54.9	62.0	62.0	0.0
56.1	61.9	61.9	0.0
57.3	61.9	61.9	0.0
58.5	61.9	61.9	0.0
59.8	61.6	61.6	0.0
61.0	61.5	61.5	0.0
62.2	61.4	61.4	0.0
63.4	61.4	61.4	0.0
64.6	61.2	61.2	0.0
65.9	61.1	61.1	0.0
67.1	61.1	61.1	0.0
68.3	61.0	61.0	0.0
69.5	60.8	60.8	0.0
70.7	60.8	60.8	0.0
72.0	60.8	60.8	0.0
73.2	60.7	60.7	0.0
74.4	60.1	60.1	0.0
75.6	60.1	60.1	0.0
76.8	60.1	60.1	0.0
78.0	60.0	60.1	0.1
79.3	60.0	60.0	0.0
80.5	59.8	59.8	0.0
81.7	59.6	59.6	0.0
82.9	59.6	59.6	0.0
84.1	59.5	59.5	0.0
85.4	59.5	59.5	0.0
86.6	59.2	59.2	0.0
87.8	59.1	59.1	0.0
89.0	59.0	59.0	0.0
90.2	59.0	59.0	0.0
91.5	58.9	58.9	0.0
92.7	58.6	58.6	0.0
93.9	57.9	57.9	0.0
95.1	57.9	57.9	0.0
96.3	57.5	57.5	0.0
97.6	57.1	57.1	0.0
98.8	55.9	55.9	0.0
Min	55.9	55.9	-0.2
Max	69.9	69.9	0.1
Mean	62.1	62.0	0.0
Median	62.2	62.2	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 103 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	72.5	72.5	0.0
2.4	71.4	71.4	0.0
3.7	70.6	70.6	0.0
4.9	70.4	70.6	0.2
6.1	70.2	70.4	0.2
7.3	70.0	70.1	0.1
8.5	69.8	69.7	-0.1
9.8	69.7	69.7	0.0
11.0	69.6	69.7	0.1
12.2	69.6	69.6	0.0
13.4	69.6	69.6	0.0
14.6	69.6	69.6	0.0
15.9	69.5	69.5	0.0
17.1	69.4	69.4	0.0
18.3	69.3	69.3	0.0
19.5	69.1	69.1	0.0
20.7	69.1	69.1	0.0
22.0	69.0	69.1	0.1
23.2	69.0	69.0	0.0
24.4	69.0	68.9	-0.1
25.6	68.8	68.8	0.0
26.8	68.6	68.8	0.2
28.0	68.3	68.6	0.3
29.3	68.3	68.3	0.0
30.5	68.3	68.3	0.0
31.7	68.3	68.3	0.0
32.9	68.2	68.3	0.1
34.1	68.2	68.2	0.0
35.4	68.1	68.1	0.0
36.6	68.0	68.0	0.0
37.8	68.0	68.0	0.0
39.0	68.0	68.0	0.0
40.2	68.0	68.0	0.0
41.5	67.9	67.9	0.0
42.7	67.7	67.7	0.0
43.9	67.6	67.6	0.0
45.1	67.6	67.6	0.0
46.3	67.4	67.4	0.0
47.6	67.4	67.4	0.0
48.8	67.4	67.4	0.0
50.0	67.3	67.3	0.0
51.2	67.2	67.3	0.1
52.4	67.1	67.2	0.1
53.7	67.0	67.1	0.1
54.9	67.0	67.0	0.0
56.1	66.9	67.0	0.1
57.3	66.8	66.9	0.1
58.5	66.8	66.8	0.0
59.8	66.8	66.8	0.0
61.0	66.7	66.8	0.1
62.2	66.4	66.7	0.3
63.4	66.3	66.4	0.1
64.6	66.3	66.3	0.0
65.9	66.2	66.3	0.1
67.1	66.2	66.2	0.0
68.3	66.0	66.2	0.2
69.5	65.8	66.0	0.2
70.7	65.8	65.8	0.0
72.0	65.8	65.8	0.0
73.2	65.7	65.7	0.0
74.4	65.5	65.7	0.2
75.6	65.4	65.5	0.1
76.8	65.4	65.5	0.1
78.0	65.3	65.4	0.1
79.3	65.1	65.1	0.0
80.5	65.1	65.1	0.0
81.7	65.0	65.0	0.0
82.9	64.9	64.9	0.0
84.1	64.8	64.8	0.0
85.4	64.6	64.6	0.0
86.6	64.6	64.6	0.0
87.8	64.4	64.4	0.0
89.0	64.0	64.0	0.0
90.2	63.7	63.7	0.0
91.5	63.6	63.6	0.0
92.7	63.4	63.4	0.0
93.9	63.2	63.2	0.0
95.1	61.9	61.9	0.0
96.3	61.7	61.7	0.0
97.6	61.0	61.0	0.0
98.8	60.0	60.0	0.0
Min	60.0	60.0	-0.1
Max	72.5	72.5	0.3
Mean	67.0	67.1	0.0
Median	67.3	67.3	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 104 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

July			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	78.4	78.1	-0.3
2.4	76.8	76.8	0.0
3.7	74.3	74.3	0.0
4.9	74.0	74.1	0.1
6.1	73.3	73.3	0.0
7.3	73.2	73.2	0.0
8.5	73.1	73.1	0.0
9.8	72.7	72.7	0.0
11.0	72.7	72.7	0.0
12.2	71.9	71.9	0.0
13.4	71.9	71.9	0.0
14.6	71.7	71.7	0.0
15.9	71.6	71.3	-0.3
17.1	71.3	71.3	0.0
18.3	71.1	71.1	0.0
19.5	70.6	70.6	0.0
20.7	70.3	70.3	0.0
22.0	70.2	70.2	0.0
23.2	70.0	70.0	0.0
24.4	70.0	70.0	0.0
25.6	70.0	70.0	0.0
26.8	69.8	69.7	-0.1
28.0	69.6	69.6	0.0
29.3	69.6	69.6	0.0
30.5	69.4	69.4	0.0
31.7	69.3	69.4	0.1
32.9	69.2	69.3	0.1
34.1	69.2	69.3	0.1
35.4	69.2	69.2	0.0
36.6	69.2	69.2	0.0
37.8	69.2	69.2	0.0
39.0	69.1	69.2	0.1
40.2	69.1	69.1	0.0
41.5	69.1	69.1	0.0
42.7	69.1	69.1	0.0
43.9	69.0	69.1	0.1
45.1	69.0	69.0	0.0
46.3	68.9	69.0	0.1
47.6	68.7	68.9	0.2
48.8	68.7	68.7	0.0
50.0	68.7	68.7	0.0
51.2	68.6	68.6	0.0
52.4	68.6	68.6	0.0
53.7	68.6	68.6	0.0
54.9	68.5	68.5	0.0
56.1	68.5	68.5	0.0
57.3	68.4	68.4	0.0
58.5	68.3	68.3	0.0
59.8	68.3	68.3	0.0
61.0	68.2	68.2	0.0
62.2	68.2	68.2	0.0
63.4	68.2	68.2	0.0
64.6	68.1	68.1	0.0
65.9	68.1	68.1	0.0
67.1	68.1	68.1	0.0
68.3	68.0	68.0	0.0
69.5	68.0	68.0	0.0
70.7	68.0	68.0	0.0
72.0	67.9	67.9	0.0
73.2	67.8	67.8	0.0
74.4	67.7	67.7	0.0
75.6	67.6	67.6	0.0
76.8	67.4	67.4	0.0
78.0	67.4	67.4	0.0
79.3	67.4	67.4	0.0
80.5	67.4	67.3	-0.1
81.7	67.3	67.3	0.0
82.9	67.3	67.3	0.0
84.1	67.2	67.2	0.0
85.4	67.0	67.0	0.0
86.6	66.9	66.9	0.0
87.8	66.9	66.8	-0.1
89.0	66.8	66.8	0.0
90.2	66.7	66.7	0.0
91.5	66.7	66.7	0.0
92.7	66.5	66.5	0.0
93.9	66.4	66.4	0.0
95.1	66.4	66.4	0.0
96.3	66.4	66.4	0.0
97.6	66.4	66.4	0.0
98.8	66.3	66.3	0.0
Min	66.3	66.3	-0.3
Max	78.4	78.1	0.2
Mean	69.2	69.2	0.0
Median	68.7	68.7	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 105 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

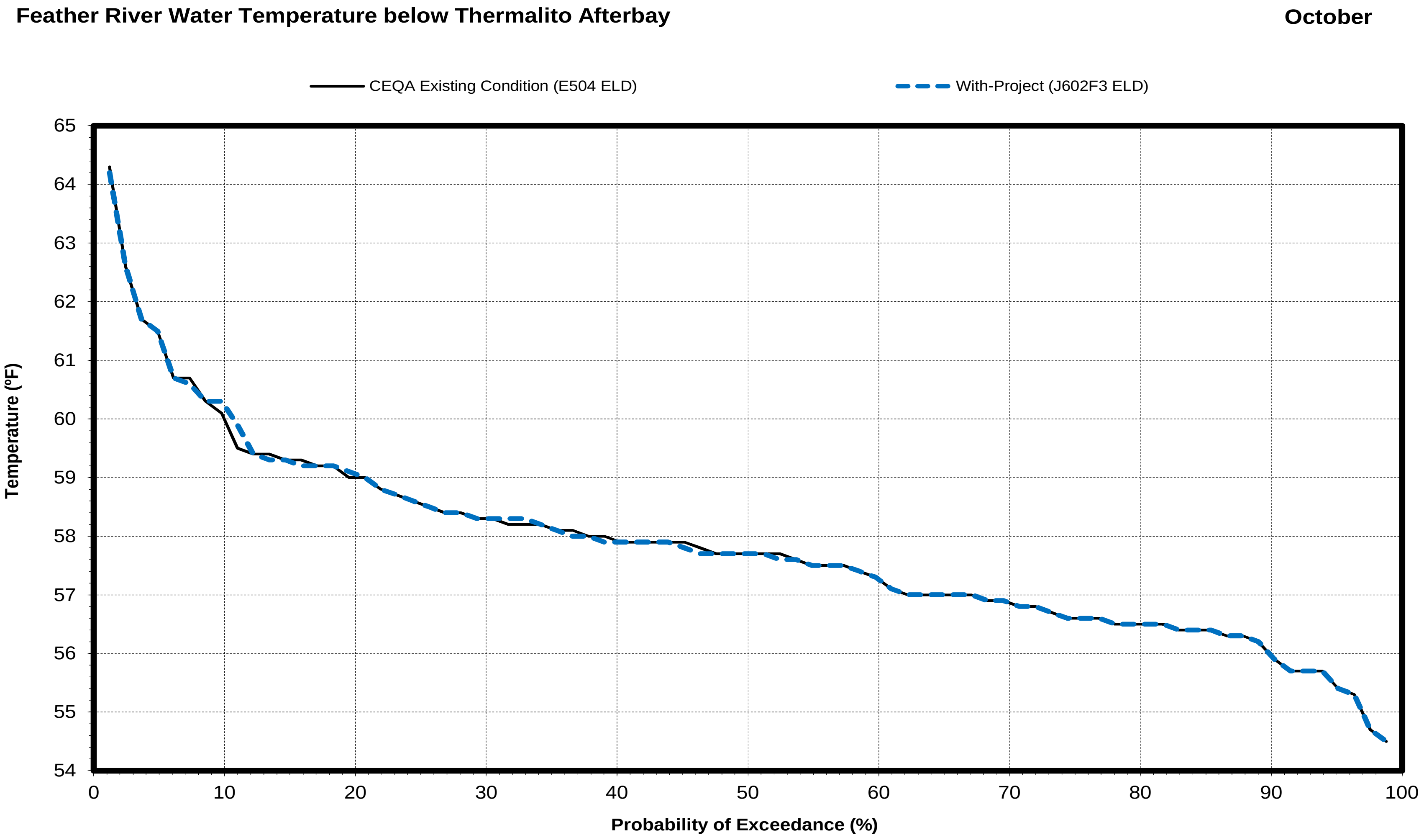
August			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	75.2	75.2	0.0
2.4	74.6	74.6	0.0
3.7	74.5	74.4	-0.1
4.9	73.7	73.7	0.0
6.1	73.5	73.5	0.0
7.3	73.2	73.2	0.0
8.5	72.6	72.6	0.0
9.8	72.1	72.1	0.0
11.0	71.8	71.8	0.0
12.2	71.2	71.2	0.0
13.4	71.1	71.1	0.0
14.6	70.7	70.9	0.2
15.9	70.6	70.7	0.1
17.1	70.6	70.6	0.0
18.3	70.5	70.6	0.1
19.5	70.5	70.6	0.1
20.7	70.5	70.5	0.0
22.0	70.4	70.5	0.1
23.2	70.4	70.4	0.0
24.4	70.4	70.4	0.0
25.6	70.3	70.3	0.0
26.8	70.3	70.2	-0.1
28.0	70.2	70.2	0.0
29.3	70.1	70.1	0.0
30.5	70.0	70.1	0.1
31.7	70.0	70.1	0.1
32.9	70.0	70.0	0.0
34.1	70.0	70.0	0.0
35.4	69.8	69.9	0.1
36.6	69.7	69.8	0.1
37.8	69.5	69.6	0.1
39.0	69.5	69.5	0.0
40.2	69.5	69.5	0.0
41.5	69.1	69.2	0.1
42.7	69.1	69.1	0.0
43.9	69.0	69.1	0.1
45.1	69.0	69.1	0.1
46.3	68.9	69.0	0.1
47.6	68.9	68.9	0.0
48.8	68.8	68.9	0.1
50.0	68.8	68.8	0.0
51.2	68.8	68.8	0.0
52.4	68.8	68.8	0.0
53.7	68.7	68.7	0.0
54.9	68.6	68.6	0.0
56.1	68.6	68.6	0.0
57.3	68.5	68.5	0.0
58.5	68.4	68.5	0.1
59.8	68.3	68.4	0.1
61.0	68.3	68.3	0.0
62.2	68.2	68.3	0.1
63.4	68.1	68.2	0.1
64.6	68.1	68.1	0.0
65.9	67.9	67.9	0.0
67.1	67.9	67.9	0.0
68.3	67.9	67.8	-0.1
69.5	67.7	67.7	0.0
70.7	67.6	67.5	-0.1
72.0	67.5	67.5	0.0
73.2	67.5	67.5	0.0
74.4	67.2	67.2	0.0
75.6	67.1	67.1	0.0
76.8	67.1	67.1	0.0
78.0	67.0	67.0	0.0
79.3	66.9	66.9	0.0
80.5	66.9	66.9	0.0
81.7	66.8	66.8	0.0
82.9	66.7	66.7	0.0
84.1	66.5	66.5	0.0
85.4	66.5	66.5	0.0
86.6	66.5	66.5	0.0
87.8	66.5	66.5	0.0
89.0	66.4	66.4	0.0
90.2	66.1	66.1	0.0
91.5	66.0	66.0	0.0
92.7	65.8	65.8	0.0
93.9	65.6	65.6	0.0
95.1	65.4	65.3	-0.1
96.3	65.3	65.3	0.0
97.6	65.3	65.3	0.0
98.8	65.1	65.1	0.0
Min	65.1	65.1	-0.1
Max	75.2	75.2	0.2
Mean	69.0	69.0	0.0
Median	68.8	68.8	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 106 E504ELD-J602F3ELD

Feather River Water Temperature below Thermalito Afterbay - Probability of Exceedance

September			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD)** **Temperature (ºF)**	**With-Project (J602F3 ELD)** **Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	67.8	67.7	-0.1
2.4	67.4	67.1	-0.3
3.7	67.1	67.1	0.0
4.9	66.0	66.1	0.1
6.1	65.2	66.0	0.8
7.3	65.1	65.3	0.2
8.5	65.1	65.2	0.1
9.8	64.9	65.1	0.2
11.0	64.9	64.9	0.0
12.2	64.9	64.9	0.0
13.4	64.8	64.9	0.1
14.6	64.8	64.8	0.0
15.9	64.8	64.7	-0.1
17.1	64.8	64.7	-0.1
18.3	64.5	64.6	0.1
19.5	64.3	64.5	0.2
20.7	64.2	64.3	0.1
22.0	64.0	64.2	0.2
23.2	64.0	64.1	0.1
24.4	63.9	64.0	0.1
25.6	63.9	63.8	-0.1
26.8	63.8	63.8	0.0
28.0	63.7	63.7	0.0
29.3	63.7	63.7	0.0
30.5	63.6	63.6	0.0
31.7	63.4	63.4	0.0
32.9	63.3	63.3	0.0
34.1	63.3	63.3	0.0
35.4	63.2	63.1	-0.1
36.6	63.0	63.0	0.0
37.8	63.0	62.9	-0.1
39.0	63.0	62.9	-0.1
40.2	62.9	62.9	0.0
41.5	62.9	62.7	-0.2
42.7	62.7	62.7	0.0
43.9	62.6	62.6	0.0
45.1	62.6	62.6	0.0
46.3	62.6	62.6	0.0
47.6	62.2	62.2	0.0
48.8	62.0	62.0	0.0
50.0	61.8	61.8	0.0
51.2	61.8	61.8	0.0
52.4	61.7	61.7	0.0
53.7	61.6	61.7	0.1
54.9	61.6	61.6	0.0
56.1	61.5	61.6	0.1
57.3	61.5	61.6	0.1
58.5	61.4	61.5	0.1
59.8	61.3	61.4	0.1
61.0	61.3	61.3	0.0
62.2	61.3	61.3	0.0
63.4	61.2	61.2	0.0
64.6	61.2	61.2	0.0
65.9	61.1	61.1	0.0
67.1	61.1	61.1	0.0
68.3	61.0	60.9	-0.1
69.5	60.9	60.9	0.0
70.7	60.9	60.8	-0.1
72.0	60.8	60.7	-0.1
73.2	60.7	60.6	-0.1
74.4	60.6	60.6	0.0
75.6	60.6	60.6	0.0
76.8	60.6	60.6	0.0
78.0	60.6	60.6	0.0
79.3	60.6	60.5	-0.1
80.5	60.5	60.5	0.0
81.7	60.5	60.3	-0.2
82.9	60.2	60.2	0.0
84.1	60.2	60.2	0.0
85.4	60.1	60.0	-0.1
86.6	60.0	60.0	0.0
87.8	59.7	59.7	0.0
89.0	59.5	59.5	0.0
90.2	59.5	59.5	0.0
91.5	59.4	59.4	0.0
92.7	59.1	59.1	0.0
93.9	59.0	59.0	0.0
95.1	58.8	58.8	0.0
96.3	58.7	58.7	0.0
97.6	58.6	58.6	0.0
98.8	56.9	56.9	0.0
Min	56.9	56.9	-0.3
Max	67.8	67.7	0.8
Mean	62.3	62.3	0.0
Median	61.8	61.8	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		98.8
X > 0.30			1.2
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**1.2**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		95.0
X > 0.30			5.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**5.0**

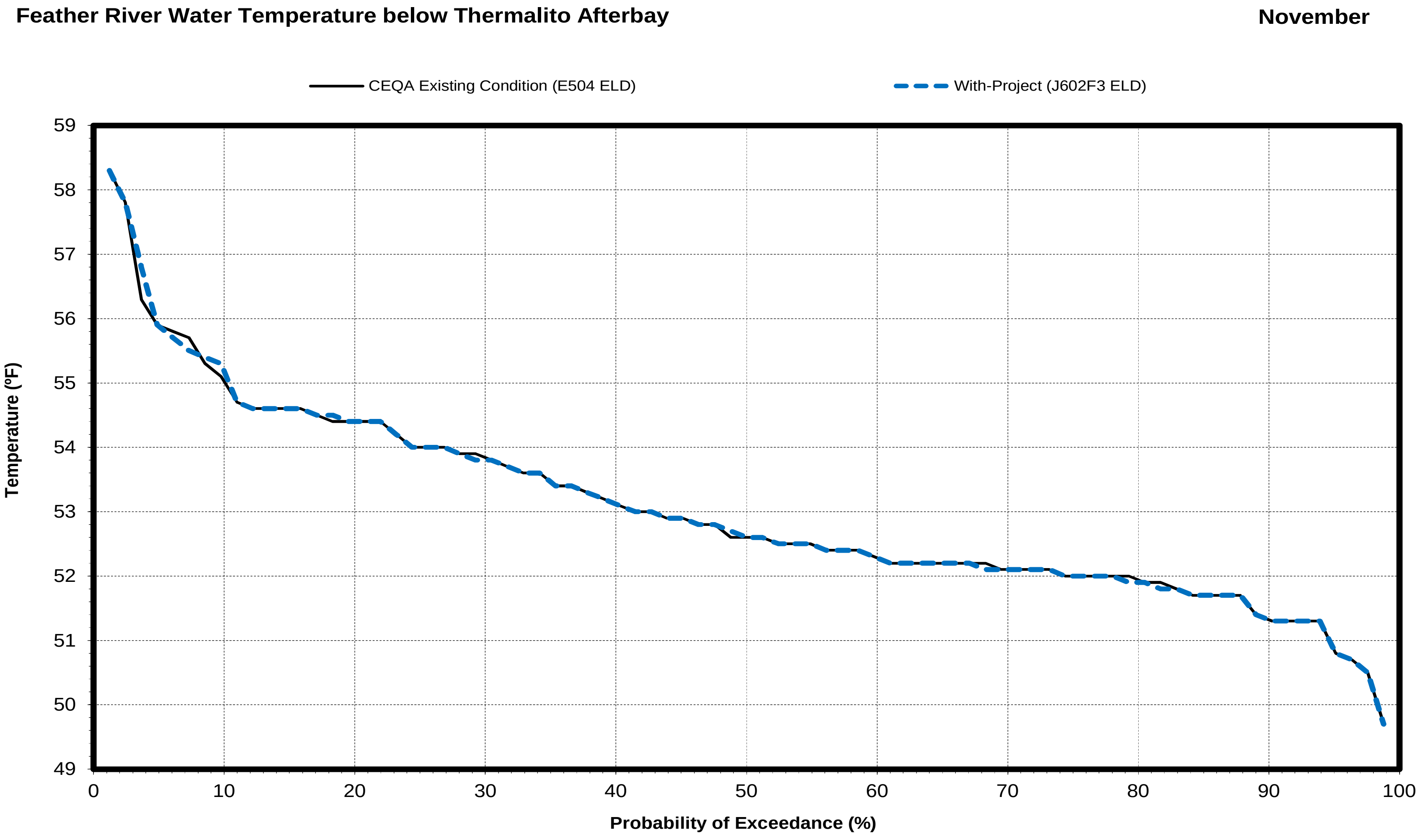
Figure 88 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

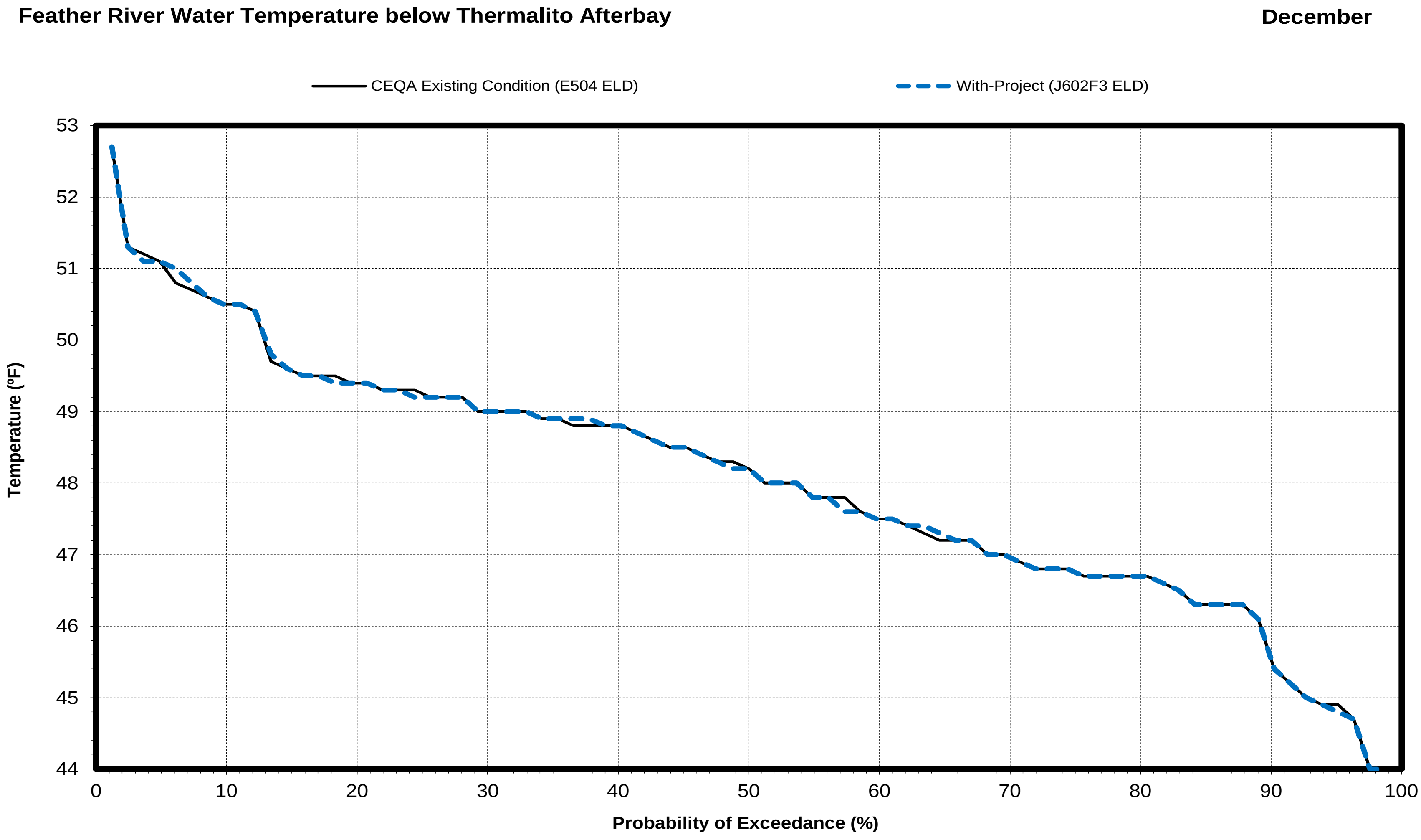
Figure 89 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

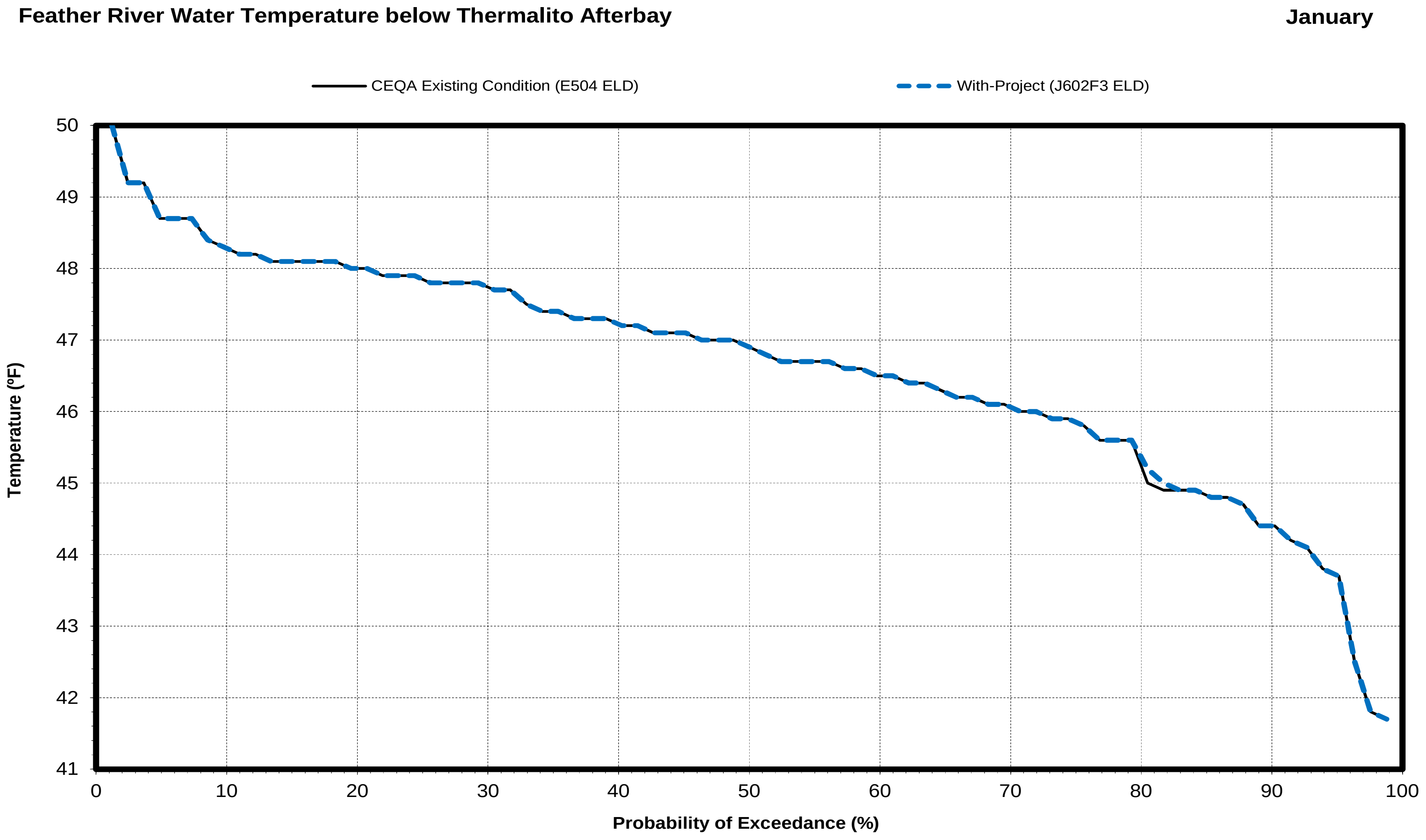
Figure 90 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

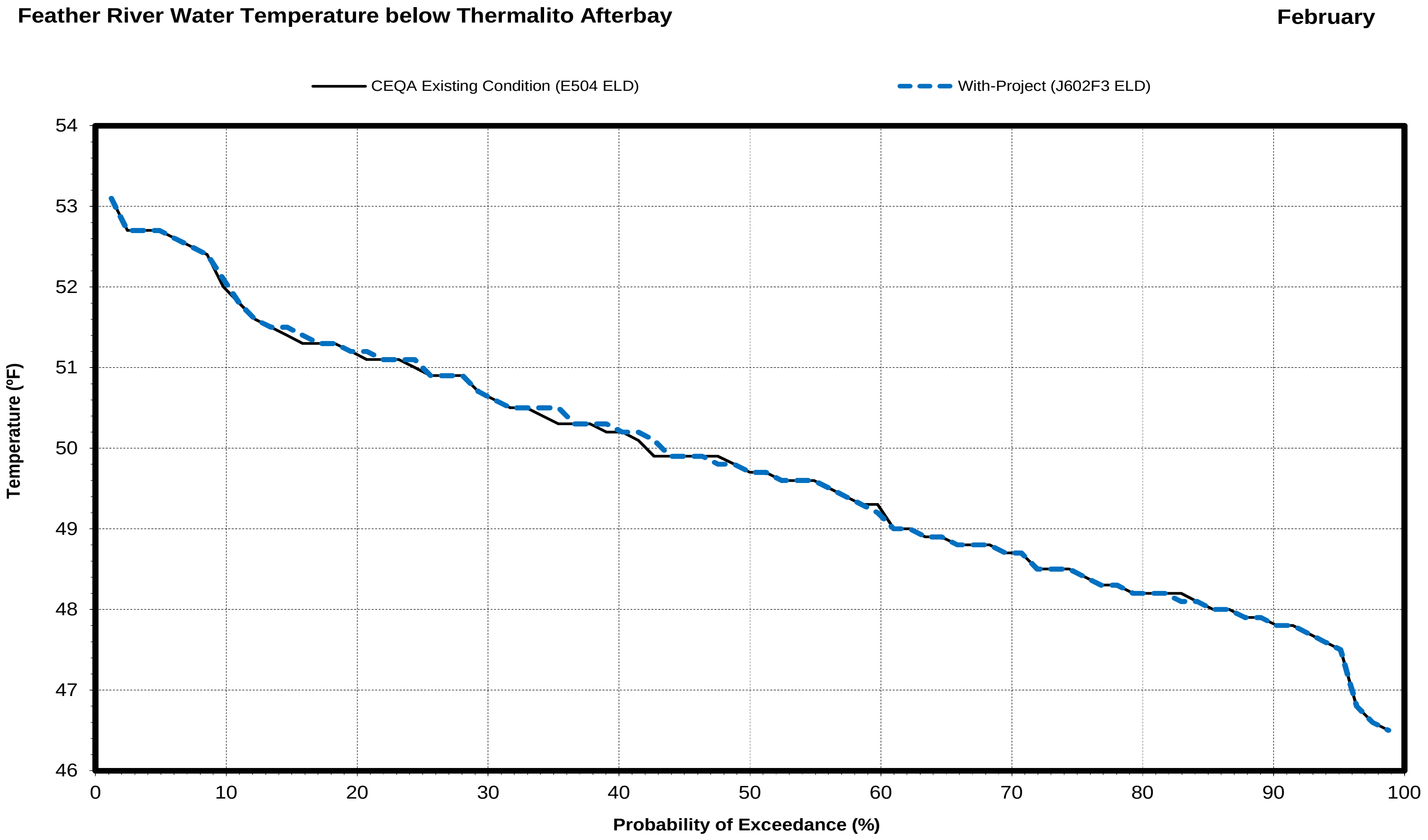
Figure 91 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

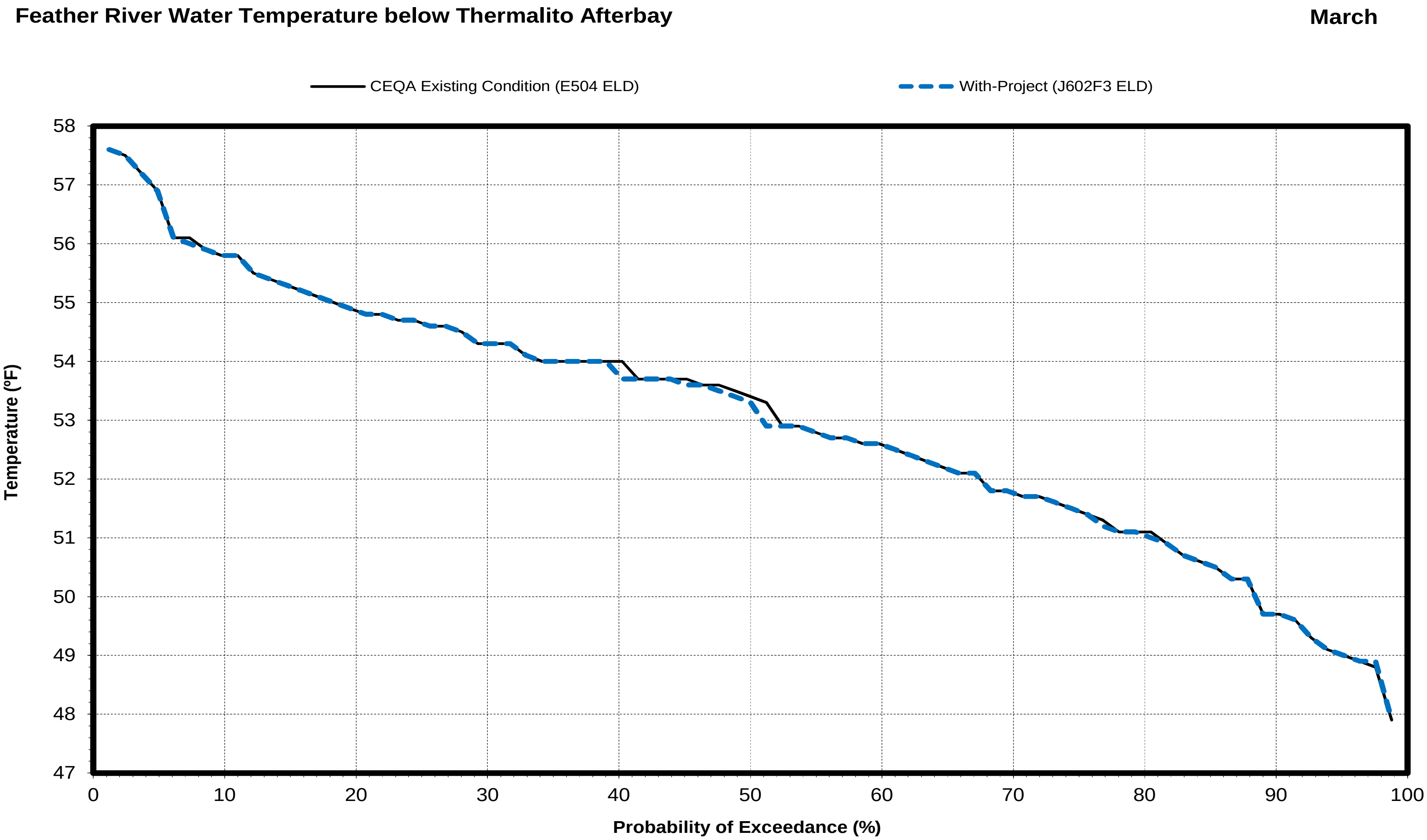
Figure 92 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

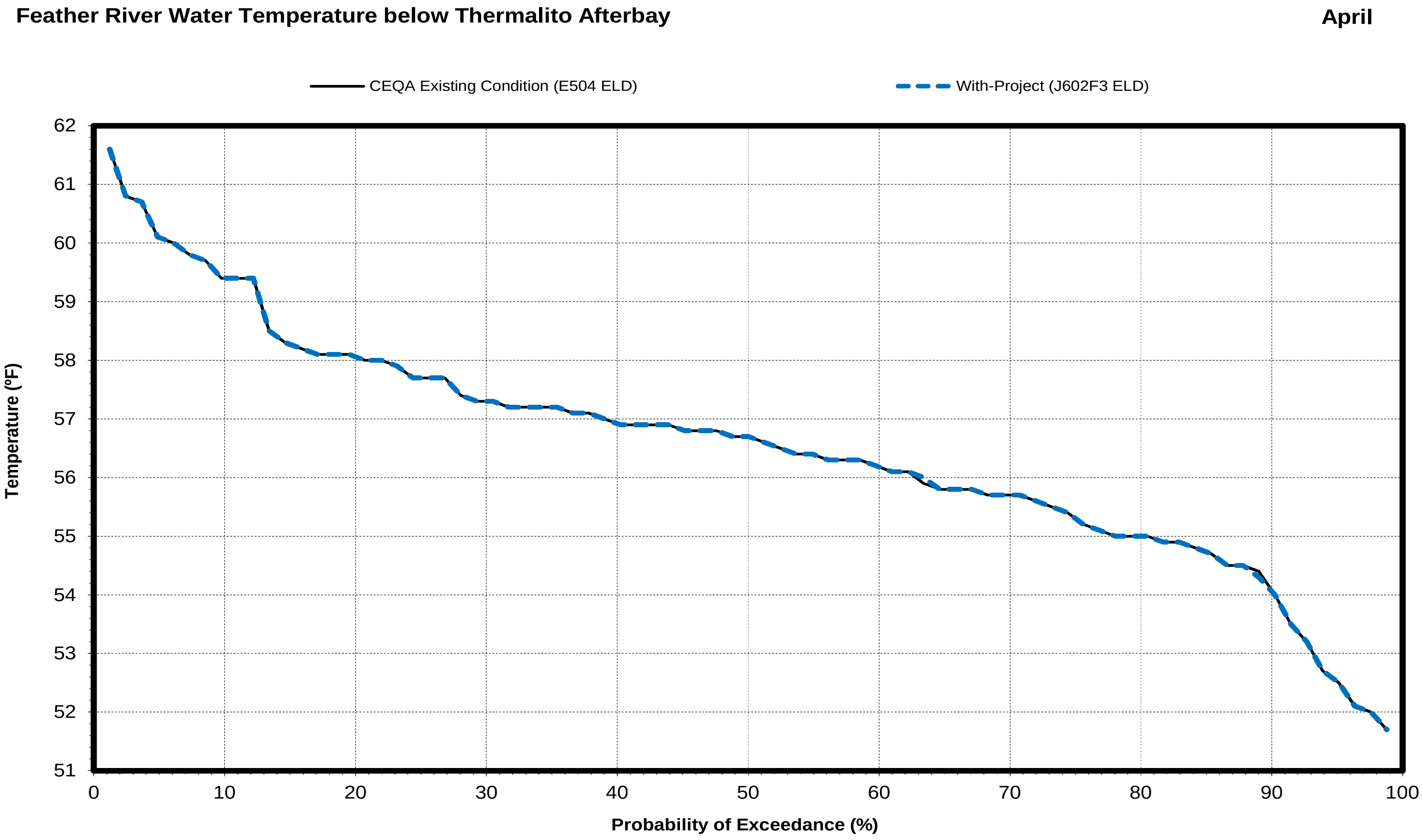
Figure 93 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

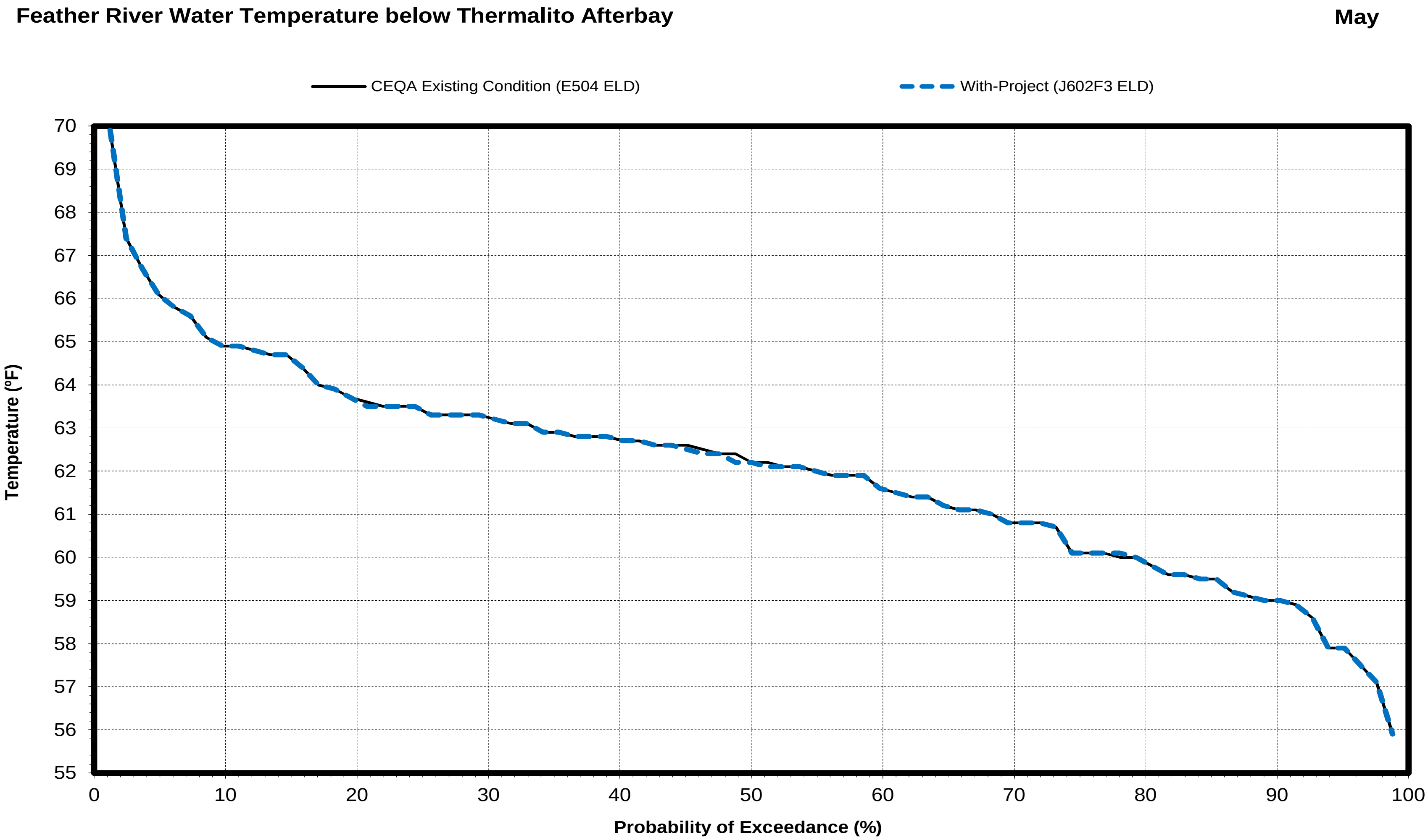
Figure 94 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

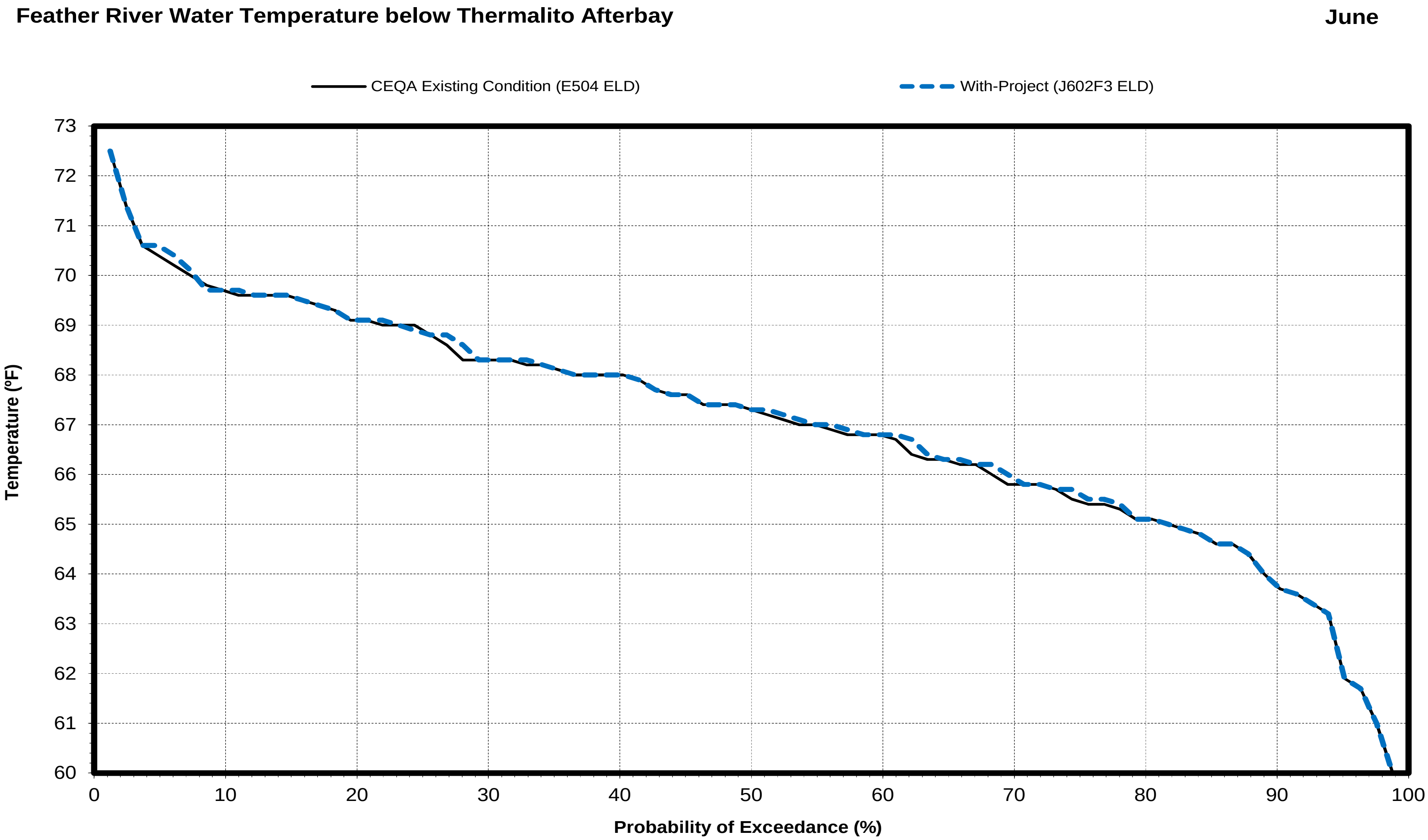
Figure 95 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 96 E504ELD-J602F3ELD

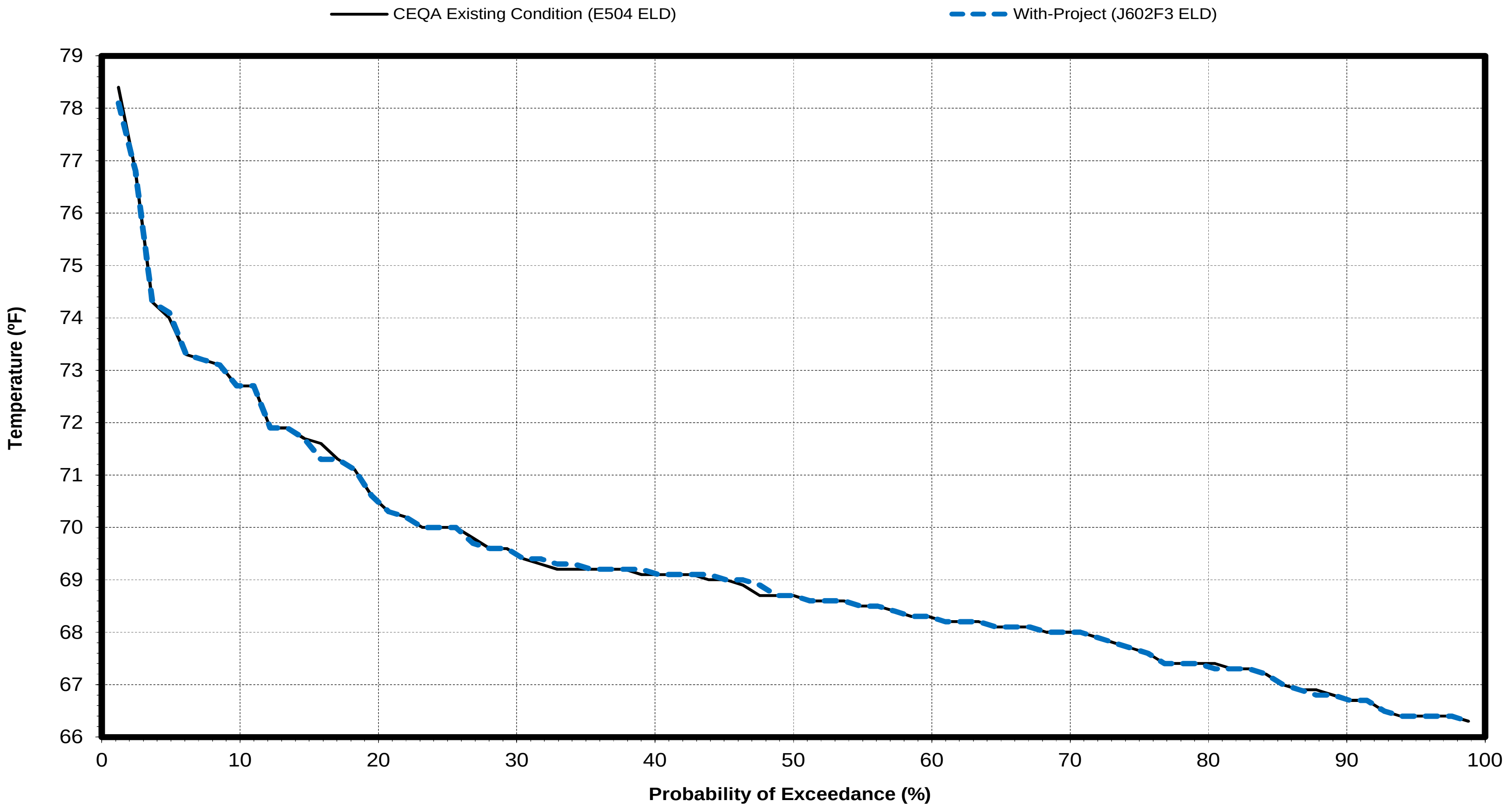


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 97 E504ELD-J602F3ELD

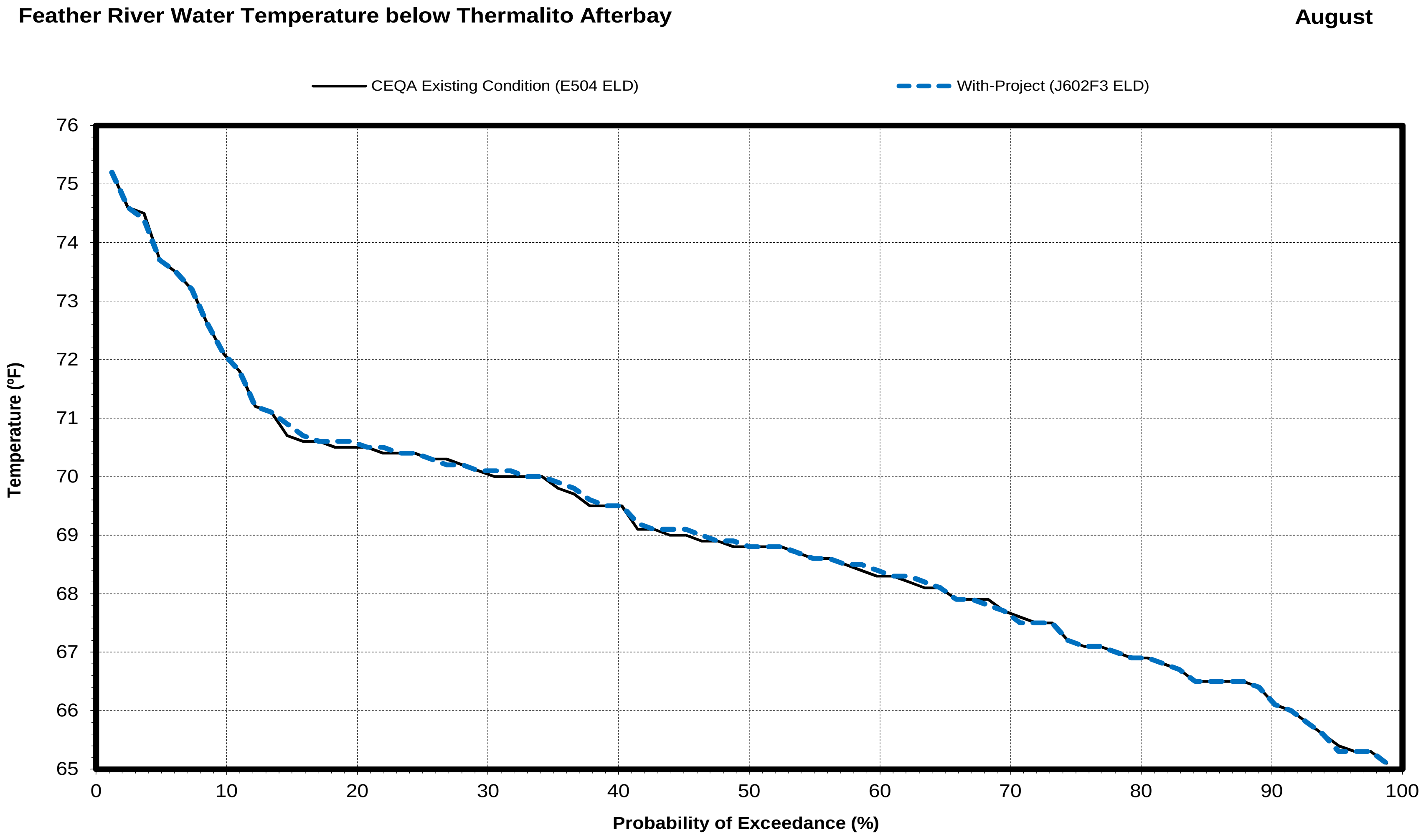
Feather River Water Temperature below Thermalito Afterbay **July**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

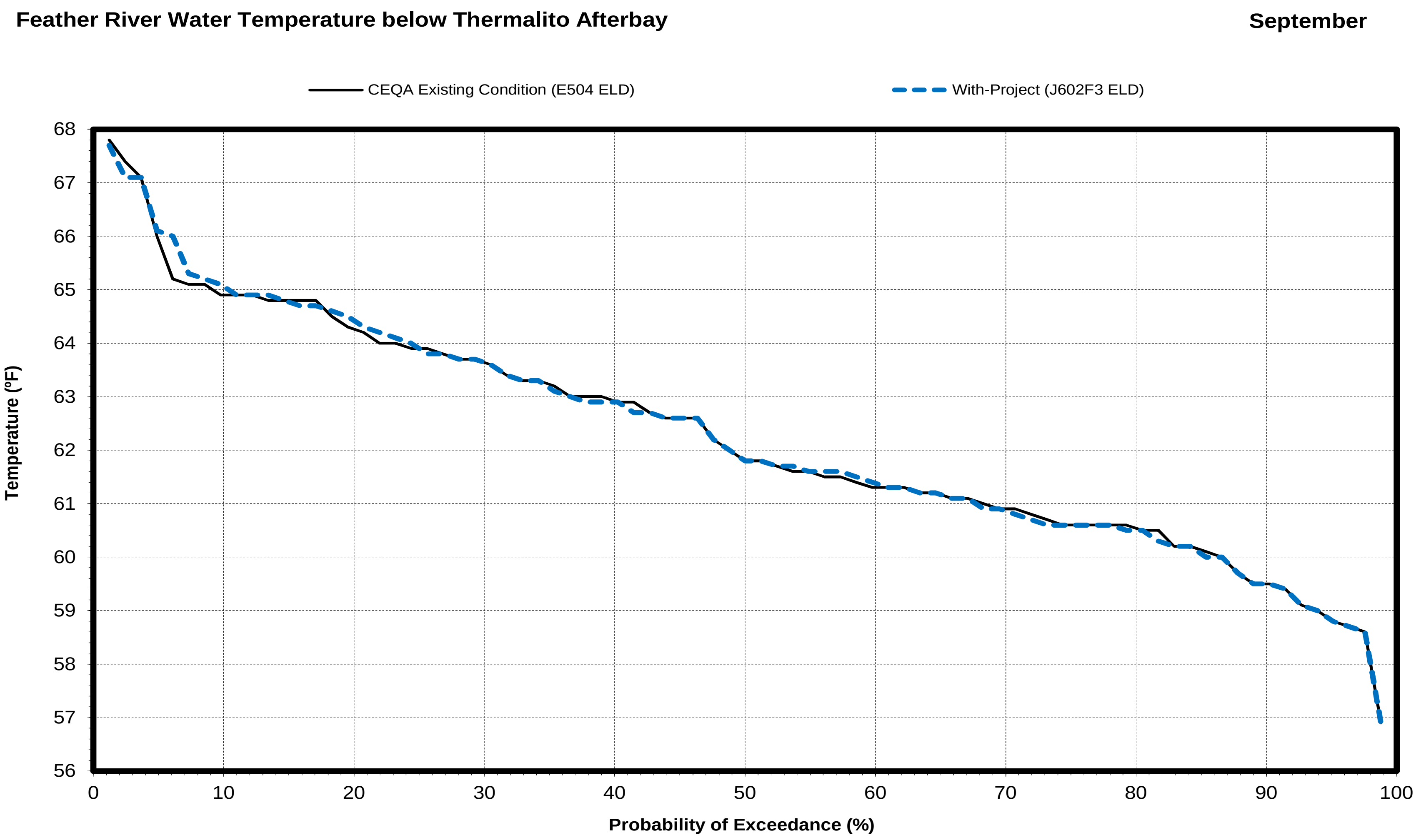
Figure 98 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 99 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 107 E504ELD-J602F3ELD

Long-term and Water Year Type Average Feather River Water Temperature at the Mouth Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Temperature (ºF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	61.0	52.5	46.5	45.7	50.2	54.6	60.7	66.4	71.5	73.6	72.9	68.2
With-Project (J602F3 ELD)	61.0	52.5	46.5	45.7	50.2	54.6	60.7	66.4	71.5	73.6	72.9	68.2
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	60.6	52.3	46.7	46.5	50.1	53.4	58.6	64.5	69.7	73.5	72.9	66.3
With-Project (J602F3 ELD)	60.6	52.3	46.7	46.5	50.1	53.4	58.6	64.5	69.7	73.5	72.9	66.3
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	61.1	53.1	47.3	46.0	50.2	54.7	60.5	66.4	71.5	72.1	70.8	66.3
With-Project (J602F3 ELD)	61.1	53.1	47.3	46.0	50.2	54.7	60.5	66.4	71.5	72.1	70.8	66.3
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below Normal												
CEQA Existing Condition (E504 ELD)	61.2	52.5	46.2	45.4	49.6	55.0	60.8	66.6	71.6	72.7	71.5	68.9
With-Project (J602F3 ELD)	61.2	52.5	46.2	45.4	49.6	55.0	60.8	66.5	71.6	72.7	71.5	68.9
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0
Dry												
CEQA Existing Condition (E504 ELD)	60.6	52.1	46.4	44.9	50.2	55.4	62.0	67.8	73.1	73.3	73.7	70.0
With-Project (J602F3 ELD)	60.6	52.1	46.4	44.9	50.2	55.4	62.0	67.8	73.1	73.3	73.7	69.9
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
Critical												
CEQA Existing Condition (E504 ELD)	62.0	53.1	45.5	45.4	51.0	55.7	63.1	68.1	72.8	76.5	75.4	70.4
With-Project (J602F3 ELD)	62.0	53.1	45.5	45.4	51.0	55.7	63.1	68.1	72.8	76.5	75.3	70.4
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	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

Table 108 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	66.2	66.2	0.0
2.4	65.6	65.6	0.0
3.7	64.7	64.7	0.0
4.9	64.5	64.5	0.0
6.1	64.4	64.4	0.0
7.3	63.5	63.5	0.0
8.5	63.5	63.5	0.0
9.8	63.4	63.4	0.0
11.0	63.3	63.3	0.0
12.2	63.2	63.2	0.0
13.4	62.8	62.8	0.0
14.6	62.8	62.7	-0.1
15.9	62.7	62.7	0.0
17.1	62.5	62.5	0.0
18.3	62.4	62.4	0.0
19.5	62.4	62.4	0.0
20.7	62.3	62.3	0.0
22.0	62.3	62.3	0.0
23.2	62.1	62.1	0.0
24.4	62.0	62.0	0.0
25.6	62.0	62.0	0.0
26.8	61.8	61.8	0.0
28.0	61.7	61.8	0.1
29.3	61.7	61.7	0.0
30.5	61.7	61.7	0.0
31.7	61.7	61.7	0.0
32.9	61.7	61.7	0.0
34.1	61.7	61.7	0.0
35.4	61.6	61.6	0.0
36.6	61.5	61.5	0.0
37.8	61.4	61.4	0.0
39.0	61.4	61.4	0.0
40.2	61.3	61.3	0.0
41.5	61.2	61.3	0.1
42.7	61.2	61.2	0.0
43.9	61.2	61.2	0.0
45.1	61.1	61.1	0.0
46.3	61.0	61.0	0.0
47.6	61.0	61.0	0.0
48.8	60.9	60.9	0.0
50.0	60.7	60.7	0.0
51.2	60.7	60.7	0.0
52.4	60.6	60.6	0.0
53.7	60.6	60.6	0.0
54.9	60.6	60.6	0.0
56.1	60.6	60.6	0.0
57.3	60.5	60.5	0.0
58.5	60.5	60.5	0.0
59.8	60.4	60.5	0.1
61.0	60.3	60.3	0.0
62.2	60.3	60.3	0.0
63.4	60.3	60.3	0.0
64.6	60.2	60.2	0.0
65.9	60.1	60.1	0.0
67.1	60.0	60.0	0.0
68.3	60.0	60.0	0.0
69.5	59.9	59.9	0.0
70.7	59.8	59.8	0.0
72.0	59.8	59.8	0.0
73.2	59.8	59.8	0.0
74.4	59.6	59.6	0.0
75.6	59.6	59.6	0.0
76.8	59.6	59.6	0.0
78.0	59.4	59.4	0.0
79.3	59.4	59.4	0.0
80.5	59.3	59.3	0.0
81.7	59.3	59.3	0.0
82.9	59.3	59.3	0.0
84.1	59.2	59.3	0.1
85.4	59.2	59.2	0.0
86.6	59.1	59.1	0.0
87.8	59.0	59.0	0.0
89.0	59.0	59.0	0.0
90.2	58.9	58.9	0.0
91.5	58.9	58.9	0.0
92.7	58.6	58.6	0.0
93.9	58.4	58.4	0.0
95.1	58.0	58.0	0.0
96.3	58.0	58.0	0.0
97.6	57.6	57.6	0.0
98.8	57.3	57.3	0.0
Min	57.3	57.3	-0.1
Max	66.2	66.2	0.1
Mean	61.0	61.0	0.0
Median	60.7	60.7	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 109 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	55.9	55.9	0.0
2.4	55.1	55.1	0.0
3.7	55.1	55.1	0.0
4.9	54.9	54.9	0.0
6.1	54.8	54.8	0.0
7.3	54.6	54.6	0.0
8.5	54.5	54.5	0.0
9.8	54.4	54.4	0.0
11.0	54.3	54.3	0.0
12.2	54.1	54.2	0.1
13.4	54.1	54.1	0.0
14.6	54.1	54.0	-0.1
15.9	54.0	54.0	0.0
17.1	54.0	54.0	0.0
18.3	53.9	53.9	0.0
19.5	53.9	53.9	0.0
20.7	53.9	53.9	0.0
22.0	53.8	53.8	0.0
23.2	53.8	53.8	0.0
24.4	53.8	53.8	0.0
25.6	53.6	53.6	0.0
26.8	53.6	53.6	0.0
28.0	53.4	53.4	0.0
29.3	53.4	53.4	0.0
30.5	53.3	53.3	0.0
31.7	53.3	53.3	0.0
32.9	53.3	53.3	0.0
34.1	53.2	53.2	0.0
35.4	53.1	53.1	0.0
36.6	53.1	53.1	0.0
37.8	52.9	52.9	0.0
39.0	52.9	52.9	0.0
40.2	52.9	52.9	0.0
41.5	52.9	52.9	0.0
42.7	52.8	52.8	0.0
43.9	52.6	52.6	0.0
45.1	52.6	52.6	0.0
46.3	52.5	52.5	0.0
47.6	52.5	52.5	0.0
48.8	52.4	52.4	0.0
50.0	52.4	52.4	0.0
51.2	52.3	52.3	0.0
52.4	52.2	52.2	0.0
53.7	52.2	52.2	0.0
54.9	52.2	52.2	0.0
56.1	52.1	52.1	0.0
57.3	52.1	52.1	0.0
58.5	52.1	52.1	0.0
59.8	52.1	52.1	0.0
61.0	52.0	52.0	0.0
62.2	52.0	51.9	-0.1
63.4	51.9	51.9	0.0
64.6	51.8	51.8	0.0
65.9	51.8	51.8	0.0
67.1	51.8	51.8	0.0
68.3	51.8	51.8	0.0
69.5	51.8	51.8	0.0
70.7	51.8	51.7	-0.1
72.0	51.7	51.7	0.0
73.2	51.6	51.6	0.0
74.4	51.6	51.6	0.0
75.6	51.5	51.5	0.0
76.8	51.5	51.5	0.0
78.0	51.5	51.5	0.0
79.3	51.4	51.4	0.0
80.5	51.4	51.4	0.0
81.7	51.3	51.3	0.0
82.9	51.0	51.0	0.0
84.1	50.9	50.9	0.0
85.4	50.9	50.9	0.0
86.6	50.8	50.8	0.0
87.8	50.8	50.8	0.0
89.0	50.7	50.7	0.0
90.2	50.5	50.5	0.0
91.5	50.5	50.5	0.0
92.7	50.4	50.4	0.0
93.9	50.3	50.3	0.0
95.1	50.3	50.3	0.0
96.3	50.2	50.2	0.0
97.6	49.6	49.6	0.0
98.8	49.4	49.4	0.0
Min	49.4	49.4	-0.1
Max	55.9	55.9	0.1
Mean	52.5	52.5	0.0
Median	52.4	52.4	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 110 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	50.5	50.5	0.0
2.4	49.4	49.4	0.0
3.7	49.2	49.2	0.0
4.9	49.1	49.1	0.0
6.1	49.0	49.0	0.0
7.3	49.0	49.0	0.0
8.5	48.8	48.8	0.0
9.8	48.6	48.6	0.0
11.0	48.6	48.6	0.0
12.2	48.5	48.5	0.0
13.4	48.5	48.5	0.0
14.6	48.3	48.3	0.0
15.9	48.3	48.3	0.0
17.1	48.2	48.1	-0.1
18.3	48.1	48.1	0.0
19.5	48.0	48.0	0.0
20.7	48.0	48.0	0.0
22.0	47.9	47.9	0.0
23.2	47.8	47.8	0.0
24.4	47.7	47.7	0.0
25.6	47.6	47.6	0.0
26.8	47.6	47.6	0.0
28.0	47.5	47.6	0.1
29.3	47.5	47.5	0.0
30.5	47.5	47.5	0.0
31.7	47.5	47.5	0.0
32.9	47.4	47.4	0.0
34.1	47.4	47.4	0.0
35.4	47.4	47.4	0.0
36.6	47.1	47.2	0.1
37.8	47.0	47.0	0.0
39.0	47.0	47.0	0.0
40.2	46.8	46.8	0.0
41.5	46.8	46.7	-0.1
42.7	46.7	46.7	0.0
43.9	46.7	46.6	-0.1
45.1	46.6	46.6	0.0
46.3	46.6	46.6	0.0
47.6	46.5	46.5	0.0
48.8	46.5	46.5	0.0
50.0	46.4	46.4	0.0
51.2	46.4	46.4	0.0
52.4	46.4	46.4	0.0
53.7	46.4	46.4	0.0
54.9	46.4	46.4	0.0
56.1	46.4	46.4	0.0
57.3	46.3	46.3	0.0
58.5	46.3	46.3	0.0
59.8	46.1	46.1	0.0
61.0	46.0	46.0	0.0
62.2	45.8	45.8	0.0
63.4	45.8	45.8	0.0
64.6	45.8	45.8	0.0
65.9	45.8	45.8	0.0
67.1	45.7	45.7	0.0
68.3	45.7	45.7	0.0
69.5	45.6	45.6	0.0
70.7	45.6	45.6	0.0
72.0	45.6	45.6	0.0
73.2	45.5	45.5	0.0
74.4	45.5	45.5	0.0
75.6	45.4	45.4	0.0
76.8	45.4	45.4	0.0
78.0	45.2	45.2	0.0
79.3	45.2	45.2	0.0
80.5	45.1	45.1	0.0
81.7	45.1	45.1	0.0
82.9	44.8	44.8	0.0
84.1	44.7	44.7	0.0
85.4	44.4	44.4	0.0
86.6	44.3	44.3	0.0
87.8	44.3	44.3	0.0
89.0	44.3	44.3	0.0
90.2	44.0	44.0	0.0
91.5	43.8	43.8	0.0
92.7	43.7	43.7	0.0
93.9	43.6	43.6	0.0
95.1	43.5	43.5	0.0
96.3	43.0	43.0	0.0
97.6	42.6	42.6	0.0
98.8	42.5	42.5	0.0
Min	42.5	42.5	-0.1
Max	50.5	50.5	0.1
Mean	46.5	46.5	0.0
Median	46.4	46.4	0.0

Entire 81-Year Simulation Period		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**
Warmest Conditions (Lower 25% of Distribution)		
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 111 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

January			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD) Temperature (ºF)**	**With-Project (J602F3 ELD) Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	49.0	49.0	0.0
2.4	49.0	49.0	0.0
3.7	48.8	48.8	0.0
4.9	48.6	48.6	0.0
6.1	48.1	48.1	0.0
7.3	48.1	48.1	0.0
8.5	48.0	48.0	0.0
9.8	47.9	47.9	0.0
11.0	47.9	47.9	0.0
12.2	47.9	47.9	0.0
13.4	47.7	47.7	0.0
14.6	47.6	47.6	0.0
15.9	47.6	47.6	0.0
17.1	47.2	47.2	0.0
18.3	47.2	47.2	0.0
19.5	47.1	47.1	0.0
20.7	47.0	47.0	0.0
22.0	47.0	47.0	0.0
23.2	47.0	47.0	0.0
24.4	46.9	46.9	0.0
25.6	46.9	46.9	0.0
26.8	46.9	46.9	0.0
28.0	46.8	46.8	0.0
29.3	46.8	46.8	0.0
30.5	46.8	46.8	0.0
31.7	46.8	46.8	0.0
32.9	46.8	46.8	0.0
34.1	46.7	46.7	0.0
35.4	46.7	46.7	0.0
36.6	46.6	46.6	0.0
37.8	46.6	46.6	0.0
39.0	46.6	46.6	0.0
40.2	46.6	46.6	0.0
41.5	46.3	46.3	0.0
42.7	46.2	46.2	0.0
43.9	46.1	46.1	0.0
45.1	46.1	46.1	0.0
46.3	45.9	45.9	0.0
47.6	45.8	45.8	0.0
48.8	45.8	45.8	0.0
50.0	45.8	45.8	0.0
51.2	45.7	45.7	0.0
52.4	45.7	45.7	0.0
53.7	45.7	45.7	0.0
54.9	45.6	45.6	0.0
56.1	45.6	45.6	0.0
57.3	45.5	45.5	0.0
58.5	45.5	45.5	0.0
59.8	45.4	45.4	0.0
61.0	45.4	45.4	0.0
62.2	45.4	45.4	0.0
63.4	45.3	45.3	0.0
64.6	45.2	45.2	0.0
65.9	45.2	45.2	0.0
67.1	45.1	45.1	0.0
68.3	45.0	45.0	0.0
69.5	44.9	44.9	0.0
70.7	44.9	44.9	0.0
72.0	44.9	44.9	0.0
73.2	44.9	44.9	0.0
74.4	44.7	44.7	0.0
75.6	44.7	44.7	0.0
76.8	44.4	44.4	0.0
78.0	44.3	44.3	0.0
79.3	44.2	44.2	0.0
80.5	44.2	44.2	0.0
81.7	44.1	44.1	0.0
82.9	44.1	44.1	0.0
84.1	44.1	44.1	0.0
85.4	43.9	43.9	0.0
86.6	43.8	43.8	0.0
87.8	43.7	43.7	0.0
89.0	43.6	43.6	0.0
90.2	43.5	43.5	0.0
91.5	43.4	43.4	0.0
92.7	43.3	43.3	0.0
93.9	42.3	42.3	0.0
95.1	42.1	42.1	0.0
96.3	41.8	41.8	0.0
97.6	41.2	41.2	0.0
98.8	41.0	41.0	0.0
Min	41.0	41.0	0.0
Max	49.0	49.0	0.0
Mean	45.7	45.7	0.0
Median	45.8	45.8	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 112 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

February			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD) Temperature (ºF)**	**With-Project (J602F3 ELD) Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	54.3	54.4	0.1
2.4	54.1	54.1	0.0
3.7	53.0	53.0	0.0
4.9	52.8	52.8	0.0
6.1	52.5	52.5	0.0
7.3	52.4	52.4	0.0
8.5	52.2	52.2	0.0
9.8	52.2	52.2	0.0
11.0	52.1	52.1	0.0
12.2	52.0	52.1	0.1
13.4	52.0	52.0	0.0
14.6	52.0	52.0	0.0
15.9	51.6	51.6	0.0
17.1	51.6	51.6	0.0
18.3	51.6	51.6	0.0
19.5	51.5	51.5	0.0
20.7	51.4	51.4	0.0
22.0	51.4	51.4	0.0
23.2	51.3	51.3	0.0
24.4	51.2	51.2	0.0
25.6	51.2	51.2	0.0
26.8	51.2	51.2	0.0
28.0	51.2	51.2	0.0
29.3	51.0	51.0	0.0
30.5	51.0	51.0	0.0
31.7	50.9	50.9	0.0
32.9	50.8	50.8	0.0
34.1	50.8	50.8	0.0
35.4	50.6	50.6	0.0
36.6	50.6	50.6	0.0
37.8	50.6	50.6	0.0
39.0	50.5	50.5	0.0
40.2	50.4	50.4	0.0
41.5	50.4	50.4	0.0
42.7	50.3	50.3	0.0
43.9	50.3	50.3	0.0
45.1	50.3	50.3	0.0
46.3	50.2	50.2	0.0
47.6	50.1	50.1	0.0
48.8	50.1	50.1	0.0
50.0	50.0	50.0	0.0
51.2	50.0	50.0	0.0
52.4	50.0	50.0	0.0
53.7	50.0	50.0	0.0
54.9	49.9	49.9	0.0
56.1	49.9	49.9	0.0
57.3	49.9	49.9	0.0
58.5	49.8	49.8	0.0
59.8	49.8	49.8	0.0
61.0	49.7	49.7	0.0
62.2	49.6	49.6	0.0
63.4	49.6	49.6	0.0
64.6	49.5	49.5	0.0
65.9	49.4	49.4	0.0
67.1	49.4	49.4	0.0
68.3	49.3	49.3	0.0
69.5	49.3	49.3	0.0
70.7	49.3	49.3	0.0
72.0	49.2	49.2	0.0
73.2	49.2	49.2	0.0
74.4	49.1	49.1	0.0
75.6	49.1	49.1	0.0
76.8	49.0	49.0	0.0
78.0	49.0	49.0	0.0
79.3	48.9	48.9	0.0
80.5	48.9	48.9	0.0
81.7	48.9	48.9	0.0
82.9	48.8	48.8	0.0
84.1	48.8	48.8	0.0
85.4	48.8	48.8	0.0
86.6	48.7	48.7	0.0
87.8	48.5	48.5	0.0
89.0	48.4	48.4	0.0
90.2	48.4	48.4	0.0
91.5	48.1	48.1	0.0
92.7	48.0	48.0	0.0
93.9	48.0	48.0	0.0
95.1	48.0	48.0	0.0
96.3	47.5	47.5	0.0
97.6	47.4	47.4	0.0
98.8	47.3	47.3	0.0
Min	47.3	47.3	0.0
Max	54.3	54.4	0.1
Mean	50.2	50.2	0.0
Median	50.0	50.0	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 113 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	59.2	59.2	0.0
2.4	58.6	58.6	0.0
3.7	57.9	57.9	0.0
4.9	57.9	57.9	0.0
6.1	57.6	57.6	0.0
7.3	57.4	57.4	0.0
8.5	57.3	57.3	0.0
9.8	57.2	57.2	0.0
11.0	57.1	57.1	0.0
12.2	56.7	56.7	0.0
13.4	56.6	56.6	0.0
14.6	56.6	56.6	0.0
15.9	56.5	56.5	0.0
17.1	56.5	56.5	0.0
18.3	56.4	56.4	0.0
19.5	56.4	56.3	-0.1
20.7	56.3	56.3	0.0
22.0	56.2	56.2	0.0
23.2	56.2	56.2	0.0
24.4	56.2	56.2	0.0
25.6	56.1	56.1	0.0
26.8	56.0	56.0	0.0
28.0	55.7	55.7	0.0
29.3	55.6	55.6	0.0
30.5	55.5	55.5	0.0
31.7	55.4	55.4	0.0
32.9	55.3	55.3	0.0
34.1	55.2	55.2	0.0
35.4	55.2	55.2	0.0
36.6	55.1	55.1	0.0
37.8	55.1	55.1	0.0
39.0	55.1	55.1	0.0
40.2	54.9	54.9	0.0
41.5	54.9	54.9	0.0
42.7	54.9	54.9	0.0
43.9	54.8	54.8	0.0
45.1	54.8	54.8	0.0
46.3	54.7	54.7	0.0
47.6	54.7	54.7	0.0
48.8	54.7	54.7	0.0
50.0	54.6	54.6	0.0
51.2	54.5	54.5	0.0
52.4	54.5	54.5	0.0
53.7	54.4	54.4	0.0
54.9	54.2	54.2	0.0
56.1	54.2	54.2	0.0
57.3	54.2	54.2	0.0
58.5	54.2	54.2	0.0
59.8	54.2	54.2	0.0
61.0	54.2	54.2	0.0
62.2	54.0	54.0	0.0
63.4	53.9	53.9	0.0
64.6	53.7	53.7	0.0
65.9	53.7	53.7	0.0
67.1	53.7	53.7	0.0
68.3	53.6	53.6	0.0
69.5	53.6	53.6	0.0
70.7	53.5	53.5	0.0
72.0	53.4	53.4	0.0
73.2	53.4	53.4	0.0
74.4	53.3	53.3	0.0
75.6	53.2	53.2	0.0
76.8	53.0	53.0	0.0
78.0	53.0	53.0	0.0
79.3	53.0	53.0	0.0
80.5	53.0	53.0	0.0
81.7	52.9	52.9	0.0
82.9	52.9	52.9	0.0
84.1	52.6	52.6	0.0
85.4	52.3	52.3	0.0
86.6	52.3	52.3	0.0
87.8	52.2	52.2	0.0
89.0	52.2	52.2	0.0
90.2	52.1	52.1	0.0
91.5	52.0	52.0	0.0
92.7	51.9	51.9	0.0
93.9	51.8	51.8	0.0
95.1	51.5	51.5	0.0
96.3	51.5	51.5	0.0
97.6	51.4	51.4	0.0
98.8	51.3	51.4	0.1
Min	51.3	51.4	-0.1
Max	59.2	59.2	0.1
Mean	54.6	54.6	0.0
Median	54.6	54.6	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 114 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	65.8	65.8	0.0
2.4	65.8	65.8	0.0
3.7	65.8	65.8	0.0
4.9	65.8	65.8	0.0
6.1	65.5	65.5	0.0
7.3	64.7	64.7	0.0
8.5	64.6	64.6	0.0
9.8	64.6	64.6	0.0
11.0	64.4	64.4	0.0
12.2	64.3	64.3	0.0
13.4	64.1	64.1	0.0
14.6	64.0	64.0	0.0
15.9	63.8	63.8	0.0
17.1	63.3	63.3	0.0
18.3	63.2	63.2	0.0
19.5	63.1	63.1	0.0
20.7	62.6	62.6	0.0
22.0	62.6	62.6	0.0
23.2	62.5	62.5	0.0
24.4	62.4	62.4	0.0
25.6	62.4	62.4	0.0
26.8	62.2	62.2	0.0
28.0	62.1	62.1	0.0
29.3	62.1	62.1	0.0
30.5	61.9	61.9	0.0
31.7	61.9	61.9	0.0
32.9	61.4	61.4	0.0
34.1	61.4	61.4	0.0
35.4	61.3	61.3	0.0
36.6	61.3	61.3	0.0
37.8	61.3	61.3	0.0
39.0	61.2	61.2	0.0
40.2	61.1	61.1	0.0
41.5	61.0	61.0	0.0
42.7	60.9	60.9	0.0
43.9	60.9	60.9	0.0
45.1	60.9	60.9	0.0
46.3	60.8	60.8	0.0
47.6	60.8	60.8	0.0
48.8	60.8	60.8	0.0
50.0	60.8	60.8	0.0
51.2	60.7	60.7	0.0
52.4	60.6	60.6	0.0
53.7	60.6	60.6	0.0
54.9	60.5	60.5	0.0
56.1	60.5	60.5	0.0
57.3	60.4	60.4	0.0
58.5	60.3	60.3	0.0
59.8	60.2	60.2	0.0
61.0	60.2	60.2	0.0
62.2	60.0	60.0	0.0
63.4	59.9	59.9	0.0
64.6	59.8	59.8	0.0
65.9	59.5	59.5	0.0
67.1	59.5	59.5	0.0
68.3	59.5	59.5	0.0
69.5	59.3	59.3	0.0
70.7	59.2	59.2	0.0
72.0	59.1	59.1	0.0
73.2	58.9	58.9	0.0
74.4	58.4	58.4	0.0
75.6	58.3	58.3	0.0
76.8	58.1	58.1	0.0
78.0	58.1	58.1	0.0
79.3	58.0	58.0	0.0
80.5	57.9	57.9	0.0
81.7	57.8	57.8	0.0
82.9	57.8	57.8	0.0
84.1	57.7	57.7	0.0
85.4	57.7	57.7	0.0
86.6	57.5	57.5	0.0
87.8	57.4	57.4	0.0
89.0	57.3	57.3	0.0
90.2	57.1	57.1	0.0
91.5	57.1	57.1	0.0
92.7	57.1	57.1	0.0
93.9	56.8	56.8	0.0
95.1	56.5	56.5	0.0
96.3	56.3	56.3	0.0
97.6	55.9	55.9	0.0
98.8	55.6	55.6	0.0
Min	55.6	55.6	0.0
Max	65.8	65.8	0.0
Mean	60.7	60.7	0.0
Median	60.8	60.8	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 115 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

May			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD) Temperature (ºF)**	**With-Project (J602F3 ELD) Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	74.8	74.8	0.0
2.4	73.6	73.6	0.0
3.7	71.7	71.7	0.0
4.9	71.3	71.3	0.0
6.1	71.2	71.2	0.0
7.3	70.1	70.1	0.0
8.5	69.9	69.9	0.0
9.8	69.5	69.5	0.0
11.0	69.5	69.5	0.0
12.2	69.2	69.2	0.0
13.4	69.1	69.1	0.0
14.6	69.1	69.1	0.0
15.9	69.1	69.1	0.0
17.1	68.9	68.9	0.0
18.3	68.8	68.8	0.0
19.5	68.5	68.5	0.0
20.7	68.2	68.2	0.0
22.0	68.2	68.2	0.0
23.2	68.2	68.2	0.0
24.4	68.1	68.1	0.0
25.6	67.8	67.8	0.0
26.8	67.7	67.7	0.0
28.0	67.6	67.6	0.0
29.3	67.5	67.5	0.0
30.5	67.5	67.5	0.0
31.7	67.5	67.5	0.0
32.9	67.5	67.5	0.0
34.1	67.4	67.4	0.0
35.4	67.3	67.3	0.0
36.6	67.2	67.2	0.0
37.8	67.1	67.1	0.0
39.0	67.1	67.1	0.0
40.2	67.0	67.0	0.0
41.5	67.0	67.0	0.0
42.7	67.0	67.0	0.0
43.9	66.9	66.9	0.0
45.1	66.9	66.9	0.0
46.3	66.8	66.8	0.0
47.6	66.6	66.6	0.0
48.8	66.5	66.5	0.0
50.0	66.4	66.4	0.0
51.2	66.4	66.4	0.0
52.4	66.4	66.4	0.0
53.7	66.4	66.4	0.0
54.9	66.4	66.4	0.0
56.1	66.3	66.3	0.0
57.3	66.2	66.1	-0.1
58.5	66.1	66.1	0.0
59.8	66.1	66.0	-0.1
61.0	66.0	65.9	-0.1
62.2	65.9	65.7	-0.2
63.4	65.7	65.6	-0.1
64.6	65.6	65.4	-0.2
65.9	65.3	65.3	0.0
67.1	64.9	64.9	0.0
68.3	64.9	64.9	0.0
69.5	64.8	64.8	0.0
70.7	64.8	64.8	0.0
72.0	64.7	64.7	0.0
73.2	64.6	64.6	0.0
74.4	64.6	64.6	0.0
75.6	64.1	64.1	0.0
76.8	64.0	64.0	0.0
78.0	64.0	64.0	0.0
79.3	63.8	63.8	0.0
80.5	63.8	63.8	0.0
81.7	63.7	63.7	0.0
82.9	63.7	63.7	0.0
84.1	63.5	63.5	0.0
85.4	63.2	63.2	0.0
86.6	63.1	63.1	0.0
87.8	63.0	63.0	0.0
89.0	63.0	63.0	0.0
90.2	62.9	62.9	0.0
91.5	62.4	62.4	0.0
92.7	62.2	62.2	0.0
93.9	62.1	62.1	0.0
95.1	61.8	61.8	0.0
96.3	61.6	61.6	0.0
97.6	61.3	61.3	0.0
98.8	60.9	60.9	0.0
Min	60.9	60.9	-0.2
Max	74.8	74.8	0.0
Mean	66.4	66.4	0.0
Median	66.4	66.4	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 116 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	76.0	76.0	0.0
2.4	75.9	75.9	0.0
3.7	75.5	75.6	0.1
4.9	75.5	75.5	0.0
6.1	75.2	75.2	0.0
7.3	75.2	75.2	0.0
8.5	74.9	74.9	0.0
9.8	74.7	74.7	0.0
11.0	74.1	74.1	0.0
12.2	74.0	74.0	0.0
13.4	74.0	74.0	0.0
14.6	73.8	73.8	0.0
15.9	73.8	73.8	0.0
17.1	73.7	73.7	0.0
18.3	73.6	73.6	0.0
19.5	73.5	73.5	0.0
20.7	73.5	73.5	0.0
22.0	73.5	73.5	0.0
23.2	73.4	73.4	0.0
24.4	73.3	73.3	0.0
25.6	73.3	73.3	0.0
26.8	73.0	73.0	0.0
28.0	72.9	72.9	0.0
29.3	72.9	72.9	0.0
30.5	72.9	72.9	0.0
31.7	72.8	72.8	0.0
32.9	72.8	72.8	0.0
34.1	72.6	72.7	0.1
35.4	72.4	72.4	0.0
36.6	72.4	72.4	0.0
37.8	72.2	72.2	0.0
39.0	72.2	72.2	0.0
40.2	72.1	72.2	0.1
41.5	72.1	72.1	0.0
42.7	72.1	72.1	0.0
43.9	72.0	72.0	0.0
45.1	71.9	71.9	0.0
46.3	71.8	71.8	0.0
47.6	71.7	71.7	0.0
48.8	71.7	71.7	0.0
50.0	71.6	71.6	0.0
51.2	71.6	71.6	0.0
52.4	71.6	71.6	0.0
53.7	71.5	71.5	0.0
54.9	71.5	71.5	0.0
56.1	71.5	71.5	0.0
57.3	71.5	71.5	0.0
58.5	71.4	71.4	0.0
59.8	71.2	71.2	0.0
61.0	71.2	71.2	0.0
62.2	71.0	71.0	0.0
63.4	70.8	70.8	0.0
64.6	70.7	70.7	0.0
65.9	70.6	70.6	0.0
67.1	70.4	70.4	0.0
68.3	70.1	70.1	0.0
69.5	70.1	70.1	0.0
70.7	70.0	70.0	0.0
72.0	70.0	70.0	0.0
73.2	70.0	70.0	0.0
74.4	70.0	70.0	0.0
75.6	69.6	69.6	0.0
76.8	69.6	69.6	0.0
78.0	69.6	69.6	0.0
79.3	69.5	69.5	0.0
80.5	69.4	69.4	0.0
81.7	69.4	69.4	0.0
82.9	69.2	69.2	0.0
84.1	69.0	69.0	0.0
85.4	69.0	69.0	0.0
86.6	69.0	69.0	0.0
87.8	69.0	69.0	0.0
89.0	68.5	68.5	0.0
90.2	68.4	68.4	0.0
91.5	67.8	67.8	0.0
92.7	67.4	67.4	0.0
93.9	67.4	67.4	0.0
95.1	67.4	67.4	0.0
96.3	67.0	67.0	0.0
97.6	65.8	65.8	0.0
98.8	65.7	65.7	0.0
Min	65.7	65.7	0.0
Max	76.0	76.0	0.1
Mean	71.5	71.5	0.0
Median	71.6	71.6	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 117 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	81.3	81.2	-0.1
2.4	80.2	80.2	0.0
3.7	78.8	78.8	0.0
4.9	76.5	76.5	0.0
6.1	76.3	76.3	0.0
7.3	76.3	76.3	0.0
8.5	76.1	76.1	0.0
9.8	75.9	75.9	0.0
11.0	75.9	75.9	0.0
12.2	75.8	75.8	0.0
13.4	75.5	75.5	0.0
14.6	75.3	75.3	0.0
15.9	75.3	75.3	0.0
17.1	75.3	75.1	-0.2
18.3	75.1	75.1	0.0
19.5	75.1	75.1	0.0
20.7	75.0	75.0	0.0
22.0	75.0	75.0	0.0
23.2	74.8	74.8	0.0
24.4	74.8	74.8	0.0
25.6	74.6	74.6	0.0
26.8	74.5	74.5	0.0
28.0	74.3	74.3	0.0
29.3	74.2	74.2	0.0
30.5	74.1	74.2	0.1
31.7	74.1	74.1	0.0
32.9	74.0	74.0	0.0
34.1	74.0	74.0	0.0
35.4	74.0	74.0	0.0
36.6	73.9	73.8	-0.1
37.8	73.9	73.8	-0.1
39.0	73.8	73.8	0.0
40.2	73.7	73.7	0.0
41.5	73.6	73.6	0.0
42.7	73.5	73.5	0.0
43.9	73.5	73.5	0.0
45.1	73.5	73.5	0.0
46.3	73.5	73.5	0.0
47.6	73.4	73.5	0.1
48.8	73.4	73.4	0.0
50.0	73.4	73.4	0.0
51.2	73.4	73.3	-0.1
52.4	73.3	73.3	0.0
53.7	73.2	73.2	0.0
54.9	73.2	73.2	0.0
56.1	73.2	73.2	0.0
57.3	73.1	73.1	0.0
58.5	73.0	73.0	0.0
59.8	72.8	73.0	0.2
61.0	72.8	72.8	0.0
62.2	72.7	72.8	0.1
63.4	72.7	72.8	0.1
64.6	72.7	72.7	0.0
65.9	72.6	72.7	0.1
67.1	72.6	72.6	0.0
68.3	72.6	72.6	0.0
69.5	72.5	72.6	0.1
70.7	72.5	72.5	0.0
72.0	72.5	72.5	0.0
73.2	72.4	72.4	0.0
74.4	72.2	72.2	0.0
75.6	72.1	72.1	0.0
76.8	72.1	72.1	0.0
78.0	72.1	72.1	0.0
79.3	72.0	72.0	0.0
80.5	72.0	72.0	0.0
81.7	71.9	71.9	0.0
82.9	71.8	71.8	0.0
84.1	71.8	71.8	0.0
85.4	71.8	71.8	0.0
86.6	71.7	71.7	0.0
87.8	71.7	71.7	0.0
89.0	71.4	71.4	0.0
90.2	71.1	71.1	0.0
91.5	71.0	71.0	0.0
92.7	71.0	71.0	0.0
93.9	70.9	70.9	0.0
95.1	70.7	70.7	0.0
96.3	70.7	70.7	0.0
97.6	70.5	70.5	0.0
98.8	70.4	70.4	0.0
Min	70.4	70.4	-0.2
Max	81.3	81.2	0.2
Mean	73.6	73.6	0.0
Median	73.4	73.4	0.0

Entire 81-Year Simulation Period

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Warmest Conditions (Lower 25% of Distribution)

(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)	100.0
X > 0.30		0.0
X < -0.30		0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F	**0.0**

Table 118 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

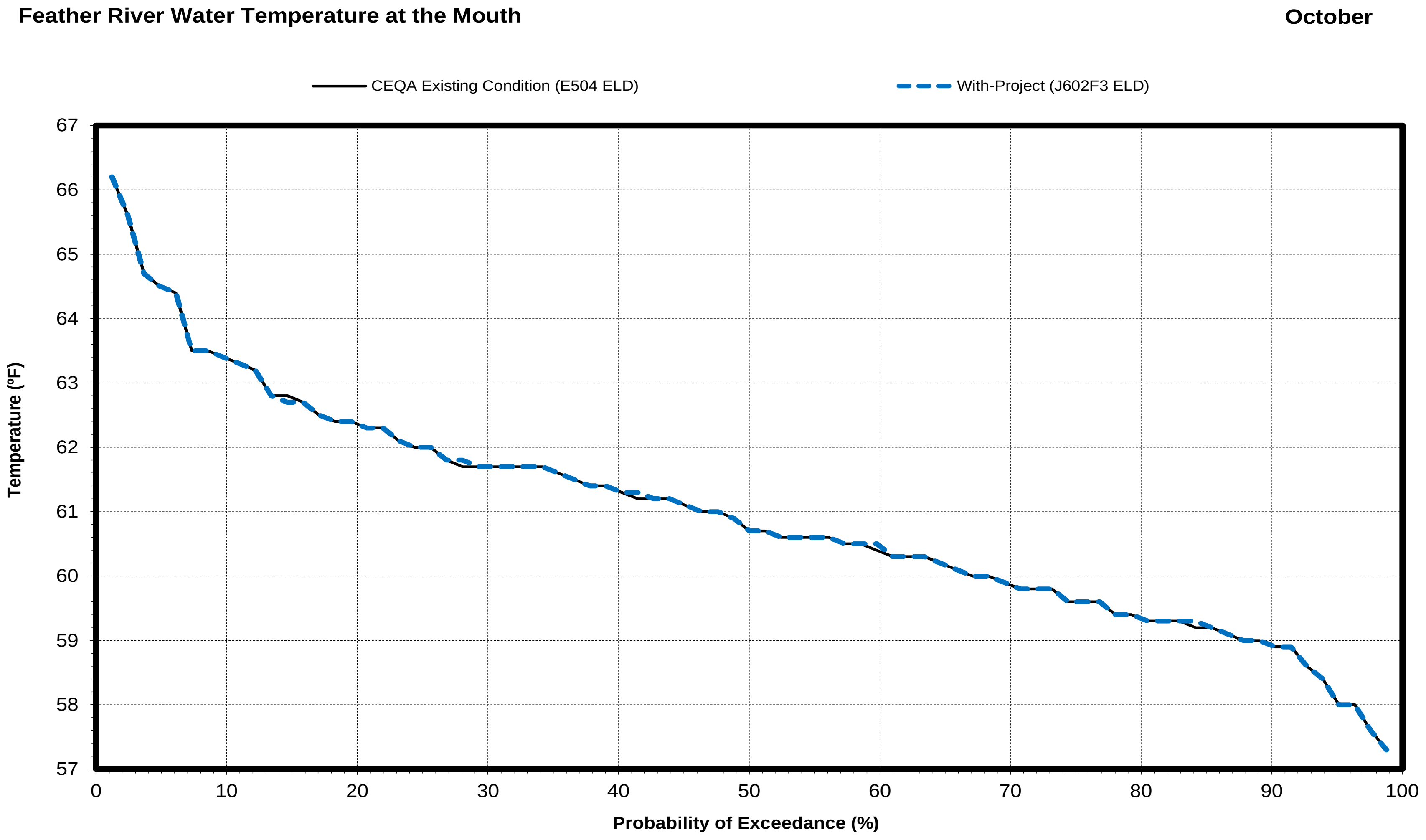
August			
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Temperature (ºF)	With-Project (J602F3 ELD) Temperature (ºF)	Absolute Difference (ºF)
1.2	77.9	77.9	0.0
2.4	77.0	77.0	0.0
3.7	77.0	77.0	0.0
4.9	77.0	77.0	0.0
6.1	76.7	76.7	0.0
7.3	76.4	76.4	0.0
8.5	76.2	76.2	0.0
9.8	76.1	76.1	0.0
11.0	76.0	76.0	0.0
12.2	75.9	75.9	0.0
13.4	75.9	75.9	0.0
14.6	75.8	75.8	0.0
15.9	75.7	75.7	0.0
17.1	75.7	75.6	-0.1
18.3	75.4	75.4	0.0
19.5	75.2	75.2	0.0
20.7	75.2	75.2	0.0
22.0	74.6	74.6	0.0
23.2	74.3	74.2	-0.1
24.4	74.2	74.2	0.0
25.6	74.1	74.1	0.0
26.8	74.1	74.1	0.0
28.0	73.9	74.1	0.2
29.3	73.9	73.9	0.0
30.5	73.9	73.9	0.0
31.7	73.9	73.9	0.0
32.9	73.8	73.9	0.1
34.1	73.7	73.8	0.1
35.4	73.7	73.7	0.0
36.6	73.7	73.6	-0.1
37.8	73.6	73.6	0.0
39.0	73.6	73.6	0.0
40.2	73.5	73.4	-0.1
41.5	73.4	73.4	0.0
42.7	73.4	73.2	-0.2
43.9	73.2	73.2	0.0
45.1	73.1	73.1	0.0
46.3	73.0	73.1	0.1
47.6	72.9	73.0	0.1
48.8	72.8	72.9	0.1
50.0	72.8	72.8	0.0
51.2	72.7	72.8	0.1
52.4	72.7	72.7	0.0
53.7	72.6	72.6	0.0
54.9	72.6	72.6	0.0
56.1	72.6	72.6	0.0
57.3	72.5	72.5	0.0
58.5	72.5	72.5	0.0
59.8	72.4	72.4	0.0
61.0	72.2	72.2	0.0
62.2	72.1	72.2	0.1
63.4	72.1	72.1	0.0
64.6	72.0	72.1	0.1
65.9	71.9	72.0	0.1
67.1	71.8	71.8	0.0
68.3	71.7	71.7	0.0
69.5	71.6	71.5	-0.1
70.7	71.4	71.4	0.0
72.0	71.3	71.3	0.0
73.2	71.2	71.2	0.0
74.4	71.1	71.1	0.0
75.6	71.0	71.0	0.0
76.8	70.9	70.9	0.0
78.0	70.8	70.8	0.0
79.3	70.7	70.7	0.0
80.5	70.7	70.7	0.0
81.7	70.6	70.6	0.0
82.9	70.5	70.5	0.0
84.1	70.5	70.5	0.0
85.4	70.4	70.4	0.0
86.6	70.4	70.4	0.0
87.8	70.3	70.3	0.0
89.0	70.2	70.2	0.0
90.2	70.2	70.2	0.0
91.5	69.9	69.9	0.0
92.7	69.8	69.8	0.0
93.9	69.7	69.7	0.0
95.1	69.5	69.5	0.0
96.3	69.2	69.2	0.0
97.6	69.2	69.2	0.0
98.8	68.8	68.8	0.0
Min	68.8	68.8	-0.2
Max	77.9	77.9	0.2
Mean	72.9	72.9	0.0
Median	72.8	72.8	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

Table 119 E504ELD-J602F3ELD

Feather River Water Temperature at the Mouth - Probability of Exceedance

September			
Percent Exceedance Probability (%)	**CEQA Existing Condition (E504 ELD) Temperature (ºF)**	**With-Project (J602F3 ELD) Temperature (ºF)**	**Absolute Difference (ºF)**
1.2	73.9	73.9	0.0
2.4	73.2	73.2	0.0
3.7	73.1	73.2	0.1
4.9	72.6	72.6	0.0
6.1	72.5	72.5	0.0
7.3	72.1	72.1	0.0
8.5	72.1	72.1	0.0
9.8	72.0	72.0	0.0
11.0	71.9	71.9	0.0
12.2	71.9	71.9	0.0
13.4	71.7	71.7	0.0
14.6	71.7	71.7	0.0
15.9	71.6	71.6	0.0
17.1	71.5	71.3	-0.2
18.3	71.3	71.3	0.0
19.5	71.0	71.0	0.0
20.7	70.7	70.7	0.0
22.0	70.6	70.6	0.0
23.2	70.5	70.5	0.0
24.4	70.4	70.4	0.0
25.6	70.2	70.2	0.0
26.8	69.9	69.9	0.0
28.0	69.7	69.7	0.0
29.3	69.4	69.6	0.2
30.5	69.1	69.4	0.3
31.7	68.9	69.0	0.1
32.9	68.8	68.9	0.1
34.1	68.6	68.8	0.2
35.4	68.6	68.6	0.0
36.6	68.5	68.6	0.1
37.8	68.4	68.4	0.0
39.0	68.4	68.4	0.0
40.2	68.4	68.4	0.0
41.5	68.3	68.3	0.0
42.7	68.3	68.3	0.0
43.9	68.3	68.3	0.0
45.1	68.3	68.2	-0.1
46.3	68.2	68.2	0.0
47.6	68.2	68.2	0.0
48.8	68.1	68.1	0.0
50.0	67.9	67.9	0.0
51.2	67.8	67.8	0.0
52.4	67.8	67.8	0.0
53.7	67.7	67.7	0.0
54.9	67.6	67.6	0.0
56.1	67.2	67.2	0.0
57.3	67.2	67.2	0.0
58.5	67.2	67.2	0.0
59.8	67.2	67.2	0.0
61.0	67.1	67.1	0.0
62.2	67.0	67.0	0.0
63.4	66.8	66.8	0.0
64.6	66.8	66.8	0.0
65.9	66.8	66.8	0.0
67.1	66.7	66.6	-0.1
68.3	66.6	66.6	0.0
69.5	66.6	66.6	0.0
70.7	66.6	66.5	-0.1
72.0	66.4	66.4	0.0
73.2	66.4	66.4	0.0
74.4	66.4	66.3	-0.1
75.6	66.3	66.2	-0.1
76.8	66.2	66.2	0.0
78.0	66.2	66.1	-0.1
79.3	66.1	66.1	0.0
80.5	66.1	66.1	0.0
81.7	66.1	66.0	-0.1
82.9	66.0	65.9	-0.1
84.1	65.9	65.5	-0.4
85.4	65.5	65.5	0.0
86.6	65.5	65.4	-0.1
87.8	65.4	65.4	0.0
89.0	65.4	65.4	0.0
90.2	65.4	65.4	0.0
91.5	65.2	65.2	0.0
92.7	64.9	65.0	0.1
93.9	64.5	64.9	0.4
95.1	63.8	63.8	0.0
96.3	63.4	63.4	0.0
97.6	62.9	62.9	0.0
98.8	61.8	61.8	0.0
Min	61.8	61.8	-0.4
Max	73.9	73.9	0.4
Mean	68.2	68.2	0.0
Median	67.9	67.9	0.0
Entire 81-Year Simulation Period			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 81 Years)		97.5
X > 0.30			1.2
X < -0.30			1.2
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**
Warmest Conditions (Lower 25% of Distribution)			
(-0.30<=X<=0.30)	Percent of Time (Percentage of the 20 Years)		100.0
X > 0.30			0.0
X < -0.30			0.0
Net Changes of > 0.3 °F	Percent of Time -- Increases of > 0.3 °F minus decreases of > 0.3 °F		**0.0**

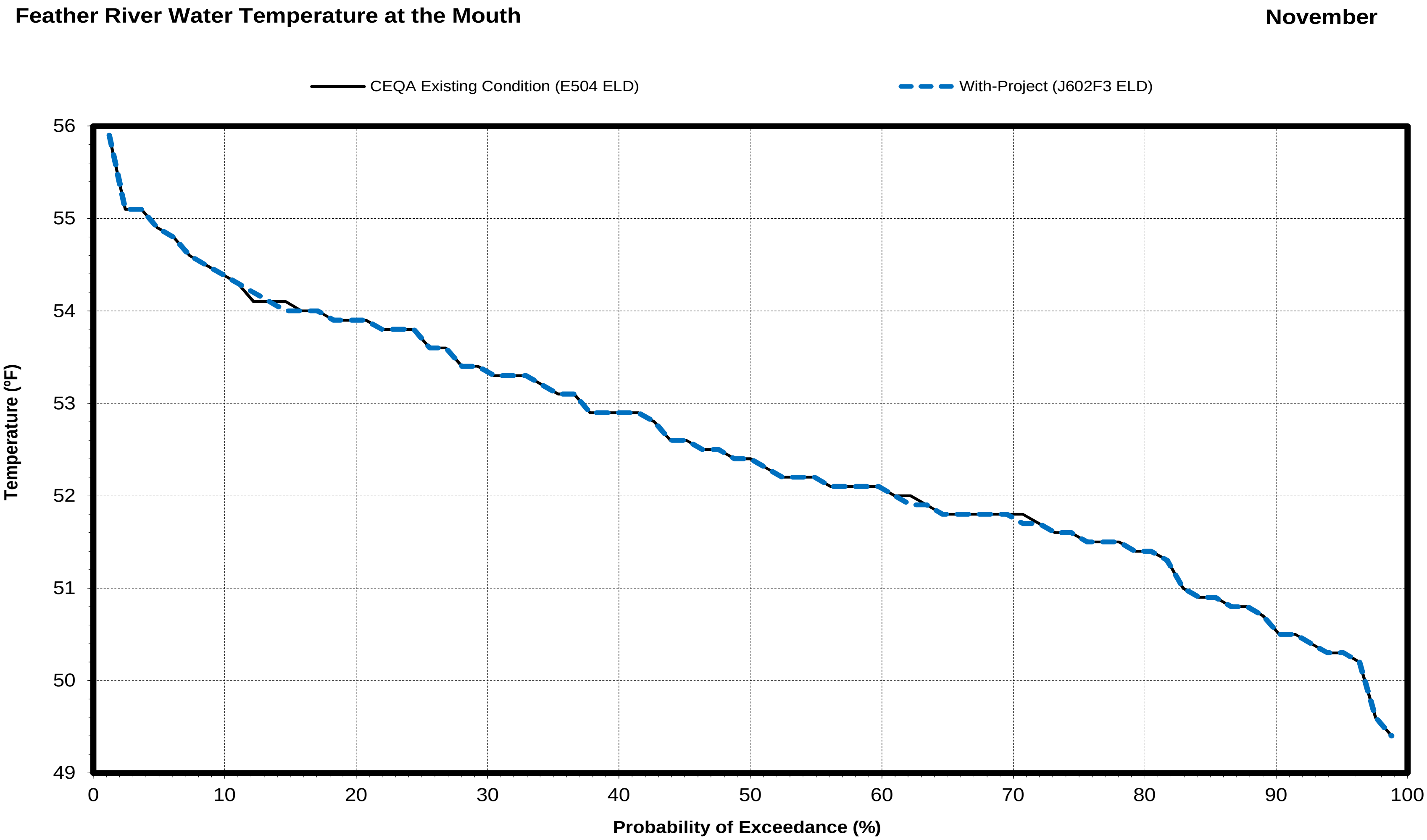
Figure 100 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

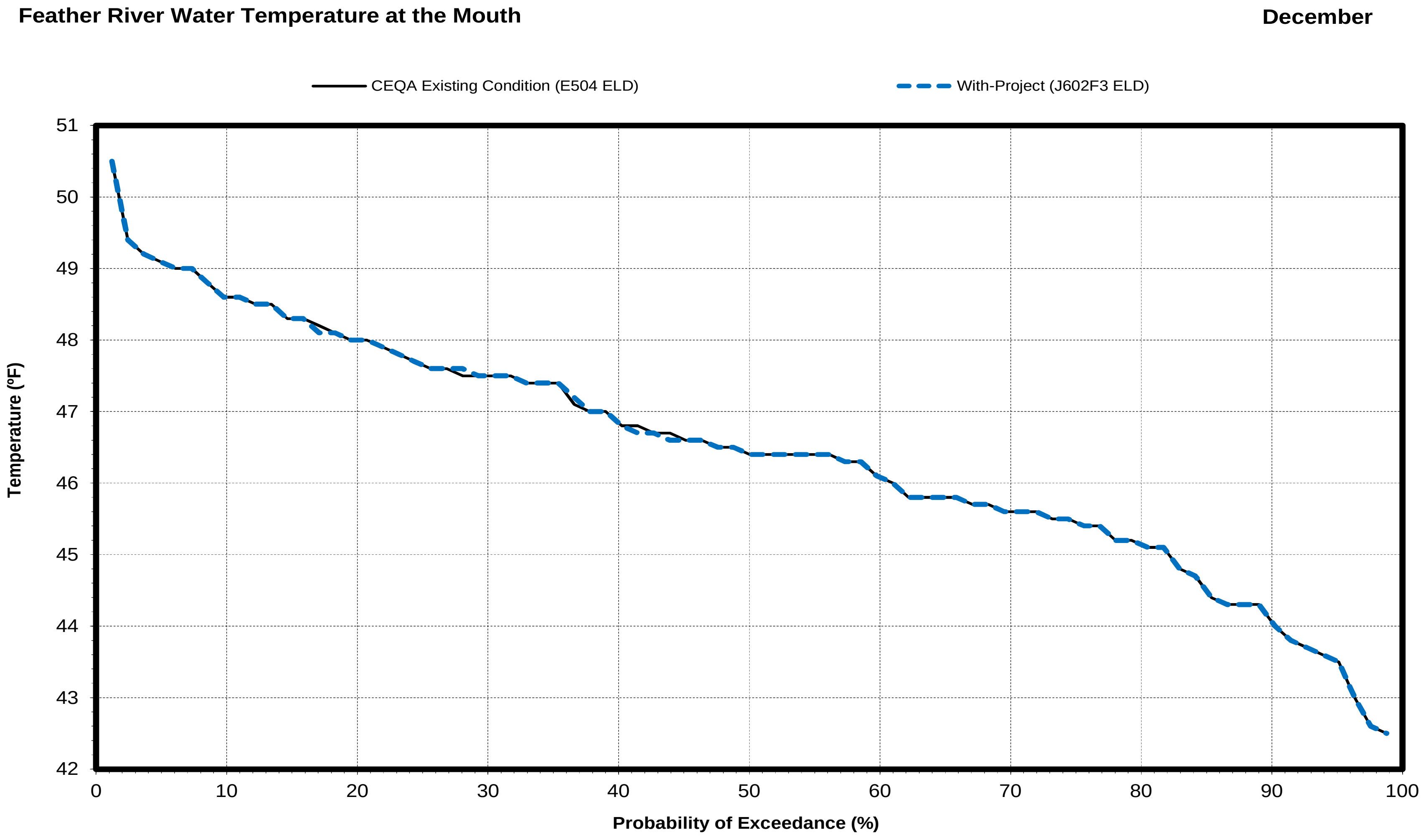
Figure 101 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

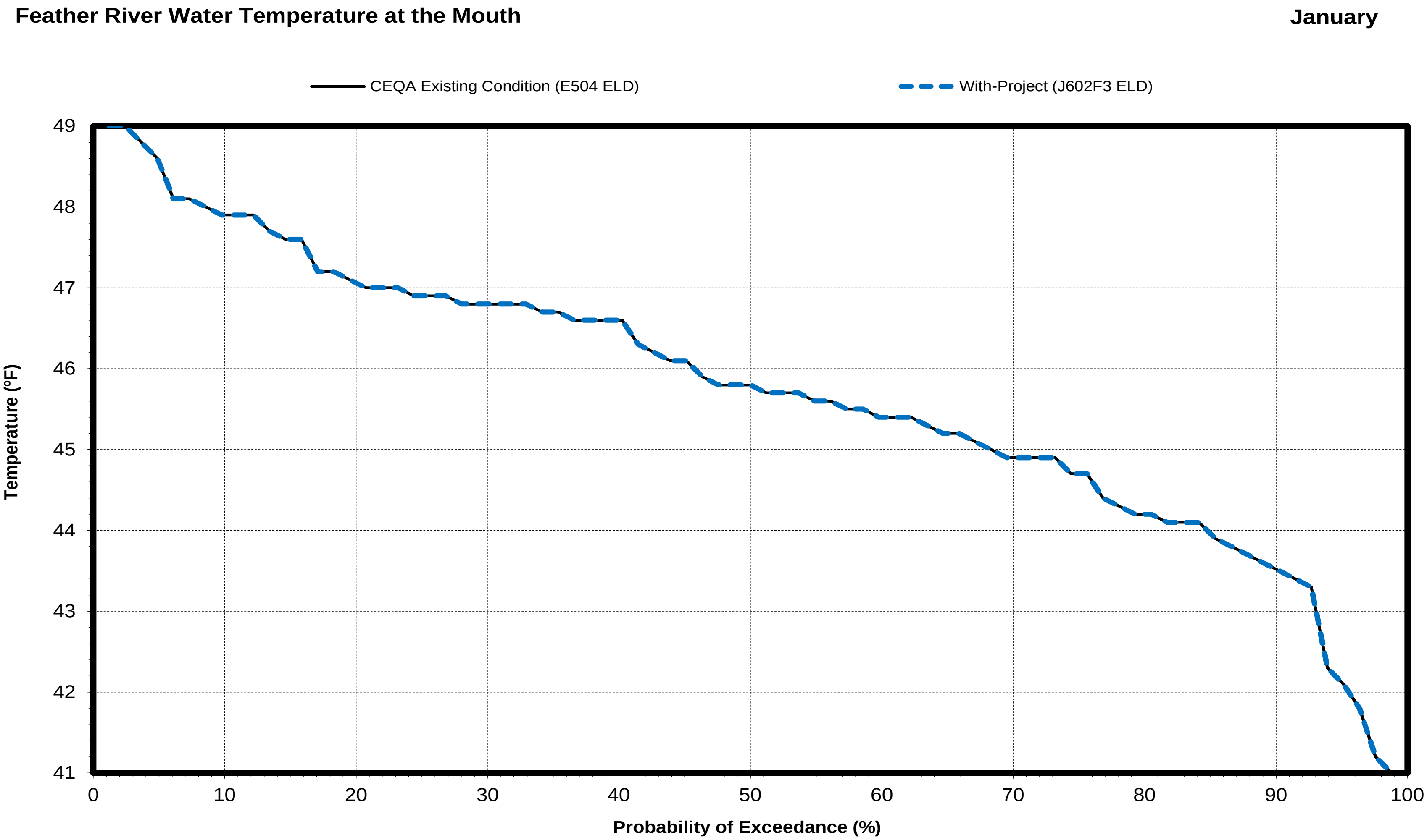
Figure 102 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

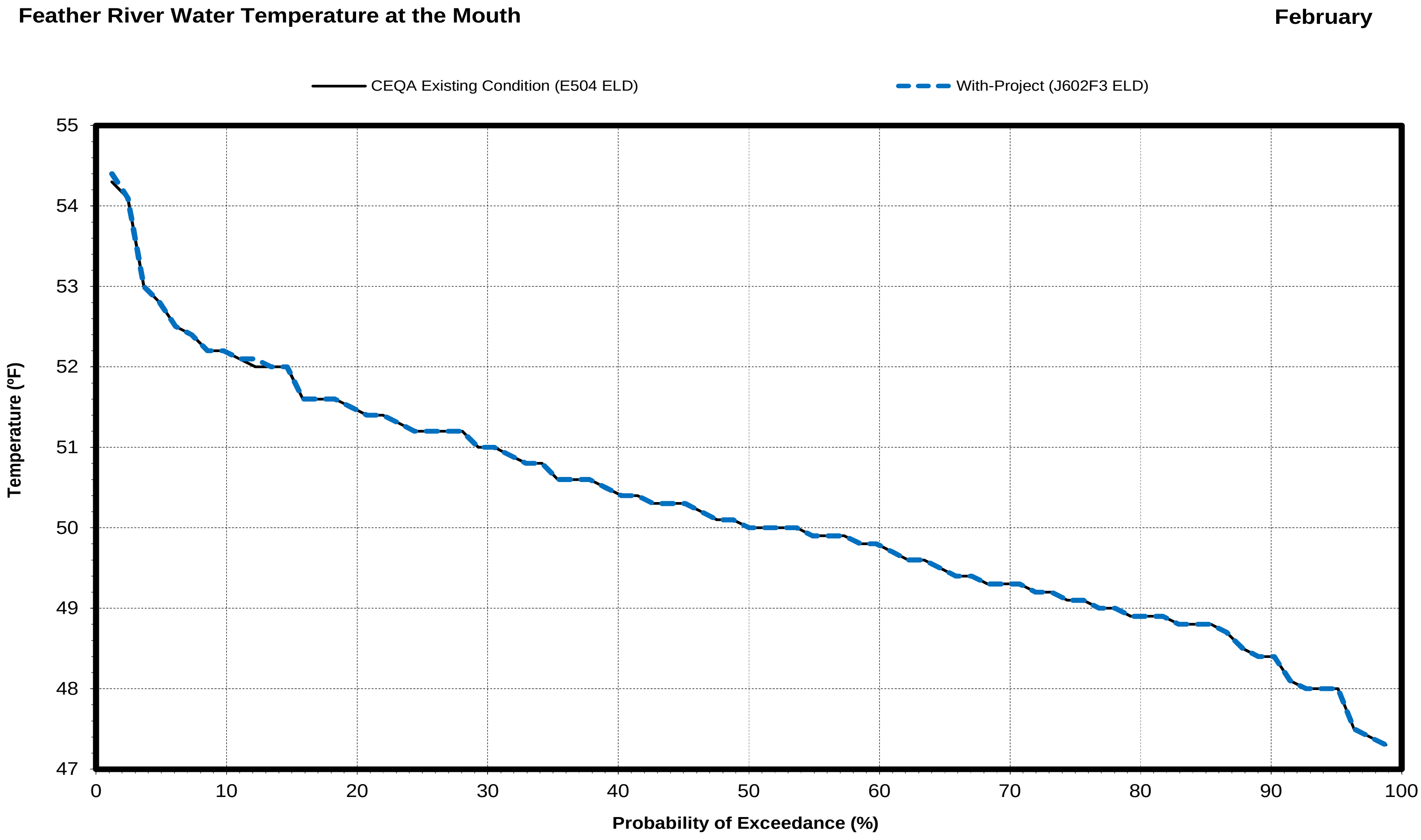
Figure 103 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

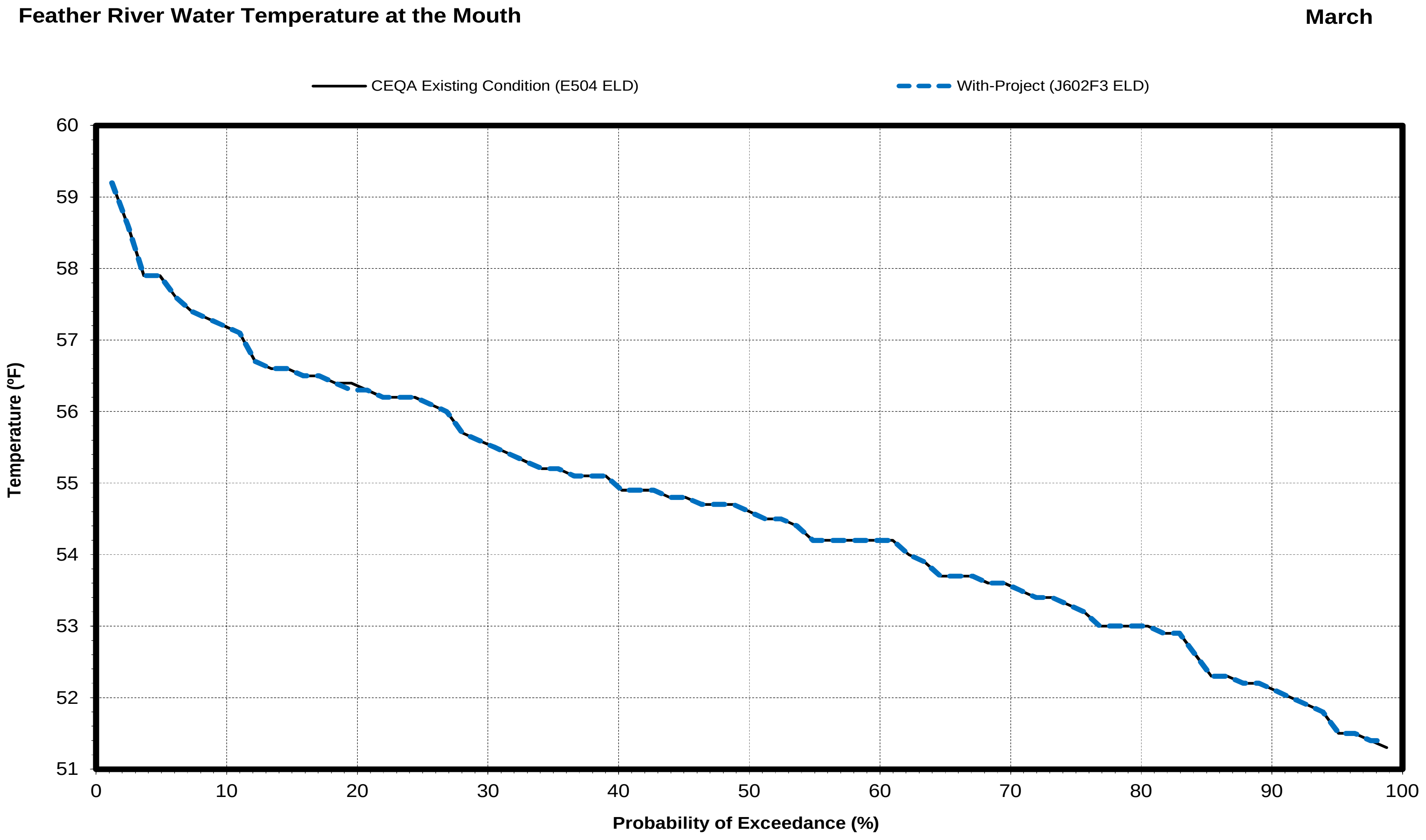
Figure 104 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

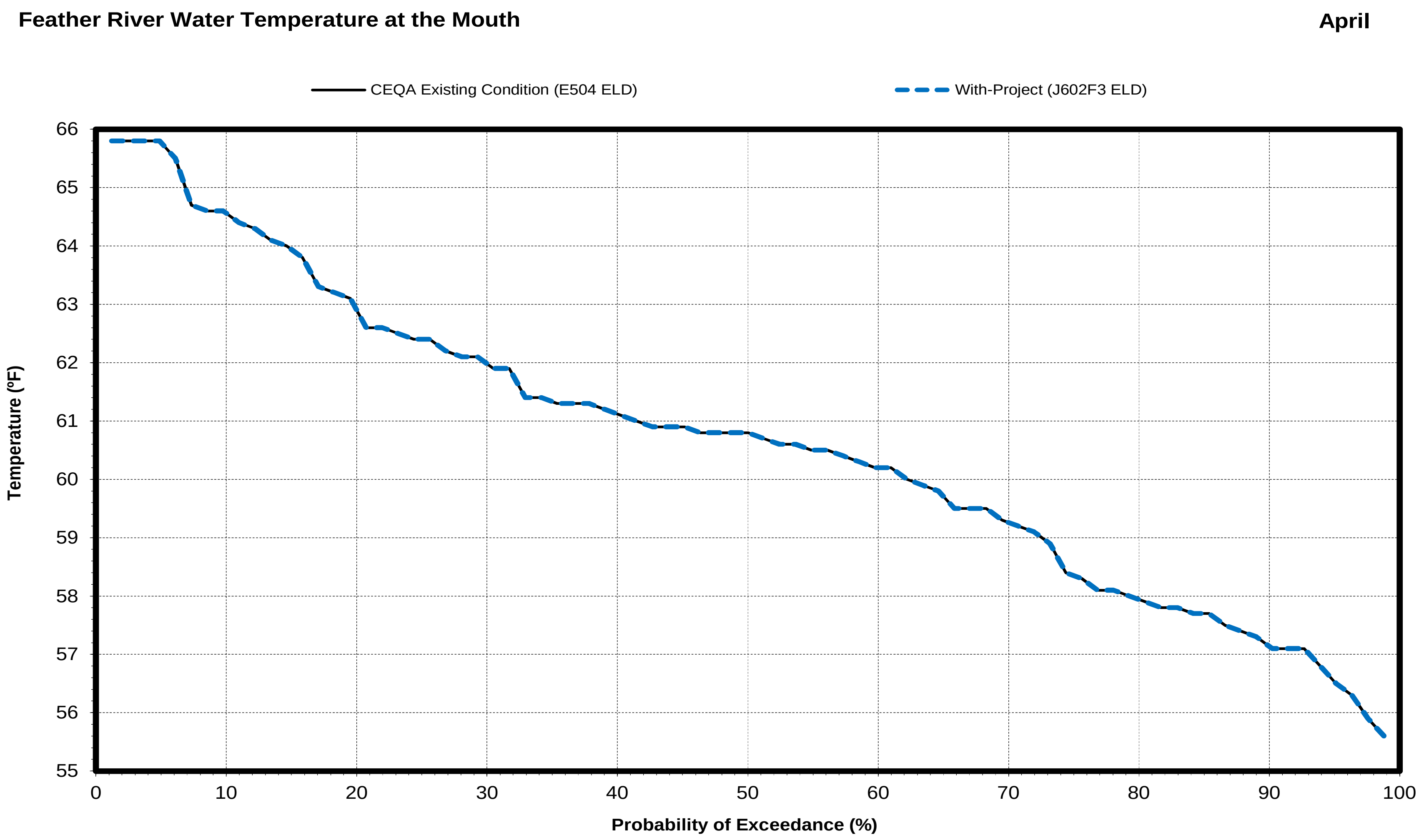
Figure 105 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

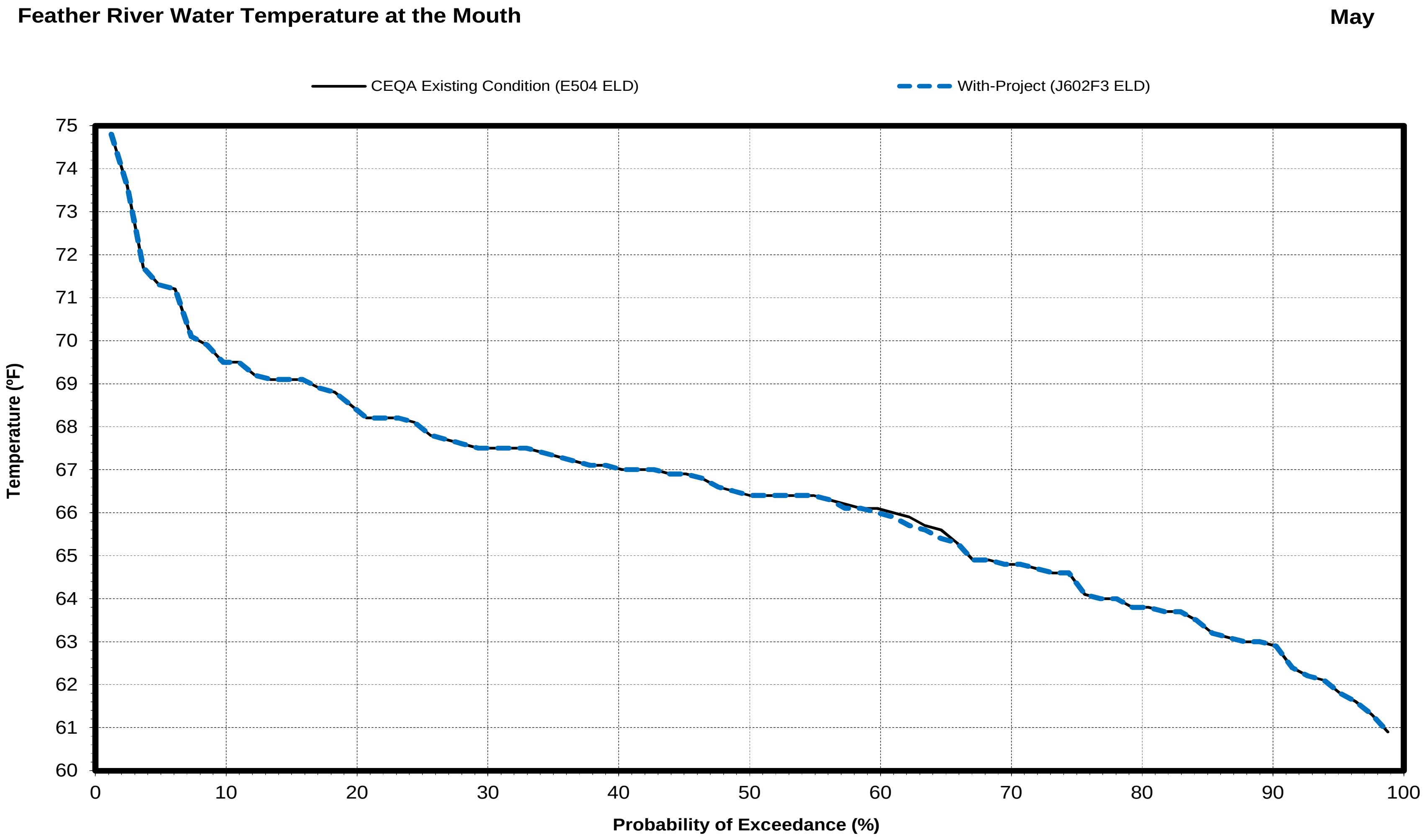
Figure 106 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

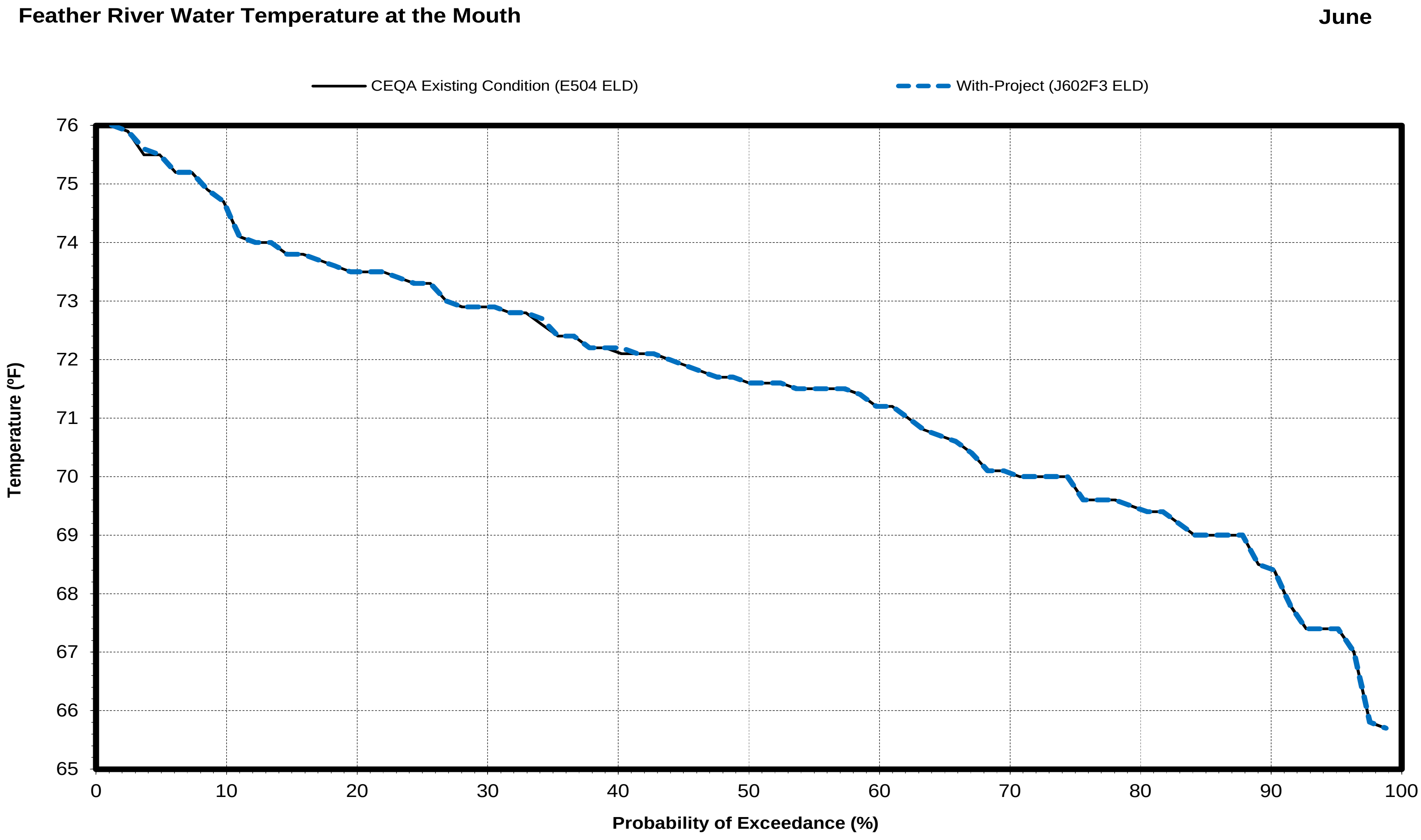
Figure 107 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

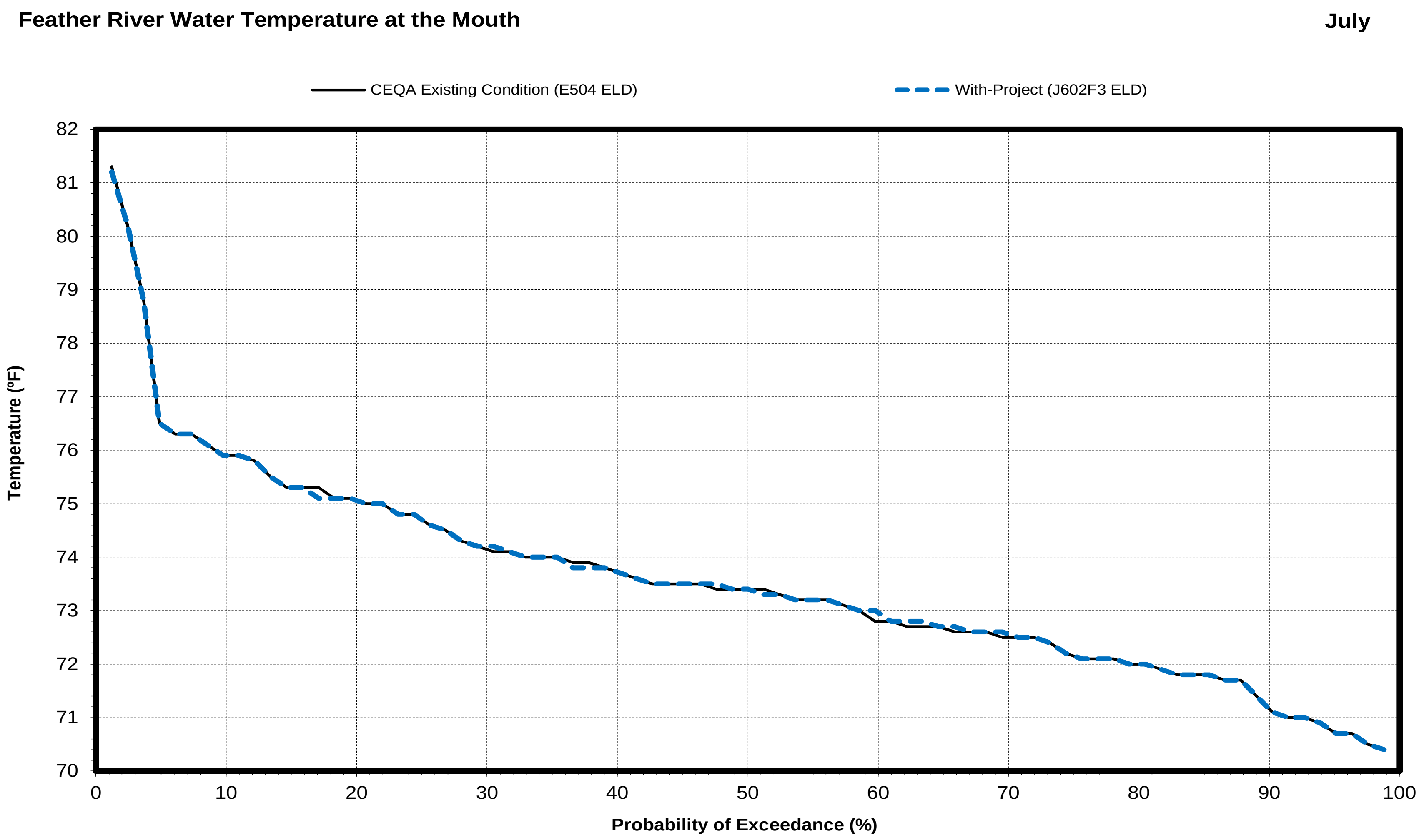
Figure 108 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

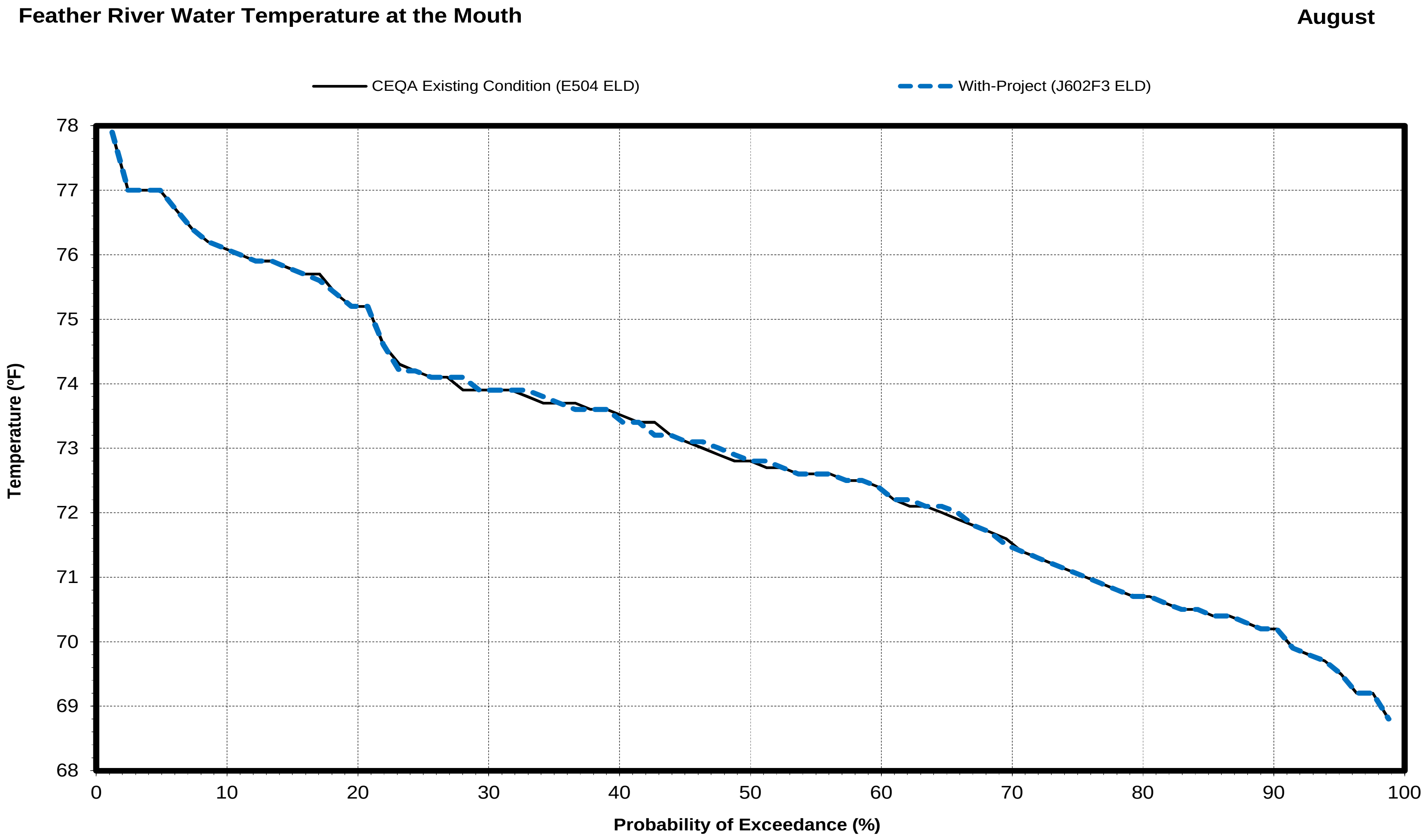
Figure 109 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

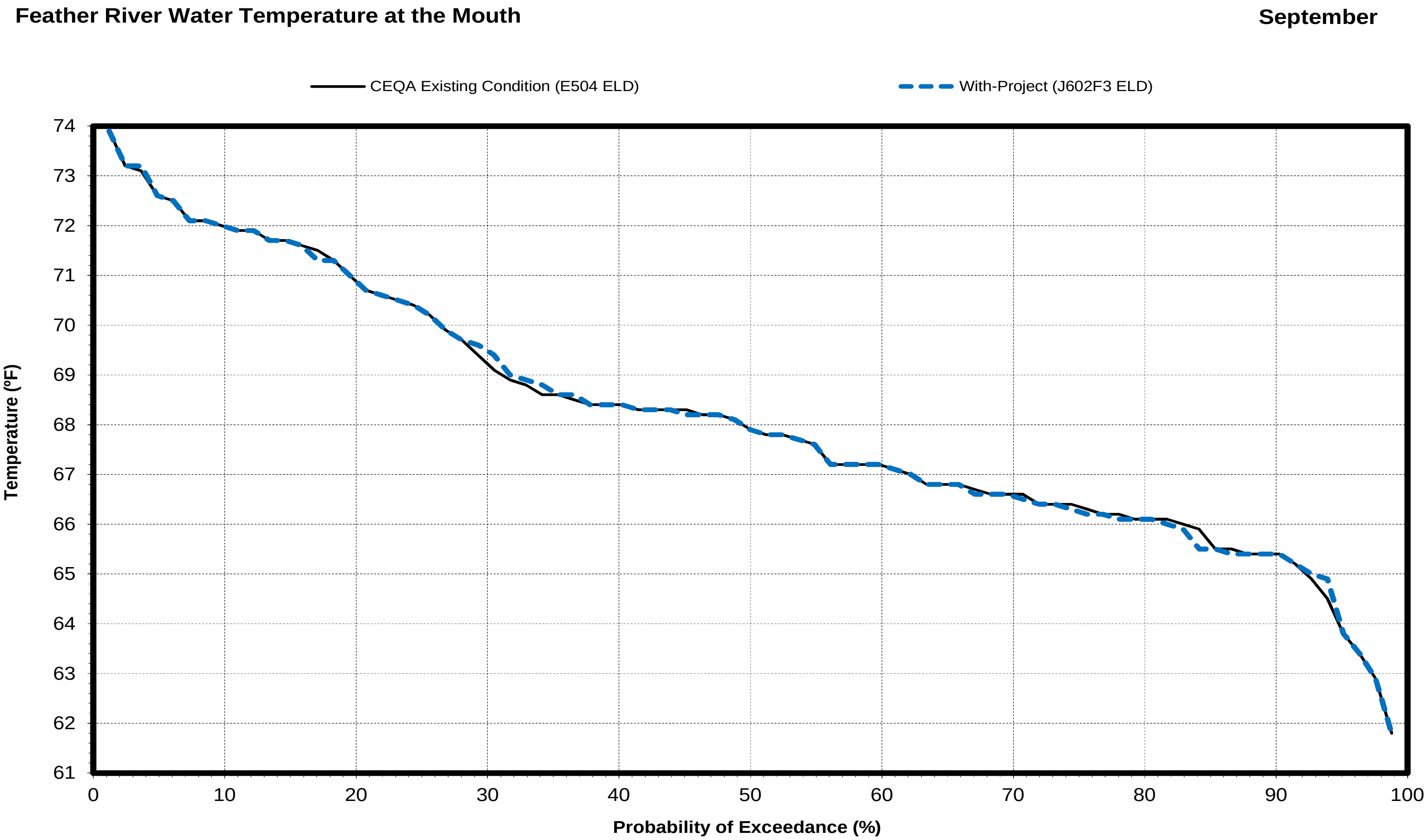
Figure 110 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 111 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 146 E504ELD-J602F3ELD

Long-term Average Delta Outflow and Average Delta Outflow by Water Year Type Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	6,019	11,602	21,022	41,708	52,546	42,182	30,378	22,122	12,784	7,957	4,342	9,725
With-Project (J602F3 ELD)	6,006	11,508	20,882	41,575	52,097	42,473	30,652	22,251	12,743	7,961	4,345	9,731
Difference	-13	-94	-140	-133	-449	291	274	129	-41	4	3	6
Percent Difference[3]	-0.2	-0.8	-0.7	-0.3	-0.9	0.7	0.9	0.6	-0.3	0.1	0.1	0.1
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	7,775	17,562	42,743	83,027	95,595	78,132	54,871	40,424	23,383	11,275	5,161	19,524
With-Project (J602F3 ELD)	7,733	17,373	42,346	82,743	94,691	79,221	55,389	40,444	23,384	11,269	5,161	19,539
Difference	-42	-189	-397	-284	-904	1,089	518	20	1	-6	0	15
Percent Difference	-0.5	-1.1	-0.9	-0.3	-0.9	1.4	0.9	0.0	0.0	-0.1	0.0	0.1
Above Normal												
CEQA Existing Condition (E504 ELD)	5,441	12,285	17,842	46,780	60,645	50,964	32,265	23,828	11,636	9,723	4,000	11,732
With-Project (J602F3 ELD)	5,447	12,071	17,786	46,439	60,241	51,191	32,756	24,132	11,575	9,728	4,000	11,732
Difference	6	-214	-56	-341	-404	227	491	304	-61	5	0	0
Percent Difference	0.1	-1.7	-0.3	-0.7	-0.7	0.4	1.5	1.3	-0.5	0.1	0.0	0.0
Below Normal												
CEQA Existing Condition (E504 ELD)	5,535	8,608	12,248	21,740	36,444	22,761	22,153	15,705	8,139	7,270	4,021	3,951
With-Project (J602F3 ELD)	5,539	8,595	12,245	21,739	35,973	22,769	22,336	15,988	8,100	7,260	4,020	3,928
Difference	4	-13	-3	-1	-471	8	183	283	-39	-10	-1	-23
Percent Difference	0.1	-0.2	0.0	0.0	-1.3	0.0	0.8	1.8	-0.5	-0.1	0.0	-0.6
Dry												
CEQA Existing Condition (E504 ELD)	5,276	8,436	8,827	14,341	22,918	19,711	14,315	10,219	6,786	5,117	3,976	3,209
With-Project (J602F3 ELD)	5,271	8,439	8,832	14,330	22,804	19,311	14,345	10,351	6,665	5,149	3,993	3,230
Difference	-5	3	5	-11	-114	-400	30	132	-121	32	17	21
Percent Difference	-0.1	0.0	0.1	-0.1	-0.5	-2.0	0.2	1.3	-1.8	0.6	0.4	0.7
Critical												
CEQA Existing Condition (E504 ELD)	4,474	6,249	5,671	11,458	14,403	11,876	9,112	6,105	5,385	4,065	3,832	3,000
With-Project (J602F3 ELD)	4,472	6,241	5,628	11,526	14,419	11,869	9,112	6,105	5,385	4,065	3,831	3,000
Difference	-2	-8	-43	68	16	-7	0	0	0	0	-1	0
Percent Difference	0.0	-0.1	-0.8	0.6	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0

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 147 E504ELD-J602F3ELD

Long-Term Average Delta X2 Locations and Average Delta X2 Locations by Water Year Type Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Location (km)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period²												
CEQA Existing Condition (E504 ELD)	83.5	83.9	82.3	76.3	67.4	60.3	60.7	63.5	67.7	74.6	80.4	85.5
With-Project (J602F3 ELD)	83.5	84.0	82.3	76.3	67.4	60.4	60.7	63.4	67.6	74.6	80.4	85.5
Difference³	0.0	0.1	0.0	0.0	0.0	0.1	0.0	-0.1	-0.1	0.0	0.0	0.0
Water Year Types¹												
Wet												
CEQA Existing Condition (E504 ELD)	80.9	80.5	76.6	63.6	53.8	50.3	52.1	54.5	57.8	65.1	74.3	82.7
With-Project (J602F3 ELD)	80.8	80.5	76.6	63.7	53.8	50.4	52.0	54.3	57.7	65.1	74.3	82.7
Difference	-0.1	0.0	0.0	0.1	0.0	0.1	-0.1	-0.2	-0.1	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	83.0	83.5	80.8	76.7	61.7	54.2	54.1	58.6	62.8	72.9	78.1	83.6
With-Project (J602F3 ELD)	83.0	83.5	80.9	76.6	61.7	54.3	54.0	58.5	62.6	72.8	78.1	83.6
Difference	0.0	0.0	0.1	-0.1	0.0	0.1	-0.1	-0.1	-0.2	-0.1	0.0	0.0
Below Normal												
CEQA Existing Condition (E504 ELD)	84.3	85.0	84.8	81.3	72.0	60.6	63.2	64.3	68.6	76.7	81.5	85.4
With-Project (J602F3 ELD)	84.3	85.0	84.8	81.3	72.0	60.7	63.3	64.3	68.4	76.6	81.5	85.4
Difference	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	-0.2	-0.1	0.0	0.0
Dry												
CEQA Existing Condition (E504 ELD)	84.2	85.1	85.2	82.5	77.5	68.7	66.5	69.9	74.7	80.6	84.7	87.6
With-Project (J602F3 ELD)	84.3	85.1	85.2	82.5	77.5	68.8	66.7	69.9	74.6	80.6	84.7	87.6
Difference	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.0	-0.1	0.0	0.0	0.0
Critical												
CEQA Existing Condition (E504 ELD)	87.7	88.9	88.8	87.8	82.3	75.0	74.4	77.3	82.4	85.8	87.9	90.0
With-Project (J602F3 ELD)	87.6	88.9	88.8	87.9	82.2	75.0	74.4	77.3	82.4	85.8	87.9	90.0
Difference	-0.1	0.0	0.0	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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 Difference in X2 location presented as a change from the No Action condition. Positive differences indicate a shift in the upstream direction; negative differences indicate a shift in the downstream direction

Table 148 E504ELD-J602F3ELD

Long-term Average Delta E/I Ratio and Average Delta E/I Ratio by Water Year Type Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Ratio (%)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	49.1	42.4	41.9	24.0	18.1	19.7	8.1	9.0	22.1	43.8	53.3	48.0
With-Project (J602F3 ELD)	49.1	42.5	42.0	23.9	18.2	19.6	8.0	9.0	22.3	43.7	53.3	48.0
Difference	0.0	0.1	0.1	-0.1	0.1	-0.1	-0.1	0.0	0.2	-0.1	0.0	0.0
Percent Difference[3]	0.0	0.2	0.2	-0.4	0.6	-0.5	-1.2	0.0	0.9	-0.2	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	47.1	37.7	24.6	12.5	11.4	15.5	5.7	6.6	24.8	43.1	58.7	33.7
With-Project (J602F3 ELD)	47.0	37.8	24.7	12.5	11.6	15.2	5.6	6.6	24.8	43.1	58.7	33.7
Difference	-0.1	0.1	0.1	0.0	0.2	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0
Percent Difference	-0.2	0.3	0.4	0.0	1.8	-1.9	-1.8	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	47.3	40.7	46.0	17.4	12.4	16.2	6.0	6.6	29.0	42.0	61.1	43.7
With-Project (J602F3 ELD)	47.2	40.7	46.0	17.4	12.5	16.1	5.9	6.5	29.1	42.0	61.1	43.9
Difference	-0.1	0.0	0.0	0.0	0.1	-0.1	-0.1	-0.1	0.1	0.0	0.0	0.2
Percent Difference	-0.2	0.0	0.0	0.0	0.8	-0.6	-1.7	-1.5	0.3	0.0	0.0	0.5
Below Normal												
CEQA Existing Condition (E504 ELD)	51.8	47.5	51.7	26.6	18.8	24.9	7.8	8.3	25.6	48.2	60.1	64.6
With-Project (J602F3 ELD)	51.8	47.3	51.7	26.6	19.0	24.8	7.8	8.2	25.7	48.2	60.0	64.6
Difference	0.0	-0.2	0.0	0.0	0.2	-0.1	0.0	-0.1	0.1	0.0	-0.1	0.0
Percent Difference	0.0	-0.4	0.0	0.0	1.1	-0.4	0.0	-1.2	0.4	0.0	-0.2	0.0
Dry												
CEQA Existing Condition (E504 ELD)	50.4	45.5	51.5	35.9	25.4	22.1	10.4	11.3	19.7	51.1	47.1	60.4
With-Project (J602F3 ELD)	50.6	45.7	51.5	35.9	25.5	22.3	10.3	11.2	20.5	50.9	47.3	60.5
Difference	0.2	0.2	0.0	0.0	0.1	0.2	-0.1	-0.1	0.8	-0.2	0.2	0.1
Percent Difference	0.4	0.4	0.0	0.0	0.4	0.9	-1.0	-0.9	4.1	-0.4	0.4	0.2
Critical												
CEQA Existing Condition (E504 ELD)	49.9	43.8	49.3	34.3	26.4	22.3	12.4	14.1	8.7	30.9	35.0	44.9
With-Project (J602F3 ELD)	50.1	43.9	49.8	33.7	26.3	22.3	12.4	14.1	8.7	30.5	34.7	44.9
Difference	0.2	0.1	0.5	-0.6	-0.1	0.0	0.0	0.0	0.0	-0.4	-0.3	0.0
Percent Difference	0.4	0.2	1.0	-1.7	-0.4	0.0	0.0	0.0	0.0	-1.3	-0.9	0.0

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 150 E504ELD-J602F3ELD

Statistical Review Showing City of Folsom Deliveries in Acre-Feet for the CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

CEQA Existing Condition (E504 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	2,169	1,855	1,822	1,822	1,823	1,893	3,162	3,576	4,138	4,255	3,780.1	2,813
Max	2,489	2,081	1,870	1,870	1,900	2,393	3,764	4,212	4,692	4,840	4,271	3,096
Min	1,725	1,678	1,678	1,678	1,677	1,678	1,913	2,646	3,462	3,762	3,301	2,265
StdDv	193	79	58	58	58	159	435	264	250	241	205	159

With-Project (J602F3 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	2,170	1,855	1,823	1,823	1,824	1,895	3,163	3,577	4,139	4,256	3,781	2,813
Max	2,489	2,081	1,870	1,870	1,900	2,393	3,765	4,212	4,692	4,840	4,271	3,096
Min	1,725	1,678	1,678	1,678	1,677	1,678	1,918	2,646	3,462	3,761	3,300	2,265
StdDv	194	79	58	58	58	159	435	264	249	241	204	159

Table 151 E504ELD-J602F3ELD

Statistical Review Showing Sacramento Suburban Water District Deliveries in Acre-Feet for the CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

CEQA Existing Condition (E504 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	499	393	382	382	383	416	768	963	1,170	1,207	1,047.8	717
Max	1,015	785	667	667	684	1,007	1,717	1,983	2,253	2,336	2,016	1,356
Min	0	0	0	0	0	0	0	0	0	0	0	0
StdDv	438	340	330	330	330	366	690	839	1,012	1,044	906	621

With-Project (J602F3 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	499	393	382	382	383	416	768	963	1,170	1,207	1,048	717
Max	1,015	785	667	667	684	1,007	1,717	1,983	2,253	2,336	2,016	1,356
Min	0	0	0	0	0	0	0	0	0	0	0	0
StdDv	438	340	330	330	330	366	690	839	1,012	1,044	906	621

Table 152 E504ELD-J602F3ELD

Statistical Review Showing Fairbairn Water Treatment Plant Deliveries in Acre-Feet for the CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

CEQA Existing Condition (E504 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	4,827	3,819	3,714	3,714	3,717	4,012	7,759	8,999	10,969	11,518	9,996.9	6,892
Max	5,683	4,398	3,735	3,735	3,835	5,642	9,353	11,106	12,617	13,082	11,290	7,593
Min	2,852	2,852	2,852	2,852	2,852	2,852	4,557	6,178	8,128	8,240	7,207	4,857
StdDv	607	253	136	136	138	536	1,163	813	671	716	599	475

With-Project (J602F3 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	4,827	3,819	3,714	3,714	3,717	4,012	7,789	8,999	10,969	11,518	9,997	6,892
Max	5,683	4,398	3,735	3,735	3,835	5,642	9,568	11,106	12,617	13,082	11,290	7,593
Min	2,852	2,852	2,852	2,852	2,852	2,852	4,557	6,178	8,128	8,240	7,207	4,857
StdDv	607	253	136	136	138	536	1,193	813	671	716	599	475

Table 153 E504ELD-J602F3ELD

Statistical Review Showing Folsom Pumping Plant Deliveries in Acre-Feet for the CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

CEQA Existing Condition (E504 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	8,656	6,865	6,681	6,681	6,686	7,079	14,230	16,667	19,890	20,554	17,848.8	12,327
Max	10,955	8,507	7,243	7,243	7,423	10,381	18,445	21,290	24,170	25,057	21,641	14,596
Min	5,729	5,452	5,452	5,452	5,452	5,452	7,471	10,615	14,582	16,319	13,922	9,505
StdDv	1,297	674	585	585	585	1,024	2,378	1,989	2,316	2,314	1,989	1,376

With-Project (J602F3 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	8,660	6,867	6,683	6,683	6,689	7,088	14,237	16,673	19,897	20,561	17,855	12,332
Max	10,955	8,507	7,243	7,243	7,423	10,381	18,445	21,290	24,170	25,057	21,641	14,596
Min	5,729	5,452	5,452	5,452	5,452	5,452	7,504	10,615	14,582	16,315	13,918	9,506
StdDv	1,304	676	587	587	587	1,022	2,379	1,993	2,317	2,316	1,990	1,379

Table 154 E504ELD-J602F3ELD

Statistical Review Showing Freeport Pumping Plant Deliveries in Acre-Feet for the CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

CEQA Existing Condition (E504 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	1,681	1,587	1,544	1,544	1,339	1,884	19,648	8,999	11,186	8,988	4,937.4	2,678
Max	11,158	6,414	6,635	6,635	6,198	19,658	52,752	35,300	45,377	40,258	24,858	16,389
Min	0	0	0	0	0	0	0	0	0	0	0	0
StdDv	2,633	2,390	2,454	2,511	2,238	3,854	15,946	8,667	11,962	10,878	5,636	3,667

With-Project (J602F3 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	1,681	1,587	1,544	1,543	1,337	1,884	19,645	8,998	11,178	8,986	4,884	2,678
Max	11,158	6,413	6,635	6,635	6,198	19,658	52,683	35,300	45,371	40,258	24,858	16,389
Min	0	0	0	0	0	0	0	0	0	0	0	0
StdDv	2,633	2,390	2,454	2,511	2,238	3,853	15,944	8,667	11,969	10,868	5,667	3,667

Table 155 E504ELD-J602F3ELD

Statistical Review Showing Placer County Water Agency Pumping Plant Deliveries in Acre-Feet for the CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

CEQA Existing Condition (E504 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	2,189	1,782	1,740	1,740	1,741	1,859	3,491	4,016	4,742	4,895	4,279.3	3,024
Max	2,522	2,006	1,740	1,740	1,779	2,506	4,317	4,703	5,310	5,497	4,777	3,291
Min	1,740	1,740	1,740	1,740	1,739	1,740	2,070	2,722	4,257	4,475	3,904	2,395
StdDv	231	81	0	0	6	204	575	303	222	211	173	153

With-Project (J602F3 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	2,189	1,782	1,740	1,740	1,741	1,859	3,491	4,016	4,742	4,895	4,279	3,024
Max	2,522	2,006	1,740	1,740	1,779	2,506	4,317	4,703	5,310	5,497	4,777	3,291
Min	1,740	1,740	1,740	1,740	1,739	1,740	2,070	2,722	4,257	4,475	3,904	2,395
StdDv	231	81	0	0	6	204	575	303	222	211	173	153

Table 156 E504ELD-J602F3ELD

Statistical Review Showing City of Roseville Deliveries in Acre-Feet for the CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

CEQA Existing Condition (E504 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	2,060	1,689	1,652	1,652	1,654	1,668	3,187	3,712	4,377	4,513	3,954.9	2,817
Max	2,642	2,120	1,850	1,850	1,888	2,520	4,275	4,849	5,463	5,653	4,924	3,420
Min	1,247	1,050	1,050	1,050	1,050	1,050	1,245	1,868	2,496	2,783	2,451	1,793
StdDv	375	247	240	240	240	305	648	610	724	732	635	452

With-Project (J602F3 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	2,062	1,691	1,654	1,654	1,655	1,674	3,192	3,716	4,382	4,518	3,959	2,820
Max	2,642	2,120	1,850	1,850	1,888	2,520	4,275	4,849	5,463	5,653	4,924	3,420
Min	1,247	1,050	1,050	1,050	1,050	1,050	1,268	1,868	2,496	2,783	2,451	1,793
StdDv	378	248	240	240	240	306	647	610	723	731	634	453

Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))
Created: 7/27/2016

Table 157 E504ELD-J602F3ELD

Statistical Review Showing San Juan Water District Deliveries in Acre-Feet for the CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

CEQA Existing Condition (E504 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	3,448	2,573	2,482	2,482	2,485	2,740	6,244	7,371	8,932	9,260	7,937.4	5,242
Max	4,164	3,055	2,482	2,482	2,568	4,128	8,019	8,847	10,152	10,554	9,006	5,814
Min	2,482	2,482	2,482	2,482	2,482	2,482	3,192	4,591	7,888	8,357	7,131	3,890
StdDv	495	174	0	0	13	437	1,234	652	476	453	372	329

With-Project (J602F3 ELD)

	Month											
Acre Feet	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	3,448	2,573	2,482	2,482	2,485	2,740	6,244	7,371	8,932	9,260	7,937	5,242
Max	4,164	3,055	2,482	2,482	2,568	4,128	8,019	8,847	10,152	10,554	9,006	5,814
Min	2,482	2,482	2,482	2,482	2,482	2,482	3,192	4,591	7,888	8,357	7,131	3,890
StdDv	495	174	0	0	13	437	1,234	652	476	453	372	329

Table 158 E504ELD-J602F3ELD

Difference in Water Supply Deliveries - CEQA Existing Condition (E504 ELD) versus With-Project (J602F3 ELD)

Difference in Deliveries With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)												
City of Folsom												
D8B_PMI+D8B_NP	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	1	0	0	0	0	1	1	1	1	1	1	1
Maximum	0	0	0	0	0	0	1	0	0	0	0	0
Minimum	0	0	0	0	0	0	5	0	0	-1	0	0
Sacramento Suburban Water District - Folsom												
D8A_NP+D302B_NP	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0
Fairbairn Water Treatment Plant												
D302	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	0	0	0	0	0	0	31	0	0	0	0	0
Maximum	0	0	0	0	0	0	214	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0
Folsom Pumping Plant												
D8	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	4	3	3	3	3	9	7	6	7	7	6	5
Maximum	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	33	0	0	-4	-3	1
Freeport Pumping Plant												
D168	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	0	1	0	-1	-2	-1	-2	-2	-8	-2	-53	0
Maximum	0	-1	0	0	0	0	-69	0	-6	0	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0
Placer County Water Agency Pumping Plant												
D300	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0
City of Roseville												
D8G_PMI+D8G_NP	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	3	2	2	2	2	6	5	4	5	5	4	3
Maximum	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	23	0	0	0	0	0
San Juan Water District												
D8E_PMI+D8E_NP+D8D_NP	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	0	0	0	0	0	0	0	0	0	0	0	0
Maximum	0	0	0	0	0	0	0	0	0	0	0	0
Minimum	0	0	0	0	0	0	0	0	0	0	0	0

Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 159 E504ELD-J602F3ELD

August 1977 Deliveries to City of Roseville, San Juan Water District and City of Folsom

August-1977	**Deliveries (AF)**		
City of Roseville (D8G)	**WR**	**CVP**	**TOTAL**
CEQA Existing Condition (E504 ELD)	564	2196	2760
With-Project (J602F3 ELD)	564	2196	2760
San Juan WD (D8E)	**WR**	**CVP**	**TOTAL**
CEQA Existing Condition (E504 ELD)	3865	1312	5177
With-Project (J602F3 ELD)	3865	1312	5177
City of Folsom (D8B)	**WR**	**CVP**	**TOTAL**
CEQA Existing Condition (E504 ELD)	2924	461	3385
With-Project (J602F3 ELD)	2924	461	3385
Total (D8G+D8E+D8B)	**WR**	**CVP**	**TOTAL**
CEQA Existing Condition (E504 ELD)	7353	3969	11322
With-Project (J602F3 ELD)	7353	3969	11322

Table 160 E504ELD-J602F3ELD

Folsom Pumping Plant April Water Supply Deliveries for CEQA Existing Condition (E504 ELD)

April Folsom Pumping Plant (D8) Diversion in Acre Feet

Water Year	Wet	Water Year	AN	Water Year	BN	Water Year	Dry	Water Year	Critical
1971	18,445	1951	18,359	1946	17,951	1949	16,900	1994	16,055
1997	16,872	2000	17,602	1945	16,752	2002	16,602	1931	15,477
1999	16,825	1973	16,889	1966	16,332	1989	16,001	1977	15,398
1984	16,745	1993	16,781	1962	16,082	1964	15,976	1934	15,303
1970	16,614	1922	16,601	1959	15,489	1939	15,571	1924	14,985
1956	16,330	1940	16,263	1968	15,280	1985	15,412	1990	14,179
1969	15,980	1957	15,393	1936	15,179	1932	15,342	1933	14,166
1975	15,382	1980	15,077	1950	14,495	1981	14,703	1976	13,452
1952	15,289	1928	14,778	1972	14,435	1925	14,377	1991	13,342
1953	15,149	1954	12,190	1979	14,089	1947	14,166	1992	12,871
1927	15,098	1978	11,697	1937	13,987	1987	14,138	1929	12,710
1974	14,931	2003	11,128	1923	11,199	1960	14,124	1988	11,435
1938	14,884			1948	9,610	1944	13,431		
1986	14,758			1935	7,471	1961	13,140		
1996	14,178					1955	13,002		
1998	14,029					2001	12,616		
1995	13,987					1930	12,361		
1943	13,073					1926	8,656		
1965	11,950								
1963	10,987								
1983	10,051								
1941	9,973								
1967	9,698								
1958	9,678								
1942	9,540								
1982	9,377								
		CEQA Existing Condition (E504 ELD) 95% of 82-year average for all months =							**13,518**

Count of Occurrences less than 95% Average Monthly Diversion

Wet	Above Normal	Below Normal	Dry	Critical	Total
9	3	3	6	5	26

Table 161 E504ELD-J602F3ELD

Folsom Pumping Plant July Water Supply Deliveries for CEQA Existing Condition (E504 ELD)

July Folsom Pumping Plant (D8) Diversion in Acre Feet

Water Year	Wet	Water Year	AN	Water Year	BN	Water Year	Dry	Water Year	Critical
1982	25,057	1957	23,518	1948	24,668	1925	21,794	1994	18,852
1998	24,670	2003	23,389	1935	22,062	1989	21,329	1992	18,484
1941	24,392	1978	22,743	1945	21,923	1949	21,228	1991	18,070
1942	24,129	1993	22,517	1946	21,515	1981	19,966	1931	17,469
1996	24,094	2000	22,474	1923	21,335	1985	19,788	1934	17,071
1963	23,865	1922	22,264	1950	21,146	2002	19,459	1924	17,050
1983	23,708	1973	21,992	1979	20,758	1926	19,415	1933	16,995
1967	23,681	1940	21,955	1937	20,394	1932	19,185	1990	16,609
1958	23,439	1951	21,822	1936	19,965	1947	18,698	1988	16,498
1995	23,265	1980	21,043	1962	19,887	1930	18,476	1929	16,401
1927	22,479	1928	20,830	1968	19,652	2001	18,337	1977	16,400
1938	22,412	1954	20,349	1959	19,014	1944	18,328	1976	16,319
1943	22,389			1966	18,684	1955	18,142		
1975	22,372			1972	18,488	1961	18,133		
1965	22,125					1939	18,096		
1953	22,042					1960	17,963		
1952	21,910					1987	17,907		
1956	21,900					1964	17,604		
1969	21,881								
1999	21,455								
1971	21,273								
1986	21,088								
1974	20,209								
1984	19,281								
1997	18,930								
1970	18,894								
		CEQA Existing Condition (E504 ELD) 95% of 82-year average for all months =							**19,526**

Count of Occurrences less than 95% Average Monthly Diversion

Wet	Above Normal	Below Normal	Dry	Critical	Total
3	0	3	13	12	31

Table 162 E504ELD-J602F3ELD

Fairbairn Water Treatment Plant April Water Supply Deliveries for CEQA Existing Condition (E504 ELD)

April Fairbairn Water Treatment Plant (D302) Diversion in Acre Feet

Water Year	Wet	Water Year	AN	Water Year	BN	Water Year	Dry	Water Year	Critical
1970	8,590	1993	8,740	1946	9,353	1989	8,997	1931	8,640
1997	8,573	1922	8,645	1936	8,532	1949	8,933	1934	8,589
1984	8,563	1951	8,554	1966	8,527	1964	8,617	1990	8,577
1971	8,561	2000	8,496	1962	8,506	1939	8,579	1994	8,538
1999	8,436	1940	8,468	1945	8,473	2002	8,550	1933	8,528
1956	8,397	1973	8,440	1959	8,468	1947	8,449	1976	8,442
1969	8,319	1957	8,045	1972	8,459	1985	8,448	1929	8,428
1975	8,006	1928	8,029	1968	8,450	1987	8,446	1991	8,396
1986	7,979	1980	7,845	1950	8,146	1960	8,445	1992	8,045
1952	7,957	1954	6,985	1979	7,917	1932	8,440	1988	7,838
1953	7,883	1978	6,072	1937	7,859	1981	8,408	1977	7,735
1927	7,856	2003	5,773	1923	6,104	1944	8,393	1924	7,487
1974	7,769			1948	5,389	1961	8,209		
1938	7,744			1935	4,557	1955	8,122		
1996	7,374					1925	8,080		
1998	7,295					2001	7,880		
1995	7,274					1930	7,761		
1943	6,794					1926	5,394		
1965	6,710								
1963	5,700								
1983	5,208								
1941	5,168								
1967	5,023								
1958	5,013								
1942	4,940								
1982	4,855								
		CEQA Existing Condition (E504 ELD) 95% of 82-year average for all months =							**7,371**

Count of Occurrences less than 95% Average Monthly Diversion

Wet	Above Normal	Below Normal	Dry	Critical	Total
11	3	3	1	0	18

Table 163 E504ELD-J602F3ELD

Fairbairn Water Treatment Plant July Water Supply Deliveries for CEQA Existing Condition (E504 ELD)

July Fairbairn Water Treatment Plant (D302) Diversion in Acre Feet

Water Year	Wet	Water Year	AN	Water Year	BN	Water Year	Dry	Water Year	Critical
1982	13,082	1957	12,325	1948	12,878	1926	12,149	1992	11,571
1998	12,879	2003	12,207	1935	12,418	1989	12,004	1991	11,515
1941	12,733	1978	11,868	1950	11,901	1925	11,822	1931	11,456
1942	12,595	1993	11,749	1945	11,816	1947	11,698	1990	11,386
1996	12,577	2000	11,727	1979	11,682	1981	11,670	1933	11,271
1963	12,457	1954	11,709	1923	11,653	1930	11,620	1988	11,202
1983	12,374	1922	11,617	1937	11,476	1944	11,576	1929	11,192
1967	12,360	1973	11,474	1972	11,442	2001	11,471	1994	11,113
1958	12,233	1940	11,454	1962	11,441	1985	11,384	1934	10,938
1995	12,142	1951	11,385	1968	11,413	1955	11,349	1976	10,692
1927	11,729	1928	11,337	1936	11,234	1961	11,344	1924	8,521
1938	11,694	1980	10,976	1946	11,224	1939	11,320	1977	8,240
1943	11,682			1959	11,041	1960	11,237		
1975	11,673			1966	10,745	1949	11,236		
1965	11,543					1987	11,201		
1953	11,500					2002	11,194		
1952	11,431					1964	11,011		
1956	11,425					1932	11,000		
1986	11,424								
1969	11,416								
1999	11,192								
1970	11,161								
1971	11,096								
1984	11,090								
1997	10,887								
1974	10,538								
		CEQA Existing Condition (E504 ELD) 95% of 82-year average for all months =							**10,942**

Count of Occurrences less than 95% Average Monthly Diversion

Wet	Above Normal	Below Normal	Dry	Critical	Total
2	0	1	0	4	7

Table 164 E504ELD-J602F3ELD

Folsom Pumping Plant April Water Supply Deliveries for With-Project (J602F3 ELD)

April Folsom Pumping Plant (D8) Diversion in Acre Feet

Water Year	Wet	Water Year	AN	Water Year	BN	Water Year	Dry	Water Year	Critical
1971	18,445	1951	18,359	1946	17,951	1949	16,929	1994	16,062
1997	16,872	2000	17,602	1945	16,722	2002	16,602	1931	15,468
1999	16,825	1973	16,889	1966	16,332	1989	16,001	1977	15,398
1970	16,823	1993	16,781	1962	16,082	1964	15,976	1934	15,314
1984	16,745	1922	16,601	1959	15,490	1939	15,571	1924	14,985
1956	16,330	1940	16,263	1968	15,379	1985	15,384	1990	14,179
1969	15,980	1957	15,411	1936	15,179	1932	15,368	1933	14,164
1975	15,382	1928	15,080	1950	14,495	1925	14,377	1976	13,449
1952	15,289	1980	15,077	1972	14,411	1981	14,345	1991	13,356
1953	15,149	1954	12,190	1979	14,098	1947	14,166	1992	12,879
1927	15,098	1978	11,697	1937	13,987	1987	14,138	1929	12,710
1974	14,931	2003	11,128	1923	11,199	1960	14,124	1988	11,435
1938	14,884			1948	9,610	1944	13,392		
1986	14,855			1935	7,504	1961	13,140		
1996	14,178					1955	13,002		
1998	14,029					2001	12,616		
1995	13,987					1930	12,427		
1943	13,073					1926	8,656		
1965	12,109								
1963	10,987								
1983	10,051								
1941	9,973								
1967	9,698								
1958	9,678								
1942	9,540								
1982	9,377								
		CEQA Existing Condition (E504 ELD) 95% of 82-year average for all months =							**13,518**

Count of Occurrences less than 95% Average Monthly Diversion

Wet	Above Normal	Below Normal	Dry	Critical	Total
9	3	3	6	5	26

Table 165 E504ELD-J602F3ELD

Folsom Pumping Plant July Water Supply Deliveries for With-Project (J602F3 ELD)

July Folsom Pumping Plant (D8) Diversion in Acre Feet

Water Year	Wet	Water Year	AN	Water Year	BN	Water Year	Dry	Water Year	Critical
1982	25,057	1957	23,545	1948	24,668	1925	21,854	1994	18,861
1998	24,670	2003	23,389	1935	22,062	1989	21,329	1992	18,495
1941	24,392	1978	22,743	1945	21,885	1949	21,265	1991	18,089
1942	24,129	1993	22,517	1946	21,515	1985	19,751	1931	17,459
1996	24,094	2000	22,474	1923	21,344	1981	19,484	1934	17,084
1963	23,865	1922	22,264	1950	21,146	2002	19,459	1924	17,049
1983	23,708	1973	21,992	1979	20,772	1926	19,415	1933	16,993
1967	23,681	1940	21,955	1937	20,394	1932	19,217	1990	16,609
1958	23,439	1951	21,822	1936	19,965	1947	18,698	1988	16,498
1995	23,265	1928	21,250	1962	19,887	1930	18,574	1929	16,401
1927	22,479	1980	21,043	1968	19,778	2001	18,337	1977	16,400
1938	22,412	1954	20,349	1959	19,015	1944	18,276	1976	16,315
1943	22,389			1966	18,684	1955	18,142		
1975	22,372			1972	18,458	1961	18,133		
1965	22,125					1939	18,096		
1953	22,042					1960	17,963		
1952	21,910					1987	17,907		
1956	21,900					1964	17,604		
1969	21,881								
1999	21,455								
1971	21,273								
1986	21,225								
1974	20,209								
1984	19,281								
1970	19,130								
1997	18,930								
		CEQA Existing Condition (E504 ELD) 95% of 82-year average for all months =							**19,526**

Count of Occurrences less than 95% Average Monthly Diversion

Wet	Above Normal	Below Normal	Dry	Critical	Total
3	0	3	14	12	32

Table 166 E504ELD-J602F3ELD

Fairbairn Water Treatment Plant April Water Supply Deliveries for With-Project (J602F3 ELD)

April Fairbairn Water Treatment Plant (D302) Diversion in Acre Feet

Water Year	Wet	Water Year	AN	Water Year	BN	Water Year	Dry	Water Year	Critical
1970	8,590	1951	9,568	1946	9,353	1989	8,997	1931	8,640
1997	8,573	2000	9,171	1962	9,239	1949	8,933	1934	8,589
1984	8,563	1993	8,740	1936	8,532	1964	8,617	1990	8,577
1971	8,561	1922	8,645	1966	8,527	1939	8,579	1994	8,538
1956	8,503	1940	8,468	1945	8,473	2002	8,550	1933	8,528
1999	8,436	1973	8,440	1959	8,468	1947	8,449	1976	8,442
1969	8,319	1957	8,045	1972	8,459	1985	8,448	1929	8,428
1975	8,006	1928	8,029	1968	8,450	1987	8,446	1991	8,396
1986	7,979	1980	7,845	1950	8,146	1960	8,445	1992	8,045
1952	7,957	1954	6,985	1979	7,917	1932	8,440	1988	7,838
1953	7,883	1978	6,072	1937	7,859	1981	8,408	1977	7,735
1927	7,856	2003	5,773	1923	6,104	1944	8,393	1924	7,487
1974	7,769			1948	5,389	1961	8,209		
1938	7,744			1935	4,557	1955	8,122		
1996	7,374					1925	8,080		
1998	7,295					2001	7,880		
1995	7,274					1930	7,761		
1943	6,794					1926	5,394		
1965	6,710								
1963	5,700								
1983	5,208								
1941	5,168								
1967	5,023								
1958	5,013								
1942	4,940								
1982	4,855								
		CEQA Existing Condition (E504 ELD) 95% of 82-year average for all months =							**7,371**

Count of Occurrences less than 95% Average Monthly Diversion

Wet	Above Normal	Below Normal	Dry	Critical	Total
11	3	3	1	0	18

Table 167 E504ELD-J602F3ELD

Fairbairn Water Treatment Plant July Water Supply Deliveries for With-Project (J602F3 ELD)

July Fairbairn Water Treatment Plant (D302) Diversion in Acre Feet

Water Year	Wet	Water Year	AN	Water Year	BN	Water Year	Dry	Water Year	Critical
1982	13,082	1957	12,325	1948	12,878	1926	12,149	1992	11,571
1998	12,879	2003	12,207	1935	12,418	1989	12,004	1991	11,515
1941	12,733	1978	11,868	1950	11,901	1925	11,822	1931	11,456
1942	12,595	1993	11,749	1945	11,816	1947	11,698	1990	11,386
1996	12,577	2000	11,727	1979	11,682	1981	11,670	1933	11,271
1963	12,457	1954	11,709	1923	11,653	1930	11,620	1988	11,202
1983	12,374	1922	11,617	1937	11,476	1944	11,576	1929	11,192
1967	12,360	1973	11,474	1972	11,442	2001	11,471	1994	11,113
1958	12,233	1940	11,454	1962	11,441	1985	11,384	1934	10,938
1995	12,142	1951	11,385	1968	11,413	1955	11,349	1976	10,692
1927	11,729	1928	11,337	1936	11,234	1961	11,344	1924	8,521
1938	11,694	1980	10,976	1946	11,224	1939	11,320	1977	8,240
1943	11,682			1959	11,041	1960	11,237		
1975	11,673			1966	10,745	1949	11,236		
1965	11,543					1987	11,201		
1953	11,500					2002	11,194		
1952	11,431					1964	11,011		
1956	11,425					1932	11,000		
1986	11,424								
1969	11,416								
1999	11,192								
1970	11,161								
1971	11,096								
1984	11,090								
1997	10,887								
1974	10,538								
		CEQA Existing Condition (E504 ELD) 95% of 82-year average for all months =							**10,942**

Count of Occurrences less than 95% Average Monthly Diversion

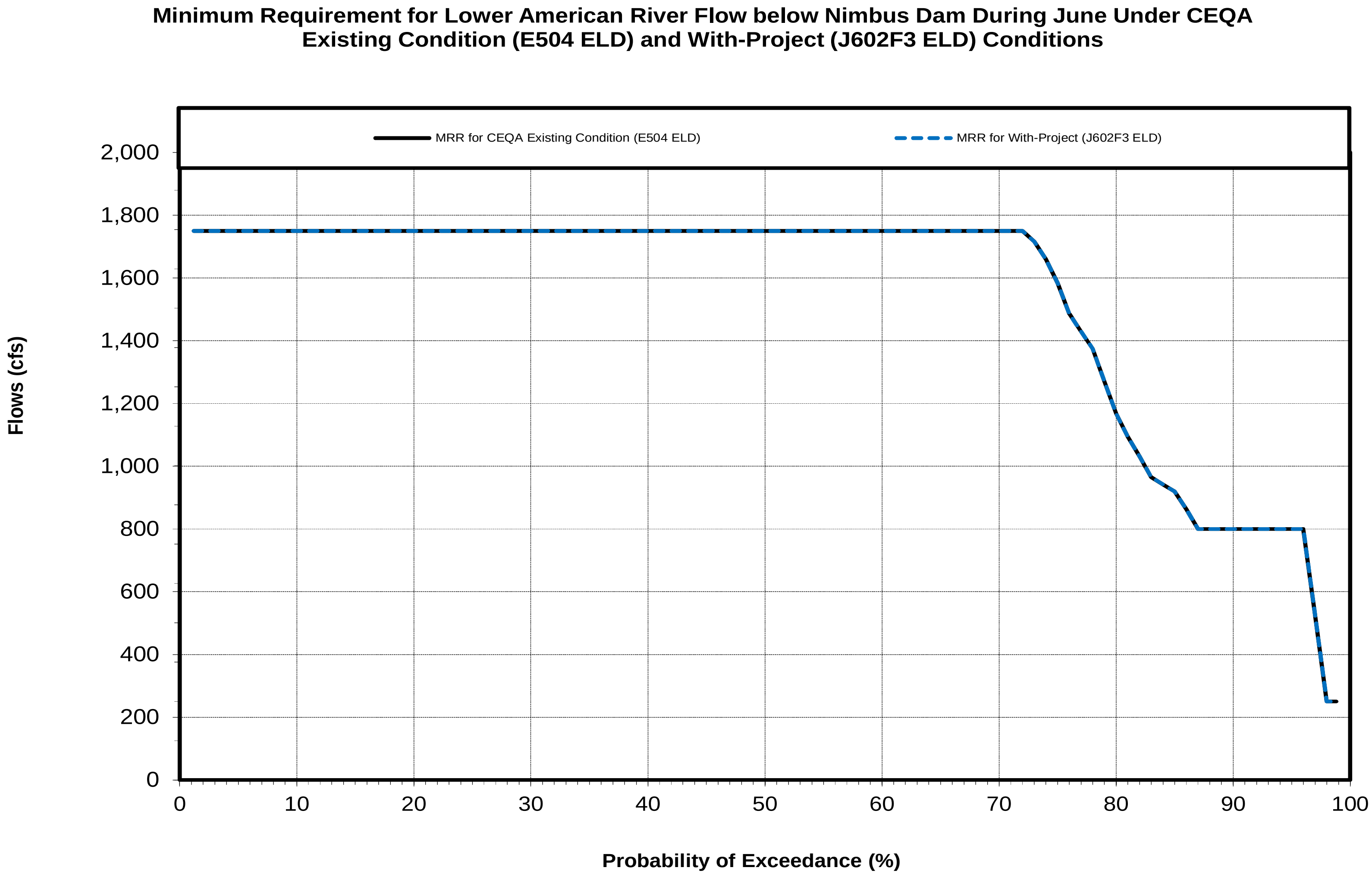
Wet	Above Normal	Below Normal	Dry	Critical	Total
2	0	1	0	4	7

Table 168 E504ELD-J602F3ELD

Water Supply Consistency Formulation - CEQA Existing Condition (E504 ELD) versus With-Project (J602F3 ELD)

Metric	Threshold	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Same as Baseline?
	Folsom Pumping Plant			
1	Number of April Months where delivery was below 95% of POR average	26	26	Yes
2	Maximum number of Aprils for any water year type where delivery fell below 95% of long-term POR average	9	9	Yes
3	Number of Julys where delivery was below 95% of POR average	31	32	No
4	Maximum number of Julys for any water year type where delivery fell below 95% of long-term POR average	13	14	No
	Fairbairn Water Treatment Plant			
5	Number of April Months where delivery was below 95% of POR average	18	18	Yes
6	Maximum number of Aprils for any water year type where delivery fell below 95% of long-term POR average	11	11	Yes
7	Number of Julys where delivery was below 95% of POR average	7	7	Yes
8	Maximum number of Julys for any water year type where delivery fell below 95% of long-term POR average	4	4	Yes
	POR Minimum Diversions			
9	Minimum Diversion For Any Month at Folsom Pumping Plant (ac-ft)	5452	5452	Yes
10	Minimum Diversion For Any Month at Fairbairn WTP	2852	2852	Yes

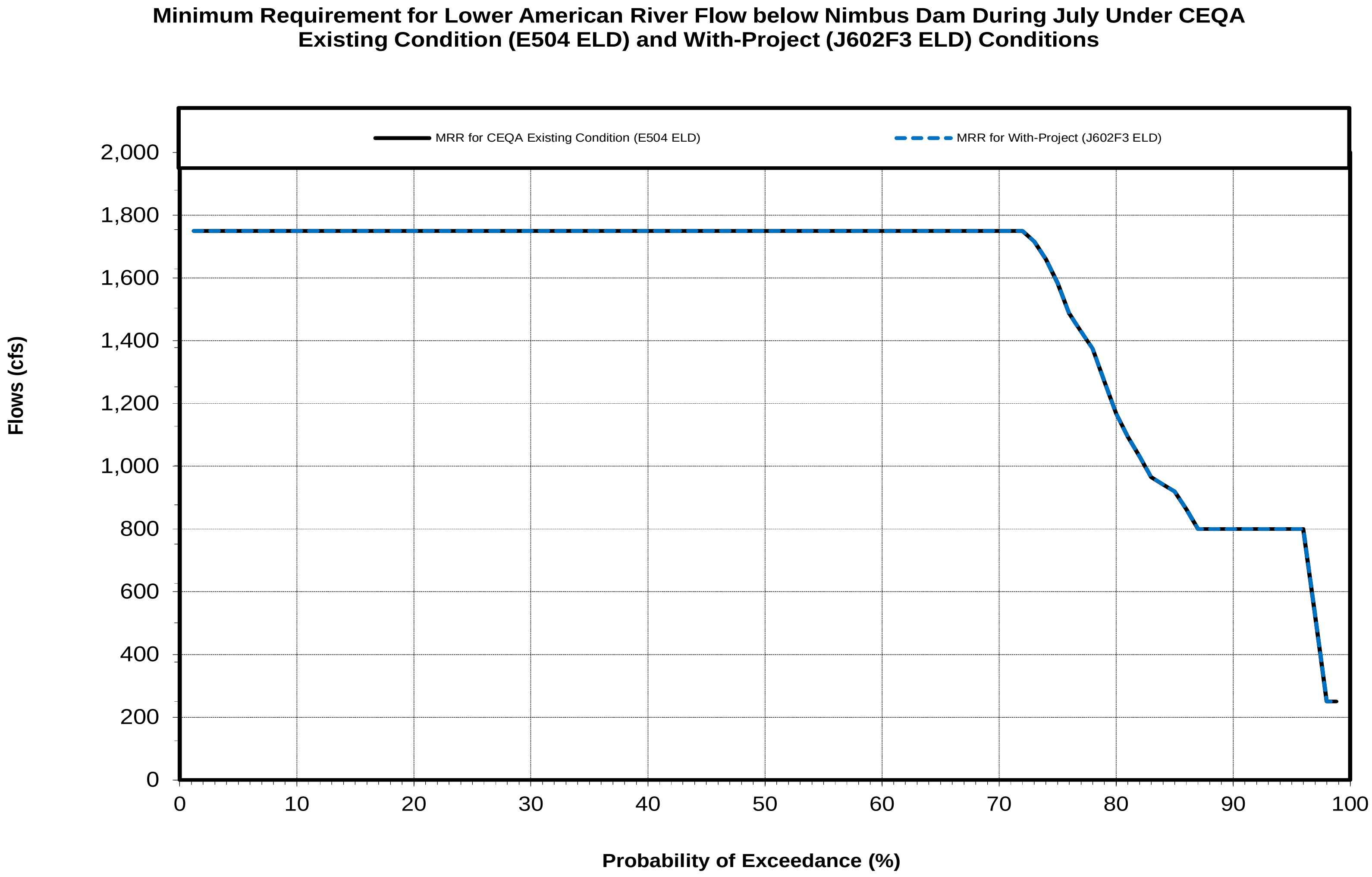
Figure 142 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

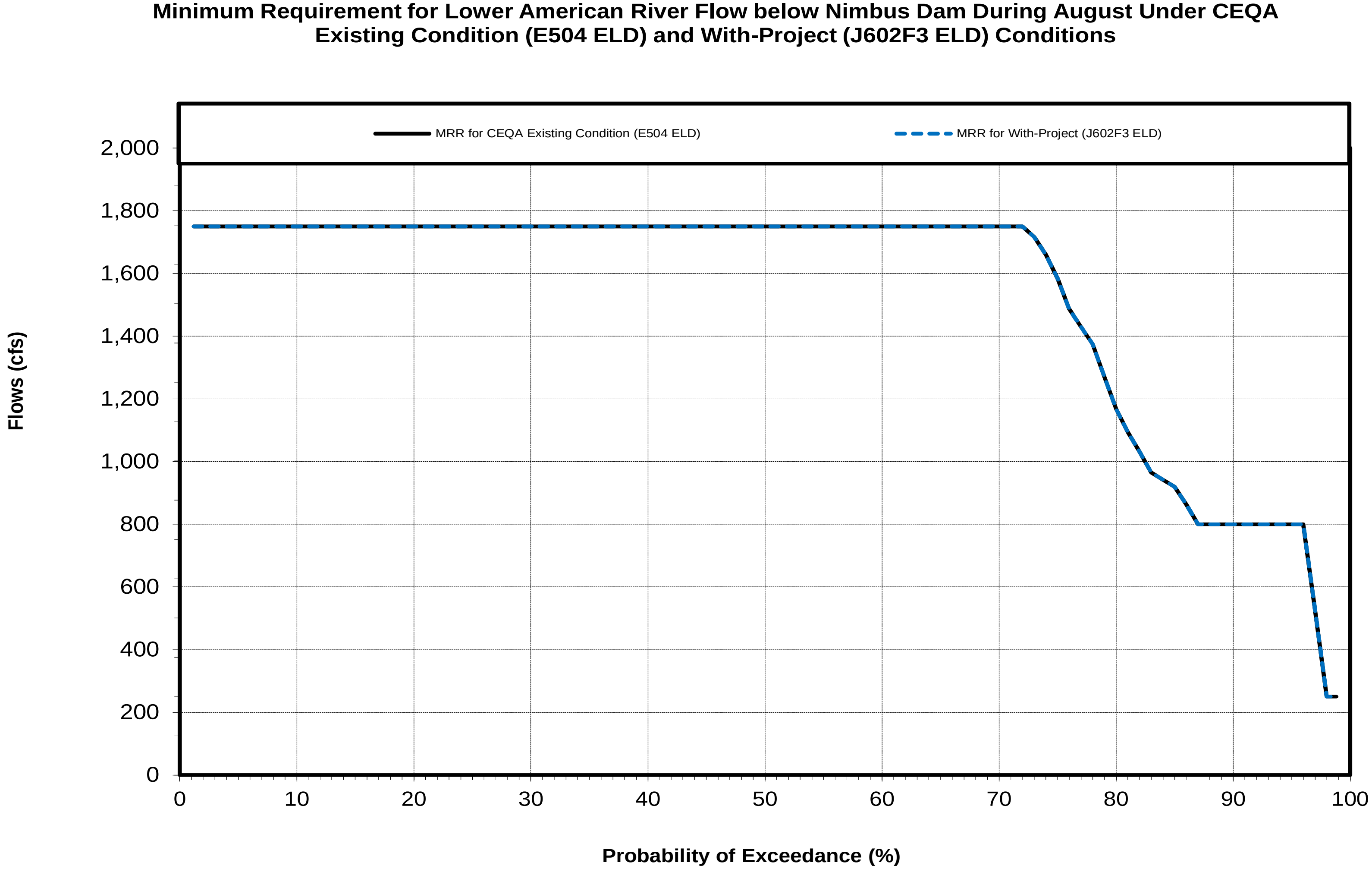
Figure 143 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

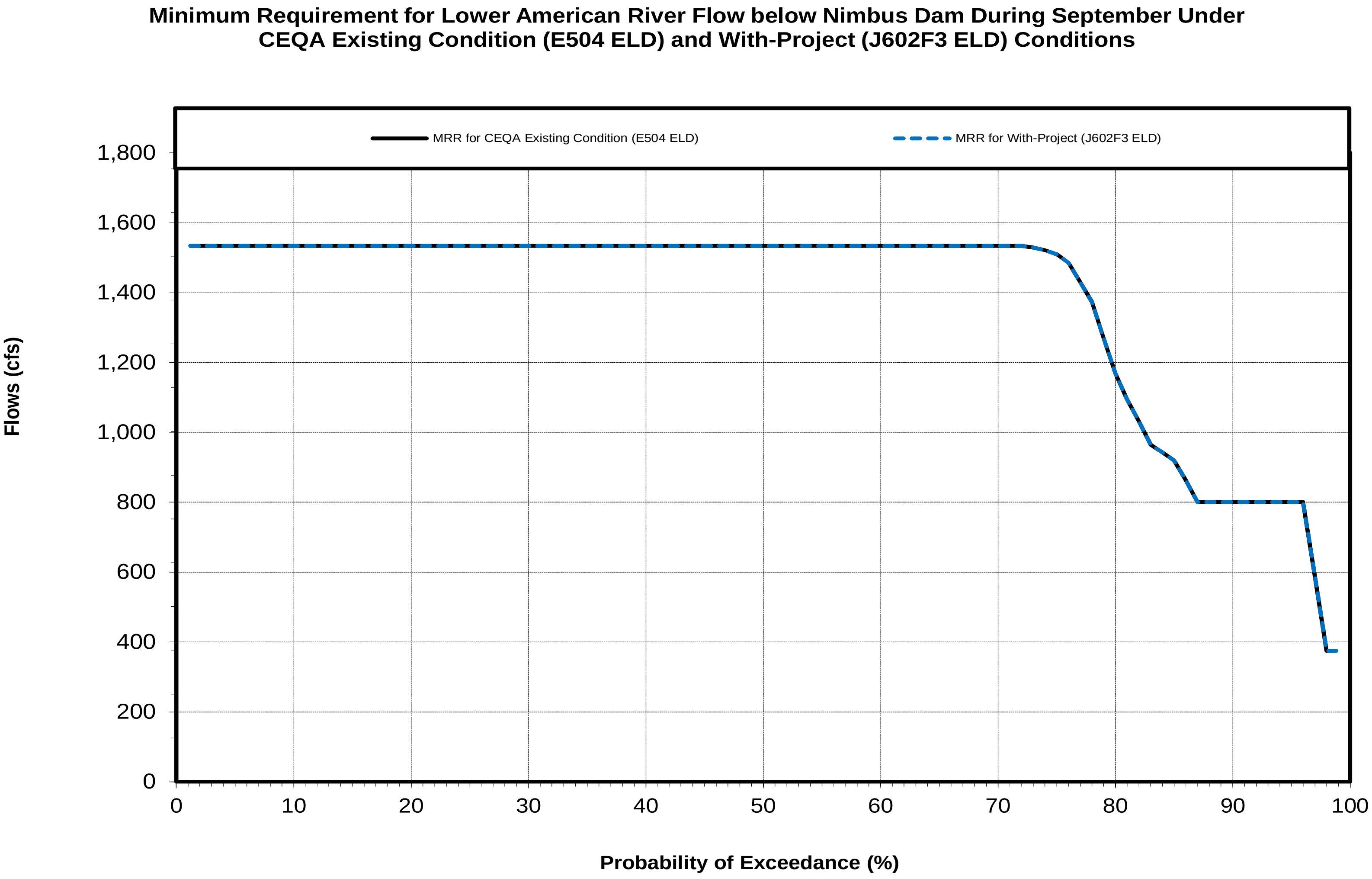
Figure 144 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

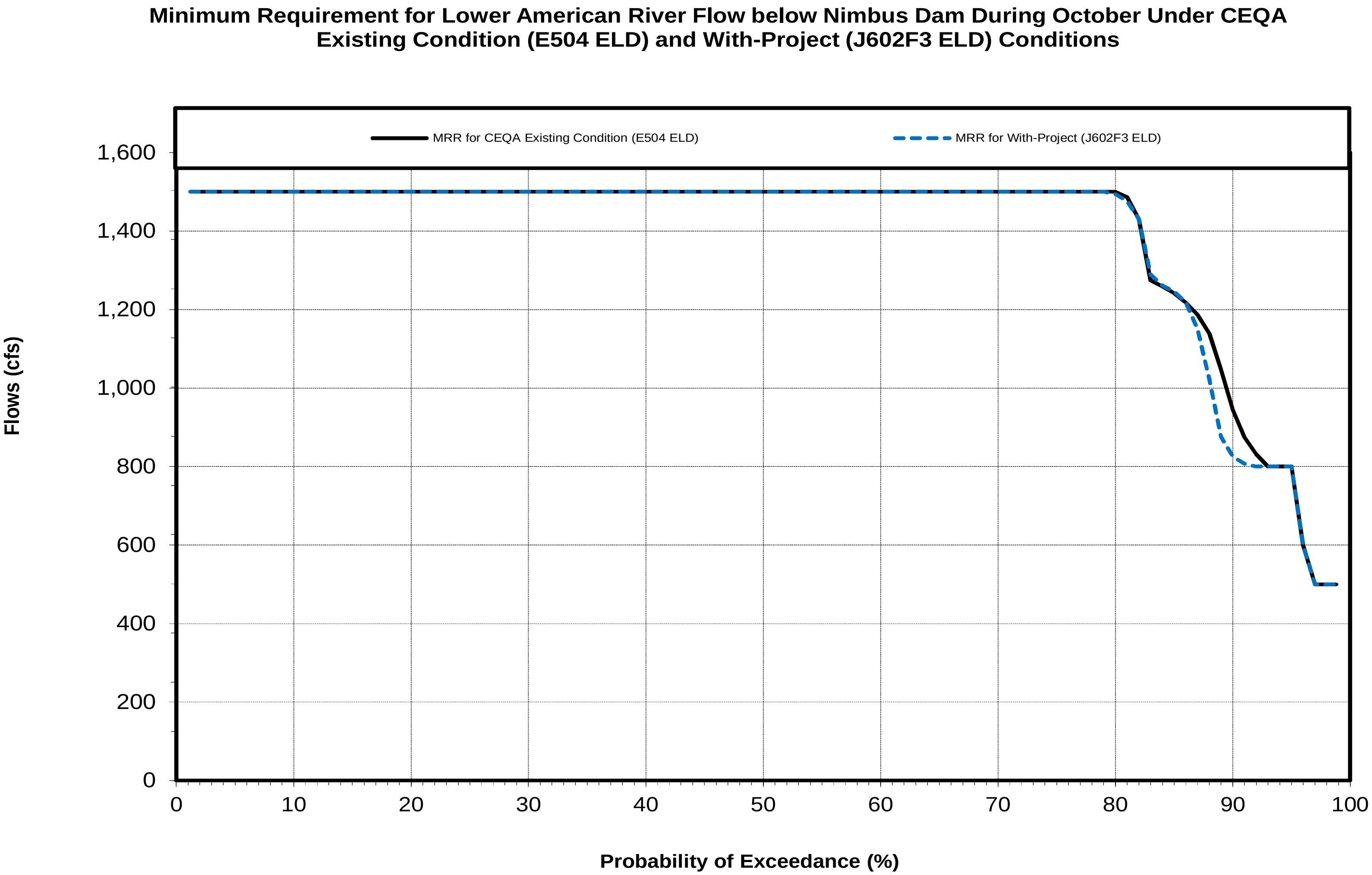
Figure 145 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

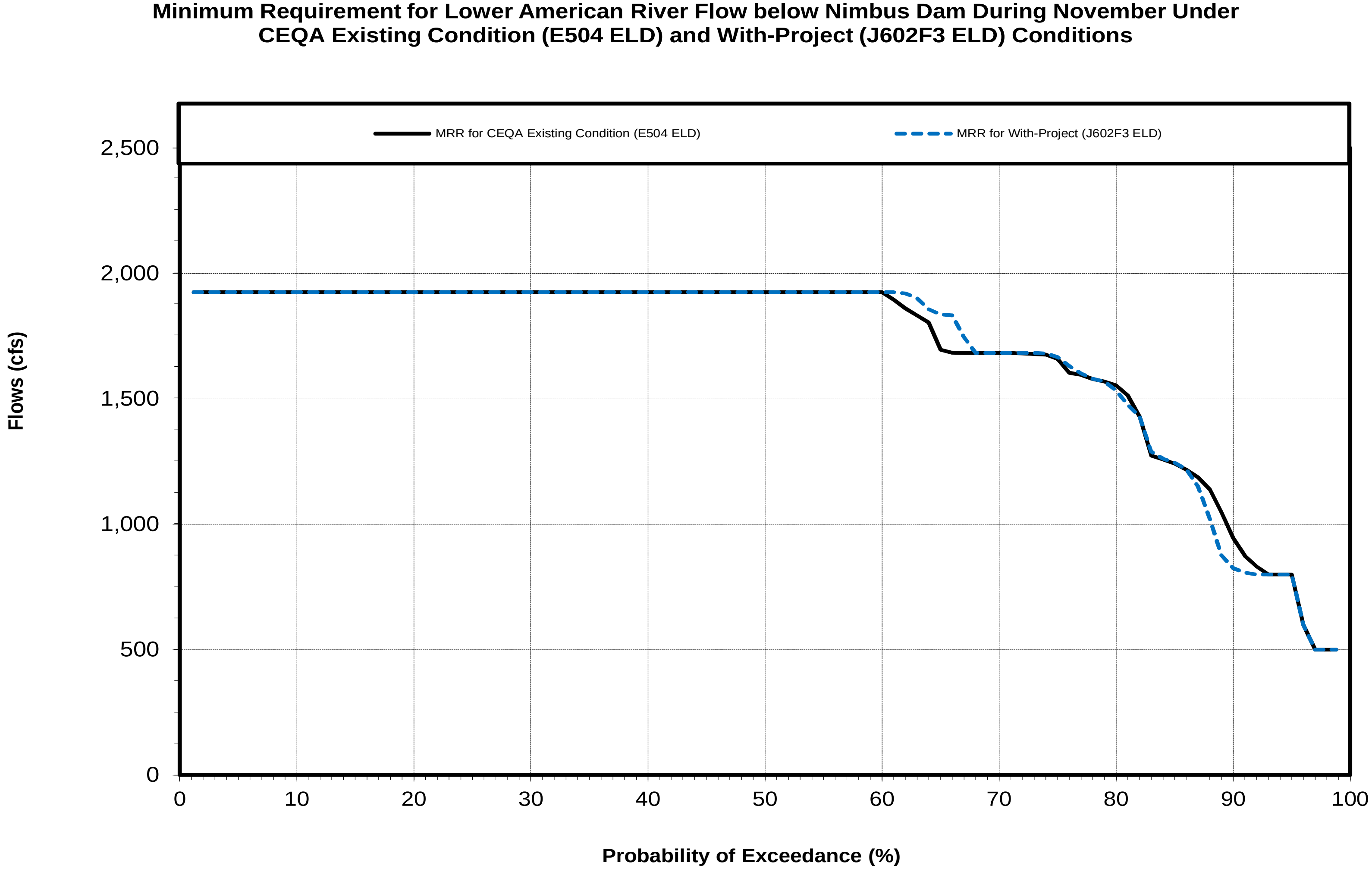
Figure 146 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

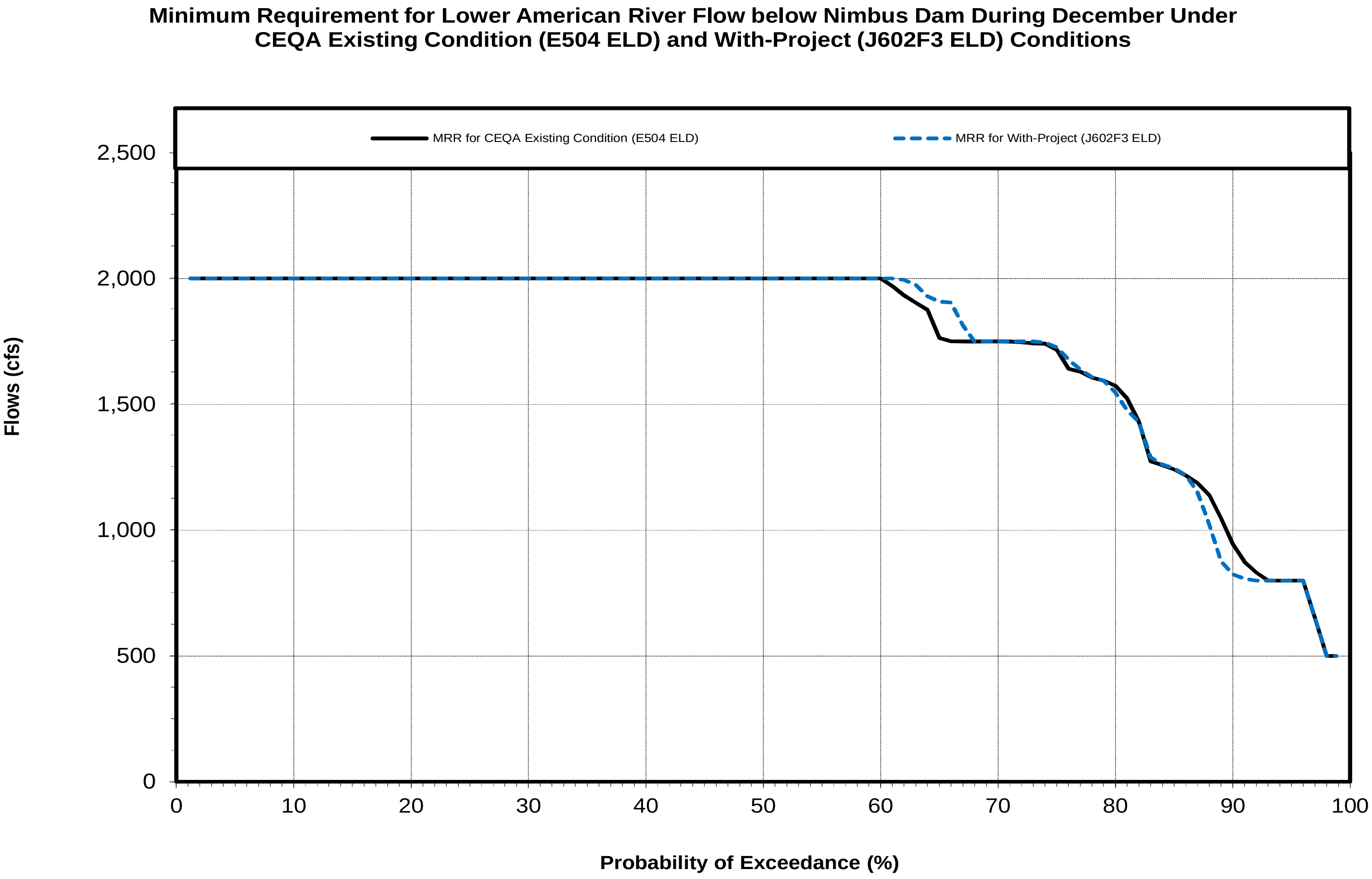
Figure 147 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 148 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 169 E504ELD-J602F3ELD

X2 Location Counts of Occurrences East of Control Point – 82-year POR, Sorted by WYT

CEQA Existing Condition (E504 ELD)					
WYT	Month				
W	Feb	Mar	Apr	May	Jun
81 km	1	0	0	0	0
74 km	1	0	0	0	0
64 km	3	0	0	2	5
AN	Feb	Mar	Apr	May	Jun
81 km	1	0	0	0	0
74 km	1	0	0	0	0
64 km	6	1	0	1	7
BN	Feb	Mar	Apr	May	Jun
81 km	3	0	0	0	0
74 km	6	1	0	0	3
64 km	11	5	6	8	11
D	Feb	Mar	Apr	May	Jun
81 km	7	1	0	0	0
74 km	12	4	3	5	12
64 km	17	14	12	15	18
C	Feb	Mar	Apr	May	Jun
81 km	9	2	1	2	8
74 km	11	7	7	10	12
64 km	12	12	10	12	12

With-Project (J602F3 ELD)					
WYT	Month				
W	Feb	Mar	Apr	May	Jun
81 km	1	0	0	0	0
74 km	1	0	0	0	0
64 km	3	0	0	2	5
AN	Feb	Mar	Apr	May	Jun
81 km	1	0	0	0	0
74 km	1	0	0	0	0
64 km	6	1	0	1	7
BN	Feb	Mar	Apr	May	Jun
81 km	3	0	0	0	0
74 km	6	1	0	0	4
64 km	11	5	6	8	11
D	Feb	Mar	Apr	May	Jun
81 km	7	1	0	0	0
74 km	12	4	3	4	12
64 km	17	14	13	15	18
C	Feb	Mar	Apr	May	Jun
81 km	9	2	1	2	8
74 km	11	7	7	10	12
64 km	12	12	10	12	12

Table 170 E504ELD-J602F3ELD

Period of Record Average, Maximum, and Minimum X2 Position

CEQA Existing Condition (E504 ELD)

	Month											
X2_PRV	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average (km)	83.5	83.9	82.3	76.3	67.4	60.3	60.7	63.5	67.7	74.6	80.4	85.5
Max (km)	93.2	94.8	94.9	93.0	88.5	84.2	81.9	82.2	86.9	90.0	90.8	92.2
Min (km)	66.8	67.3	51.5	47.3	47.2	47.2	47.2	47.3	48.3	49.4	57.3	66.1
StdDv (km)	7.9	8.5	9.4	13.0	13.9	11.1	9.8	9.6	10.1	9.4	6.2	3.9

With-Project (J602F3 ELD)

	Month											
X2_PRV	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average (km)	83.5	84.0	82.3	76.3	67.4	60.4	60.7	63.4	67.6	74.6	80.4	85.5
Max (km)	93.2	94.8	94.8	93.0	88.3	84.2	82.0	82.2	86.9	90.0	90.8	92.2
Min (km)	66.8	67.3	51.9	47.3	47.2	47.2	47.2	47.3	48.3	49.4	57.3	66.1
StdDv (km)	7.9	8.5	9.4	13.0	13.8	11.0	9.8	9.7	10.0	9.3	6.2	3.9

Relative Difference

	Month											
X2_PRV	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average (km)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	-0.1	0.0	0.0	0.0
Max (km)	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Min (km)	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 171 E504ELD-J602F3ELD

Evaluation of Relative Change in X2 Location (82-year POR) - CEQA Existing Condition (E504 ELD) Versus With-Project (J602F3 ELD)

	Month											
Change in X2 (km)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Maximum Monthly Change	0.3	1.1	1.2	0.5	0.3	1.0	1.1	0.9	0.7	0.8	0.6	0.2
Minimum Monthly Change	-0.8	-0.8	-0.6	-0.4	-0.7	-0.5	-0.9	-1.0	-3.1	-1.7	-0.1	-0.2
	Change in X2 Location - Count											
No Change	1	1	1	1	1	0	0	0	1	0	0	0
Positive Shift	43	43	47	45	51	58	33	21	18	39	47	50
Negative Shift	38	38	34	36	30	24	49	61	63	43	35	32

Alternative - Baseline
Positive Shift - Alternative is farther East than Baseline
Negative Shift - Baseline is farther East than Alternative

Table 172 E504ELD-J602F3ELD

Evaluation of Shift in Position of the X2 Location (82-year POR) - CEQA Existing Condition (E504 ELD) Versus With-Project (J602F3 ELD)

	Month											
Positive Shift (Count)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Change GE 1.0 km	0	1	1	0	0	1	1	0	0	0	0	0
Change GT 0.5 km and LT 1.0 km	0	0	2	1	0	1	5	2	1	1	1	0
Change GE 0.25 and LE 0.5 km	1	1	1	3	2	10	2	5	0	1	1	0

Table 173 E504ELD-J602F3ELD

Count of Occurrences of X2 Location Exceeding Fall Standards

	Count of occurrences			
	Following Wet Years		Following Above Normal Years	
Model	Sept > 74 km	Oct > 74 km	Sept > 81 km	Oct > 81 km
CEQA Existing Condition (E504 ELD)	23	0	12	0
With-Project (J602F3 ELD)	23	0	12	0

Table 174 E504ELD-J602F3ELD

Delta Outflow Objectives

CEQA Existing Condition (E504 ELD)

Water Year Type	Count < Delta Standard								
	July	Aug	Sep	Oct	Nov	Dec	Jana	Janb	
Wet	0	0	0	0	0	0	0	0	
AN	0	0	0	0	0	0	0	0	
BN	0	0	0	0	0	0	0	0	
D	0	0	0	0	0	0	0	0	a January Standard of 4,500 cfs
C	0	0	0	0	0	0	0	0	b January Standard of 6,000 cfs

With-Project (J602F3 ELD)

Water Year Type	Count < Delta Standard								
	July	Aug	Sep	Oct	Nov	Dec	Jana	Janb	
Wet	0	0	0	0	0	0	0	0	
AN	0	0	0	0	0	0	0	0	
BN	0	0	0	0	0	0	0	0	
D	0	0	0	0	0	0	0	0	a January Standard of 4,500 cfs
C	0	0	0	0	0	0	0	0	b January Standard of 6,000 cfs

Table 175 E504ELD-J602F3ELD

Period of Record Average, Maximum, and Minimum OMR Flows (cfs)

CEQA Existing Condition (E504 ELD)

	Month											
OMR	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	-6453	-6704	-6570	-3649	-3331	-2903	859	257	-3713	-9213	-8627	-8219
Max	-2035	-2467	4686	24818	14508	25389	7742	5534	350	-1394	-2011	-2910
Min	-10416	-10491	-9953	-5000	-5000	-5000	-1520	-1851	-5000	-11772	-11302	-10390
StdDv	1988	2155	2571	3485	2872	4010	1868	1528	1504	2772	2812	2355

With-Project (J602F3 ELD)

	Month											
OMR	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	-6459	-6711	-6577	-3639	-3336	-2906	859	257	-3743	-9201	-8636	-8235
Max	-2034	-2467	4686	24818	14508	25389	7742	5534	350	-1394	-2011	-2911
Min	-10416	-10491	-9967	-5000	-5000	-5000	-1520	-1851	-5000	-11752	-11302	-10390
StdDv	2001	2140	2562	3488	2871	4008	1868	1529	1477	2806	2814	2355

Table 176 E504ELD-J602F3ELD

Evaluation of Relative Change in OMR Flows - CEQA Existing Condition (E504 ELD) Versus With-Project (J602F3 ELD)

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Positive Flows	Month											
CFS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
minimum	0	0	0	0	-109	-121	-7	0	0	0	0	0
maximum	0	0	0	84	84	0	1	1	0	0	0	0
Negative result indicates alternative has smaller magnitude OMR flow												
Positive result indicates alternative has greater magnitude OMR flow												

Reverse Flows	Month											
CFS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
minimum	-880	-748	-286	-45	-611	-71	-5	-58	-2350	-484	-582	-1186
maximum	727	848	116	793	296	76	0	0	1	1348	458	580
Negative result signifies alternative model OMR is more negative; larger magnitude reverse flow												
Positive result signifies alternative model OMR is less negative; smaller magnitude reverse flow												

Table 177 E504ELD-J602F3ELD

Count of Occurrences, greater than 150 mg/L for Monthly Interval for Rock Slough Salinity

CEQA Existing Condition (E504 ELD)

	Month											
Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	9	9	4	2	0	0	0	0	0	0	0	0
AN	7	7	6	4	0	0	0	0	0	0	0	0
BN	7	8	8	7	3	0	0	0	0	0	0	0
D	5	9	10	8	2	0	0	0	0	0	0	0
C	6	9	9	8	6	0	0	0	0	0	0	4

With-Project (J602F3 ELD)

	Month											
Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
W	9	9	4	2	0	0	0	0	0	0	0	0
AN	7	7	6	4	0	0	0	0	0	0	0	0
BN	6	8	8	7	3	0	0	0	0	0	0	0
D	4	9	10	8	2	0	0	0	0	0	0	0
C	6	9	9	8	6	0	0	0	0	0	0	3

Maximum variation observed: below bormal water year type; year 1935
CEQA Existing Condition (E504 ELD) = 171.79 mg/L
With-Project (J602F3 ELD) = 184.35 mg/L

Table 178 E504ELD-J602F3ELD

Monthly Average CVP Facilities Generation, Capacity, Project Use, and Net Generation at Load Center

CVP Facilities Period of Record [1]

Average Monthly CVP Generation at Load Center (GWh)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	310	312	328	368	495	534	645	513	398	296	264	258	4,721
Alternative - With-Project (J602F3 ELD)	311	310	333	374	497	534	644	513	398	296	265	260	4,735
Difference	1	(2)	5	6	2	0	(1)	0	0	0	1	2	14
Percent Difference	0.3	(0.6)	1.5	1.6	0.4	0.0	(0.2)	0.0	0.0	0.0	0.4	0.8	0.3

Average Monthly CVP Capacity at Load Center (MW)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Baseline - CEQA Existing Condition (E504 ELD)	1,581	1,647	1,712	1,757	1,762	1,735	1,686	1,600	1,540	1,505	1,499	1,522	1,629
Alternative - With-Project (J602F3 ELD)	1,583	1,651	1,716	1,758	1,762	1,735	1,686	1,600	1,539	1,505	1,497	1,522	1,630
Difference	2	4	4	1	0	0	0	0	(1)	0	(2)	0	1
Percent Difference	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	(0.1)	0.0	(0.1)	0.0	0.1

Average Monthly CVP Project Use at Load Center (GWh)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	114	99	96	40	55	82	134	120	93	98	129	131	1,190
Alternative - With-Project (J602F3 ELD)	114	99	96	40	55	82	134	121	94	98	130	131	1,194
Difference	0	0	0	0	0	0	0	1	1	0	1	0	4
Percent Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	1.1	0.0	0.8	0.0	0.3

Average Monthly CVP Net Project Generation at Load Center (GWh)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	196	213	232	329	441	452	511	393	304	198	135	127	3,531
Alternative - With-Project (J602F3 ELD)	197	211	236	334	443	452	510	393	304	198	135	128	3,541
Difference	1	(2)	4	5	2	0	(1)	0	0	0	0	1	10
Percent Difference	0.5	(0.9)	1.7	1.5	0.5	0.0	(0.2)	0.0	0.0	0.0	0.0	0.8	0.3

Notes: 1. The average quantity for the calendar years 1922-2002.

2. Driest Periods is the average quantity for the calendar years 1929-1934, 1976-1977, and 1987-1992.

Table 179 E504ELD-J602F3ELD

Monthly Average CVP Facilities Driest Years Generation, Capacity, Project Use, and Net Generation at Load Center

CVP Facilities Dry Years [2]

Average Monthly CVP Generation at Load Center (GWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	169	123	151	257	332	412	508	395	193	186	126	117	2,969
Alternative - With-Project (J602F3 ELD)	168	121	149	260	332	411	507	390	193	187	129	117	2,964
Difference	(1)	(2)	(2)	3	0	(1)	(1)	(5)	0	1	3	0	(5)
Percent Difference	(0.6)	(1.6)	(1.3)	1.2	0.0	(0.2)	(0.2)	(1.3)	0.0	0.5	2.4	0.0	(0.2)

Average Monthly CVP Capacity at Load Center (MW)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Baseline - CEQA Existing Condition (E504 ELD)	1,341	1,390	1,468	1,513	1,503	1,458	1,385	1,257	1,151	1,124	1,105	1,147	1,320
Alternative - With-Project (J602F3 ELD)	1,340	1,395	1,469	1,514	1,497	1,458	1,383	1,257	1,151	1,123	1,105	1,148	1,320
Difference	(1)	5	1	1	(6)	0	(2)	0	0	(1)	0	1	0
Percent Difference	(0.1)	0.4	0.1	0.1	(0.4)	0.0	(0.1)	0.0	0.0	(0.1)	0.0	0.1	0.0

Average Monthly CVP Project Use at Load Center (GWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	96	67	49	28	38	34	81	91	63	70	74	102	794
Alternative - With-Project (J602F3 ELD)	95	67	46	28	38	36	81	90	65	71	76	103	796
Difference	(1)	0	(3)	0	0	2	0	(1)	2	1	2	1	2
Percent Difference	(1.0)	0.0	(6.1)	0.0	0.0	5.9	0.0	(1.1)	3.2	1.4	2.7	1.0	0.3

Average Monthly CVP Net Project Generation at Load Center (GWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	73	55	102	229	294	378	428	303	130	115	52	15	2,175
Alternative - With-Project (J602F3 ELD)	73	54	103	232	294	375	426	300	128	116	53	14	2,168
Difference	0	(1)	1	3	0	(3)	(2)	(3)	(2)	1	1	(1)	(7)
Percent Difference	0.0	(1.8)	1.0	1.3	0.0	(0.8)	(0.5)	(1.0)	(1.5)	0.9	1.9	(6.7)	(0.3)

Notes: 1. The average quantity for the calendar years 1922-2002.

2. Driest Periods is the average quantity for the calendar years 1929-1934, 1976-1977, and 1987-1992.

Table 180 E504ELD-J602F3ELD

Monthly Average SWP Facilities Generation, Capacity, Project Use, and Net Generation at Load Center

SWP Facilities Period of Record [1]

Average Monthly SWP Facilities Generation at Load Center (GWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	218	241	288	325	417	428	562	457	458	334	288	295	4,309
Alternative -With-Project (J602F3 ELD)	218	240	287	324	418	428	561	457	457	334	287	295	4,306
Difference	0	(1)	(1)	(1)	1	0	(1)	0	(1)	0	(1)	0	(3)
Percent Difference	0.0	(0.4)	(0.3)	(0.3)	0.2	0.0	(0.2)	0.0	(0.2)	0.0	(0.3)	0.0	(0.1)

Average Monthly SWP Facilities Capacity at Load Center (MW)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Baseline - CEQA Existing Condition (E504 ELD)	792	957	1,044	1,105	1,136	1,119	1,120	1,045	990	860	792	835	983
Alternative -With-Project (J602F3 ELD)	790	953	1,043	1,104	1,136	1,116	1,118	1,044	990	857	792	832	981
Difference	(2)	(4)	(1)	(1)	0	(3)	(2)	(1)	0	(3)	0	(3)	(2)
Percent Difference	(0.3)	(0.4)	(0.1)	(0.1)	0.0	(0.3)	(0.2)	(0.1)	0.0	(0.3)	0.0	(0.4)	(0.2)

Average Monthly SWP Facilities Project Use at Load Center (GWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	381	435	498	498	643	715	906	934	898	764	678	729	8,079
Alternative -With-Project (J602F3 ELD)	379	433	496	496	643	716	906	935	898	764	676	728	8,071
Difference	(2)	(2)	(2)	(2)	0	1	0	1	0	0	(2)	(1)	(8)
Percent Difference	(0.5)	(0.5)	(0.4)	(0.4)	0.0	0.1	0.0	0.1	0.0	0.0	(0.3)	(0.1)	(0.1)

Average Monthly SWP Net Project Generation at Load Center (GWh)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	(163)	(194)	(210)	(173)	(226)	(287)	(344)	(477)	(440)	(430)	(391)	(434)	(3,770)
Alternative -With-Project (J602F3 ELD)	(161)	(194)	(209)	(172)	(225)	(288)	(344)	(478)	(441)	(430)	(390)	(434)	(3,765)
Difference	2	0	1	1	1	(1)	0	(1)	(1)	0	1	0	5
Percent Difference	(1.2)	0.0	(0.5)	(0.6)	(0.4)	0.3	0.0	0.2	0.2	0.0	(0.3)	0.0	(0.1)

Notes: 1. The average quantity for the calendar years 1922-2002.

2. Driest Periods is the average quantity for the calendar years 1929-1934, 1976-1977, and 1987-1992.

Table 181 E504ELD-J602F3ELD

Monthly Average SWP Facilities Driest Years Generation, Capacity, Project Use, and Net Generation at Load Center

SWP Facilities Dry Years [2]

Average Monthly SWP Generation at Load Center (GWh)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	67	81	76	116	209	277	341	266	190	133	126	158	2,040
Alternative -With-Project (J602F3 ELD)	67	80	77	116	209	280	336	265	192	132	124	158	2,036
Difference	0	(1)	1	0	0	3	(5)	(1)	2	(1)	(2)	0	(4)
Percent Difference	0.0	(1.2)	1.3	0.0	0.0	1.1	(1.5)	(0.4)	1.1	(0.8)	(1.6)	0.0	(0.2)

Average Monthly SWP Capacity at Load Center (MW)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
Baseline - CEQA Existing Condition (E504 ELD)	412	532	653	720	819	831	695	549	462	363	315	378	561
Alternative -With-Project (J602F3 ELD)	412	533	654	721	820	817	691	549	462	351	310	375	558
Difference	0	1	1	1	1	(14)	(4)	0	0	(12)	(5)	(3)	(3)
Percent Difference	0.0	0.2	0.2	0.1	0.1	(1.7)	(0.6)	0.0	0.0	(3.3)	(1.6)	(0.8)	(0.5)

Average Monthly SWP Project Use at Load Center (GWh)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	170	200	151	128	333	445	557	546	546	332	330	450	4,188
Alternative -With-Project (J602F3 ELD)	169	200	152	128	334	447	554	547	547	333	324	447	4,183
Difference	(1)	0	1	0	1	2	(3)	1	1	1	(6)	(3)	(5)
Percent Difference	(0.6)	0.0	0.7	0.0	0.3	0.4	(0.5)	0.2	0.2	0.3	(1.8)	(0.7)	(0.1)

Average Monthly SWP Net Project Generation at Load Center (GWh)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Baseline - CEQA Existing Condition (E504 ELD)	(103)	(119)	(75)	(12)	(124)	(168)	(216)	(280)	(357)	(199)	(203)	(292)	(2,148)
Alternative -With-Project (J602F3 ELD)	(103)	(120)	(75)	(13)	(124)	(168)	(218)	(282)	(355)	(201)	(200)	(289)	(2,147)
Difference	0	(1)	0	(1)	0	0	(2)	(2)	2	(2)	3	3	1
Percent Difference	0.0	0.8	0.0	8.3	0.0	0.0	0.9	0.7	(0.6)	1.0	(1.5)	(1.0)	0.0

Notes: 1. The average quantity for the calendar years 1922-2002.

2. Driest Periods is the average quantity for the calendar years 1929-1934, 1976-1977, and 1987-1992.

Table 182 E504ELD-J602F3ELD

Long-term and Water Year Type Average of CVP San Luis Reservoir End of Month Storage Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Storage (TAF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	241	368	534	651	732	798	707	546	363	230	151	178
With-Project (J602F3 ELD)	241	370	536	652	734	799	707	546	363	228	150	178
Difference	0	2	2	1	2	1	0	0	0	-2	-1	0
Percent Difference[3]	0.0	0.5	0.4	0.2	0.3	0.1	0.0	0.0	0.0	-0.9	-0.7	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	240	376	540	667	785	885	792	626	465	277	166	193
With-Project (J602F3 ELD)	239	376	540	667	786	885	791	625	463	275	164	190
Difference	-1	0	0	0	1	0	-1	-1	-2	-2	-2	-3
Percent Difference	-0.4	0.0	0.0	0.0	0.1	0.0	-0.1	-0.2	-0.4	-0.7	-1.2	-1.6
Above Normal												
CEQA Existing Condition (E504 ELD)	208	344	517	630	712	817	706	524	346	174	103	128
With-Project (J602F3 ELD)	207	344	516	630	711	816	704	522	342	167	95	125
Difference	-1	0	-1	0	-1	-1	-2	-2	-4	-7	-8	-3
Percent Difference	-0.5	0.0	-0.2	0.0	-0.1	-0.1	-0.3	-0.4	-1.2	-4.0	-7.8	-2.3
Below Normal												
CEQA Existing Condition (E504 ELD)	271	408	585	683	745	813	715	550	360	257	190	242
With-Project (J602F3 ELD)	270	407	583	683	746	813	715	549	358	256	188	241
Difference	-1	-1	-2	0	1	0	0	-1	-2	-1	-2	-1
Percent Difference	-0.4	-0.2	-0.3	0.0	0.1	0.0	0.0	-0.2	-0.6	-0.4	-1.1	-0.4
Dry												
CEQA Existing Condition (E504 ELD)	225	345	521	643	717	744	649	479	264	189	105	135
With-Project (J602F3 ELD)	225	348	523	644	717	742	646	475	263	187	109	140
Difference	0	3	2	1	0	-2	-3	-4	-1	-2	4	5
Percent Difference	0.0	0.9	0.4	0.2	0.0	-0.3	-0.5	-0.8	-0.4	-1.1	3.8	3.7
Critical												
CEQA Existing Condition (E504 ELD)	263	361	498	608	648	654	599	489	310	211	189	186
With-Project (J602F3 ELD)	271	372	511	618	658	664	608	499	320	217	193	190
Difference	8	11	13	10	10	10	9	10	10	6	4	4
Percent Difference	3.0	3.0	2.6	1.6	1.5	1.5	1.5	2.0	3.2	2.8	2.1	2.2

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 183 E504ELD-J602F3ELD

Long-term and Water Year Type Average of SWP San Luis Reservoir End of Month Storage Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Storage (TAF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	342	338	435	580	706	822	728	558	395	401	348	371
With-Project (J602F3 ELD)	339	335	432	577	703	820	727	556	394	400	346	367
Difference	-3	-3	-3	-3	-3	-2	-1	-2	-1	-1	-2	-4
Percent Difference[3]	-0.9	-0.9	-0.7	-0.5	-0.4	-0.2	-0.1	-0.4	-0.3	-0.2	-0.6	-1.1
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	382	384	460	611	763	919	787	576	443	453	456	495
With-Project (J602F3 ELD)	377	379	455	606	759	915	784	574	441	450	453	491
Difference	-5	-5	-5	-5	-4	-4	-3	-2	-2	-3	-3	-4
Percent Difference	-1.3	-1.3	-1.1	-0.8	-0.5	-0.4	-0.4	-0.3	-0.5	-0.7	-0.7	-0.8
Above Normal												
CEQA Existing Condition (E504 ELD)	321	299	437	576	689	809	678	462	288	299	314	372
With-Project (J602F3 ELD)	319	298	438	576	690	809	679	462	288	299	314	372
Difference	-2	-1	1	0	1	0	1	0	0	0	0	0
Percent Difference	-0.6	-0.3	0.2	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Below Normal												
CEQA Existing Condition (E504 ELD)	342	337	441	566	691	806	687	490	290	334	361	405
With-Project (J602F3 ELD)	342	336	441	565	687	803	683	487	289	334	359	397
Difference	0	-1	0	-1	-4	-3	-4	-3	-1	0	-2	-8
Percent Difference	0.0	-0.3	0.0	-0.2	-0.6	-0.4	-0.6	-0.6	-0.3	0.0	-0.6	-2.0
Dry												
CEQA Existing Condition (E504 ELD)	298	310	421	578	692	786	735	618	442	476	317	314
With-Project (J602F3 ELD)	291	303	413	571	688	784	735	617	445	476	314	312
Difference	-7	-7	-8	-7	-4	-2	0	-1	3	0	-3	-2
Percent Difference	-2.3	-2.3	-1.9	-1.2	-0.6	-0.3	0.0	-0.2	0.7	0.0	-0.9	-0.6
Critical												
CEQA Existing Condition (E504 ELD)	344	320	394	538	640	698	689	605	449	356	182	144
With-Project (J602F3 ELD)	346	320	395	536	638	696	687	603	448	356	182	143
Difference	2	0	1	-2	-2	-2	-2	-2	-1	0	0	-1
Percent Difference	0.6	0.0	0.3	-0.4	-0.3	-0.3	-0.3	-0.3	-0.2	0.0	0.0	-0.7

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 184 E504ELD-J602F3ELD

Long-term and Water Year Type Average of San Luis Reservoir End of Month Storage Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Storage (TAF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	583	706	969	1,231	1,439	1,620	1,435	1,104	758	631	499	549
With-Project (J602F3 ELD)	580	704	968	1,229	1,437	1,618	1,433	1,102	757	628	496	546
Difference	-3	-2	-1	-2	-2	-2	-2	-2	-1	-3	-3	-3
Percent Difference[3]	-0.5	-0.3	-0.1	-0.2	-0.1	-0.1	-0.1	-0.2	-0.1	-0.5	-0.6	-0.5
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	622	760	1,000	1,279	1,548	1,804	1,579	1,202	907	730	622	688
With-Project (J602F3 ELD)	616	755	995	1,273	1,544	1,800	1,576	1,199	904	725	617	682
Difference	-6	-5	-5	-6	-4	-4	-3	-3	-3	-5	-5	-6
Percent Difference	-1.0	-0.7	-0.5	-0.5	-0.3	-0.2	-0.2	-0.2	-0.3	-0.7	-0.8	-0.9
Above Normal												
CEQA Existing Condition (E504 ELD)	529	643	954	1,206	1,400	1,625	1,384	986	634	473	417	501
With-Project (J602F3 ELD)	527	642	954	1,206	1,402	1,625	1,383	984	630	466	409	497
Difference	-2	-1	0	0	2	0	-1	-2	-4	-7	-8	-4
Percent Difference	-0.4	-0.2	0.0	0.0	0.1	0.0	-0.1	-0.2	-0.6	-1.5	-1.9	-0.8
Below Normal												
CEQA Existing Condition (E504 ELD)	612	745	1,026	1,249	1,436	1,618	1,402	1,039	650	592	551	647
With-Project (J602F3 ELD)	612	743	1,024	1,247	1,433	1,616	1,398	1,036	647	590	547	638
Difference	0	-2	-2	-2	-3	-2	-4	-3	-3	-2	-4	-9
Percent Difference	0.0	-0.3	-0.2	-0.2	-0.2	-0.1	-0.3	-0.3	-0.5	-0.3	-0.7	-1.4
Dry												
CEQA Existing Condition (E504 ELD)	523	656	942	1,221	1,410	1,530	1,384	1,097	706	665	422	449
With-Project (J602F3 ELD)	515	651	936	1,215	1,405	1,526	1,380	1,092	708	663	422	451
Difference	-8	-5	-6	-6	-5	-4	-4	-5	2	-2	0	2
Percent Difference	-1.5	-0.8	-0.6	-0.5	-0.4	-0.3	-0.3	-0.5	0.3	-0.3	0.0	0.4
Critical												
CEQA Existing Condition (E504 ELD)	607	681	892	1,146	1,288	1,352	1,288	1,094	758	567	371	329
With-Project (J602F3 ELD)	616	692	906	1,154	1,296	1,360	1,296	1,102	767	573	375	334
Difference	9	11	14	8	8	8	8	8	9	6	4	5
Percent Difference	1.5	1.6	1.6	0.7	0.6	0.6	0.6	0.7	1.2	1.1	1.1	1.5

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 185 E504ELD-J602F3ELD

Winter-run Chinook Salmon in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	November through July	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
			Bend Bridge		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
			Verona		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1		
			Freeport		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	64		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
				68		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
			Bend Bridge	64		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
				68		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
			Feather River Confluence	64		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0		
				68		All Years		0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	-0.1		
			Freeport	64		All Years		0.0	0.0	0.0	0.0	0.0	-0.6	-0.6	0.0	0.0		
				68		All Years		0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.0		
Adult Holding	November through July	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
			Bend Bridge		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
				65		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
			Bend Bridge	61		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6		
				65		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Spawning and Embryo Incubation	April through August	Mean Monthly Flow (cfs)	Below Keswick Dam		10	All Years							0.0	0.0	0.0	0.0	0.0	
			Bend Bridge		10	All Years							0.0	0.0	0.0	0.0	0.0	
	April through September	Mean Monthly Water Temperature (°F)	Below Keswick Dam	56		All Years							0.0	0.0	0.0	0.2	-0.2	0.0
				58		All Years							0.0	0.0	0.0	0.0	0.0	0.1
			Ball's Ferry	56		All Years							0.0	0.0	0.0	0.2	-0.6	-1.2
				58		All Years							0.0	0.0	0.0	0.1	0.0	0.5
			Jelly's Ferry	56		All Years							0.0	0.0	0.0	0.0	0.0	-0.7
				58		All Years							0.0	0.0	0.0	0.2	-2.5	-1.0
			Bend Bridge	56		All Years							0.0	1.3	1.2	1.3	1.2	-1.4
				58		All Years							0.0	-1.2	0.2	0.3	-2.4	-2.4
Juvenile Rearing and Downstream Movement*	July through March	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
			Bend Bridge		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0				-6.1	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61		All Years	-1.0	0.0	0.0	0.0	0.0	0.0				0.0	-0.1	0.0
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
			Bend Bridge	61		All Years	0.1	0.0	0.0	0.0	0.0	0.0				0.6	-0.2	0.4
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.1	0.0
			Feather River Confluence	61		All Years	1.2	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	-1.2
			Freeport	61		All Years	0.0	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0
				65		All Years	0.1	0.0	0.0	0.0	0.0	0.0				0.0	0.0	0.0

Table 186 E504ELD-J602F3ELD

Spring-run Chinook Salmon in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	March through September	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Bend Bridge		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Verona		10	Lower 40%						0.0	0.0	0.0	0.0	-6.1	0.0	0.0
			Freeport		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	64		All Years						0.0	0.0	0.0	0.0	0.0	0.0	-0.2
				68		All Years						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Bend Bridge	64		All Years						0.0	0.0	0.0	0.0	0.0	0.4	-0.3
				68		All Years						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Feather River Confluence	64		All Years						0.0	0.0	0.2	0.0	0.0	0.0	0.2
				68		All Years						0.0	0.0	-0.2	0.0	-0.1	0.0	0.0
			Freeport	64		All Years						0.0	-0.6	-0.6	0.0	0.0	0.0	0.0
				68		All Years						0.0	0.0	-0.4	0.0	0.0	0.0	0.0
Adult Holding	March through September	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Bend Bridge		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61		All Years						0.0	0.0	0.0	0.0	0.0	-0.1	0.0
				65		All Years						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Bend Bridge	61		All Years						0.0	0.0	0.0	0.0	0.6	-0.2	0.4
				65		All Years						0.0	0.0	0.0	0.0	0.0	0.1	0.0
Spawning and Embryo Incubation	September and October	Mean Monthly Flow (cfs)	Below Keswick Dam		10	All Years	0.0											0.0
			Bend Bridge		10	All Years	0.0											0.0
	September through January	Mean Monthly Water Temperature (°F)	Below Keswick Dam	56		All Years	-1.2	0.0	0.0	0.0								0.0
				58		All Years	0.0	0.0	0.0	0.0								0.1
			Ball's Ferry	56		All Years	-0.6	0.0	0.0	0.0								-1.2
				58		All Years	0.9	0.0	0.0	0.0								0.5
			Jelly's Ferry	56		All Years	1.2	0.0	0.0	0.0								-0.7
				58		All Years	0.7	0.0	0.0	0.0								-1.0
			Bend Bridge	56		All Years	1.2	0.0	0.0	0.0								-1.4
				58		All Years	0.6	0.0	0.0	0.0								-2.4
Juvenile Rearing (and Downstream Movement)	Year-round	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Bend Bridge		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61		All Years	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Bend Bridge	61		All Years	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	-0.2	0.4
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
			Feather River Confluence	61		All Years	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2
Smolt Emigration	October through May	Mean Monthly Flow (cfs)	Red Bluff		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
		Mean Monthly Water Temperature (°F)	Red Bluff	63		All Years	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
			Feather River Confluence	63		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2				
			Freeport	63		All Years	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-0.6				
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4				

Table 187 E504ELD-J602F3ELD

Fall-run Chinook Salmon in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Staging	July through December	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0							0.0	0.0	0.0
			Red Bluff		10	Lower 40%	0.0	0.0	0.0							0.0	0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0							-6.1	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0							0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	64		All Years	0.1	0.0	0.0							0.0	0.0	-0.2
				68		All Years	0.0	0.0	0.0							0.0	0.0	0.0
			Red Bluff	64		All Years	0.1	0.0	0.0							1.6	0.1	-0.1
				68		All Years	0.0	0.0	0.0							0.0	1.1	0.0
			Feather River Confluence	64		All Years	0.2	0.0	0.0							0.0	0.0	0.2
				68		All Years	0.0	0.0	0.0							-0.1	0.0	0.0
			Freeport	64		All Years	-0.1	0.0	0.0							0.0	0.0	0.0
				68		All Years	0.0	0.0	0.0							0.0	0.0	0.0
Spawning and Embryo Incubation	October through December	Mean Monthly Flow (cfs)	Below Keswick Dam		10	All Years	0.0	0.0	0.0									
			Bend Bridge		10	All Years	0.0	0.0	0.0									
	October through March	Mean Monthly Water Temperature (°F)	Below Keswick Dam	56		All Years	-1.2	0.0	0.0	0.0	0.0	0.0						
				58		All Years	0.0	0.0	0.0	0.0	0.0	0.0						
			Ball's Ferry	56		All Years	-0.6	0.0	0.0	0.0	0.0	0.0						
				58		All Years	0.9	0.0	0.0	0.0	0.0	0.0						
			Jelly's Ferry	56		All Years	1.2	0.0	0.0	0.0	0.0	0.0						
				58		All Years	0.7	0.0	0.0	0.0	0.0	0.0						
			Bend Bridge	56		All Years	1.2	0.0	0.0	0.0	0.0	0.0						
				58		All Years	0.6	0.0	0.0	0.0	0.0	0.0						
Juvenile Rearing and Downstream Movement	December through July	Mean Monthly Flow (cfs)	Bend Bridge		10	Lower 40%			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
			Verona		10	Lower 40%			0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1		
			Freeport		10	Lower 40%			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61		All Years			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
				65		All Years			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
			Bend Bridge	61		All Years			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6		
				65		All Years			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
			Freeport	61		All Years			0.0	0.0	0.0	0.0	-3.1	0.0	0.0	0.0		
				65		All Years			0.0	0.0	0.0	0.0	-0.2	-1.2	0.0	0.0		

Table 188 E504ELD-J602F3ELD

Late Fall-run Chinook Salmon in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Staging	October through April	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
			Red Bluff		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	64		All Years	0.1	0.0	0.0	0.0	0.0	0.0	0.0					
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
			Red Bluff	64		All Years	0.1	0.0	0.0	0.0	0.0	0.0	0.0					
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
			Feather River Confluence	64		All Years	0.2	0.0	0.0	0.0	0.0	0.0	0.0					
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
			Freeport	64		All Years	-0.1	0.0	0.0	0.0	0.0	0.0	-0.6					
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Spawning and Embryo Incubation	January through April	Mean Monthly Flow (cfs)	Below Keswick Dam		10	All Years				0.0	0.0	0.0	0.0					
			Bend Bridge		10	All Years				0.0	0.0	0.0	0.0					
	January through June	Mean Monthly Water Temperature (°F)	Below Keswick Dam	56		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
				58		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
			Ball's Ferry	56		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
				58		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
			Jelly's Ferry	56		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
				58		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
			Bend Bridge	56		All Years				0.0	0.0	0.0	0.0	1.3	1.2			
				58		All Years				0.0	0.0	0.0	0.0	-1.2	0.2			
Juvenile Rearing and Downstream Movement	April through December	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0				0.0	0.0	0.0	-6.1	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61		All Years	-1.0	0.0	0.0				0.0	0.0	0.0	0.0	-0.1	0.0
				65		All Years	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
			Bend Bridge	61		All Years	0.1	0.0	0.0				0.0	0.0	0.0	0.6	-0.2	0.4
				65		All Years	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.1	0.0
			Freeport	61		All Years	0.0	0.0	0.0				-3.1	0.0	0.0	0.0	0.0	0.0
				65		All Years	0.1	0.0	0.0				-0.2	-1.2	0.0	0.0	0.0	0.0

Table 189 E504ELD-J602F3ELD

Steelhead in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	August through March	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Red Bluff		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	64		All Years	0.1	0.0	0.0	0.0	0.0	0.0					0.0	-0.2
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Red Bluff	64		All Years	0.1	0.0	0.0	0.0	0.0	0.0					0.1	-0.1
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0					1.1	0.0
			Feather River Confluence	64		All Years	0.2	0.0	0.0	0.0	0.0	0.0					0.0	0.2
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Freeport	64		All Years	-0.1	0.0	0.0	0.0	0.0	0.0					0.0	0.0
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
Adult Holding	August through March	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Bend Bridge		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61		All Years	-1.0	0.0	0.0	0.0	0.0	0.0					-0.1	0.0
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Bend Bridge	61		All Years	0.1	0.0	0.0	0.0	0.0	0.0					-0.2	0.4
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.1	0.0
Spawning and Embryo Incubation	December through April	Mean Monthly Flow (cfs)	Below Keswick Dam		10	All Years			0.0	0.0	0.0	0.0	0.0					
			Bend Bridge		10	All Years			0.0	0.0	0.0	0.0	0.0					
	December through May	Mean Monthly Water Temperature (°F)	Below Keswick Dam	54		All Years			0.0	0.0	0.0	0.0	0.0	0.0				
				57		All Years			0.0	0.0	0.0	0.0	0.0	0.0				
			Bend Bridge	54		All Years			0.0	0.0	0.0	0.0	0.0	0.2				
				57		All Years			0.0	0.0	0.0	0.0	0.0	-2.4				
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Bend Bridge		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Bend Bridge	65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Feather River Confluence	65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	-0.1	0.0	0.0
Smolt Emigration	January through June	Mean Monthly Flow (cfs)	Red Bluff		10	Lower 40%				0.0	0.0	0.0	0.0	0.0	0.0			
			Verona		10	Lower 40%				0.0	0.0	0.0	0.0	0.0	0.0			
			Freeport		10	Lower 40%				0.0	0.0	0.0	0.0	0.0	0.0			
		Mean Monthly Water Temperature (°F)	Red Bluff	52		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
				55		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
			Feather River Confluence	52		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
				55		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
			Freeport	52		All Years				0.0	-0.4	-1.3	0.0	0.0	0.0			
				55		All Years				0.0	0.0	1.2	-0.2	0.0	0.0			

Table 190 E504ELD-J602F3ELD

Green Sturgeon in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Holding	February through July	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%					0.0	0.0	0.0	0.0	0.0	0.0		
			Red Bluff		10	Lower 40%					0.0	0.0	0.0	0.0	0.0	0.0		
			Freeport		10	Lower 40%					0.0	0.0	0.0	0.0	0.0	0.0		
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61		All Years					0.0	0.0	0.0	0.0	0.0	0.0		
			Red Bluff	61		All Years					0.0	0.0	0.0	0.0	0.0	0.1		
			Freeport	61		All Years					0.0	0.0	-3.1	0.0	0.0	0.0		
Spawning and Embryo Incubation	March through August	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	
			Red Bluff		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	
			Wilkins Slough		10	Lower 40%						0.0	0.0	0.0	0.0	-3.0	0.0	
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	63		All Years						0.0	0.0	0.0	0.0	0.0	0.0	
			Red Bluff	63		All Years						0.0	0.0	0.0	0.0	0.5	0.0	
			Wilkins Slough	63		All Years						0.0	0.1	-0.2	0.0	0.0	0.0	
Adult Post-Spawning Holding and Emigration	July through November	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0								0.0	0.0	0.0
			Red Bluff		10	Lower 40%	0.0	0.0								0.0	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0								0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61		All Years	-1.0	0.0								0.0	-0.1	0.0
			Red Bluff	61		All Years	0.4	0.0								0.1	-0.2	-0.6
			Freeport	61		All Years	0.0	0.0								0.0	0.0	0.0
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Red Bluff		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Wilkins Slough		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Red Bluff	66		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Wilkins Slough	66		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	-0.6
			Freeport	66		All Years	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0

Table 191 E504ELD-J602F3ELD

White Sturgeon in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Holding	November through May	Mean Monthly Flow (cfs)	Red Bluff		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
			Wilkins Slough		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
			Freeport		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
		Mean Monthly Water Temperature (°F)	Red Bluff	77		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
			Wilkins Slough	77		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
			Freeport	77		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Spawning and Egg Incubation	February through June	Mean Monthly Flow (cfs)	Red Bluff		10	Lower 40%					0.0	0.0	0.0	0.0	0.0			
			Verona		10	Lower 40%					0.0	0.0	0.0	0.0	0.0			
			Freeport		10	Lower 40%					0.0	0.0	0.0	0.0	0.0			
		Mean Monthly Water Temperature (°F)	Red Bluff	61		All Years					0.0	0.0	0.0	0.0	0.0			
			Wilkins Slough	61		All Years					0.0	0.0	0.0	-0.1	0.0			
			Feather River Confluence	61		All Years					0.0	0.0	0.0	0.0	0.0			
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Wilkins Slough		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Wilkins Slough	66		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	-0.6
			Feather River Confluence	66		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	1.2
			Freeport	66		All Years	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0

Table 192 E504ELD-J602F3ELD

River Lamprey in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	September through June	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0
			Wilkins Slough		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	42-60[1]		All Years	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			-0.1
			Wilkins Slough	42-60		All Years	-1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0
			Freeport	42-60		All Years	2.5	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0			0.0
Spawning and Embryo Incubation	February through July	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%					0.0	0.0	0.0	0.0	0.0	0.0		
			Red Bluff		10	Lower 40%					0.0	0.0	0.0	0.0	0.0	0.0		
			Wilkins Slough		10	Lower 40%					0.0	0.0	0.0	0.0	0.0	-3.0		
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	50-64		All Years					0.0	1.3	0.0	0.0	0.1	0.0		
			Red Bluff	50-64		All Years					0.0	0.0	0.0	0.0	0.0	-1.6		
			Wilkins Slough	50-64		All Years					0.0	0.0	0.0	0.0	0.0	0.0		
Ammocoete Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Wilkins Slough		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Wilkins Slough	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	-0.2	0.0
			Freeport	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 193 E504ELD-J602F3ELD

Pacific Lamprey in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	January through June	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%				0.0	0.0	0.0	0.0	0.0	0.0			
			Wilkins Slough		10	Lower 40%				0.0	0.0	0.0	0.0	0.0	0.0			
			Freeport		10	Lower 40%				0.0	0.0	0.0	0.0	0.0	0.0			
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	42-60[1]		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
			Wilkins Slough	42-60		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
			Freeport	42-60		All Years				0.0	0.0	0.0	2.2	0.0	0.0			
Adult Spawning and Embryo Incubation	March through August	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	
			Red Bluff		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	
			Wilkins Slough		10	Lower 40%						0.0	0.0	0.0	0.0	-3.0	0.0	
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	50-64		All Years						1.3	0.0	0.0	0.1	0.0	1.2	
			Red Bluff	50-64		All Years						0.0	0.0	0.0	0.0	-1.6	-0.1	
			Wilkins Slough	50-64		All Years						0.0	0.0	0.0	0.0	0.0	0.0	
Ammocoete Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Wilkins Slough		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Wilkins Slough	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	-0.2	0.0
			Freeport	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 194 E504ELD-J602F3ELD

Hardhead in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adults and Other Lifestages	Year-round	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	61-77[1]		All Years	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
			Feather River Confluence	61-77		All Years	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Freeport	61-77		All Years	0.0	0.0	0.0	0.0	0.0	0.0	-3.1	0.0	0.0	0.0	0.0	0.0
Adult Spawning	April through June	Mean Monthly Flow (cfs)	Below Keswick Dam		10	Lower 40%							0.0	0.0	0.0			
			Wilkins Slough		10	Lower 40%							0.0	0.0	0.0			
			Freeport		10	Lower 40%							0.0	0.0	0.0			
		Mean Monthly Water Temperature (°F)	Below Keswick Dam	59-64		All Years							0.0	0.0	0.0			
			Wilkins Slough	59-64		All Years							1.2	0.0	0.0			
			Freeport	59-64		All Years							-0.3	0.6	0.0			

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 195 E504ELD-J602F3ELD

American Shad in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Spawning	April through June	Mean Monthly Flow (cfs)	Red Bluff		10	Lower 40%							0.0	0.0	0.0			
			Verona		10	Lower 40%							0.0	0.0	0.0			
			Freeport		10	Lower 40%							0.0	0.0	0.0			
		Mean Monthly Water Temperature (°F)	Red Bluff	60-70[1]		All Years							0.0	0.0	0.1			
			Feather River Confluence	60-70		All Years							0.0	0.0	0.0			
			Freeport	60-70		All Years							-2.2	-0.2	1.2			
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Wilkins Slough		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1	0.0	0.0
			Freeport		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Mean Monthly Water Temperature (°F)	Wilkins Slough	63-77		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.2	0.0	0.0	0.0	1.3
			Feather River Confluence	63-77		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Freeport	63-77		All Years	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-0.6	0.0	0.0	0.0	-0.2

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 196 E504ELD-J602F3ELD

Striped Bass in the Sacramento River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Spawning	April through June	Mean Monthly Flow (cfs)	Wilkins Slough		10	Lower 40%							0.0	0.0	0.0			
			Verona		10	Lower 40%							0.0	0.0	0.0			
		Mean Monthly Water Temperature (°F)	Wilkins Slough	59-68[1]		All Years							1.2	0.0	-1.2			
			Feather River Confluence	59-68		All Years							0.0	0.2	0.0			
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Wilkins Slough		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	0.0
			Verona		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1	0.0	0.0
		Mean Monthly Water Temperature (°F)	Wilkins Slough	61-71		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.7	0.0	0.9	0.0
			Feather River Confluence	61-71		All Years	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.3	0.0	0.0	0.0

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 197 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Sacramento River below Keswick Dam, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	72.0	74.4	87.8	96.3	90.2	96.3	85.4	82.9	84.1	85.4	85.4	78.0
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	6.1	23.2	9.8	2.4	8.5	2.4	11.0	11.0	2.4	0.0	6.1	13.4
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	17.1	1.2	2.4	0.0	1.2	1.2	3.7	3.7	12.2	13.4	8.5	8.5
Net Change in % Exceedance:	-11.0	22.0	7.3	2.4	7.3	1.2	7.3	7.3	-9.8	-13.4	-2.4	4.9
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	72.7	72.7	90.9	100.0	100.0	97.0	90.9	72.7	93.9	81.8	78.8	75.8
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	12.1	27.3	9.1	0.0	0.0	3.0	6.1	21.2	3.0	0.0	6.1	18.2
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	6.1	0.0	0.0	0.0	0.0	0.0	3.0	0.0	3.0	18.2	15.2	6.1
Net Change in % Exceedance:	6.1	27.3	9.1	0.0	0.0	3.0	3.0	21.2	0.0	-18.2	-9.1	12.1
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 198 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Sacramento River at Bend Bridge, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	70.7	84.1	87.8	100.0	93.9	96.3	87.8	78.0	93.9	82.9	87.8	86.6
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	11.0	13.4	7.3	0.0	4.9	2.4	8.5	14.6	0.0	0.0	7.3	8.5
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	15.9	2.4	2.4	0.0	1.2	1.2	3.7	6.1	6.1	17.1	3.7	3.7
Net Change in % Exceedance:	-4.9	11.0	4.9	0.0	3.7	1.2	4.9	8.5	-6.1	-17.1	3.7	4.9
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	72.7	78.8	87.9	100.0	97.0	93.9	78.8	66.7	97.0	81.8	81.8	93.9
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	15.2	18.2	9.1	0.0	3.0	6.1	12.1	30.3	0.0	0.0	9.1	3.0
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	9.1	3.0	0.0	0.0	0.0	0.0	9.1	0.0	3.0	18.2	6.1	3.0
Net Change in % Exceedance:	6.1	15.2	9.1	0.0	3.0	6.1	3.0	30.3	-3.0	-18.2	3.0	0.0
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 199 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Sacramento River below Red Bluff Diversion Dam, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	70.7	84.1	87.8	98.8	93.9	95.1	91.5	79.3	82.9	82.9	85.4	84.1
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	8.5	12.2	8.5	1.2	4.9	3.7	4.9	12.2	2.4	0.0	8.5	8.5
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	15.9	3.7	2.4	0.0	1.2	1.2	3.7	4.9	13.4	14.6	4.9	6.1
Net Change in % Exceedance:	-7.3	8.5	6.1	1.2	3.7	2.4	1.2	7.3	-11.0	-14.6	3.7	2.4
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	78.8	81.8	87.9	100.0	97.0	90.9	81.8	72.7	97.0	81.8	84.8	84.8
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	9.1	15.2	12.1	0.0	3.0	9.1	9.1	21.2	3.0	0.0	9.1	9.1
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	6.1	3.0	0.0	0.0	0.0	0.0	9.1	0.0	0.0	18.2	3.0	3.0
Net Change in % Exceedance:	3.0	12.1	12.1	0.0	3.0	9.1	0.0	21.2	3.0	-18.2	6.1	6.1
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 200 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Sacramento River at Wilkins Slough, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	73.2	78.0	96.3	100.0	97.6	95.1	95.1	85.4	68.3	61.0	79.3	79.3
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	7.3	15.9	3.7	0.0	2.4	2.4	3.7	7.3	4.9	1.2	8.5	12.2
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
X<-1.0 (Total %)	17.1	4.9	0.0	0.0	0.0	0.0	1.2	6.1	26.8	32.9	11.0	8.5
Net Change in % Exceedance:	-9.8	11.0	3.7	0.0	2.4	2.4	2.4	1.2	-22.0	-31.7	-2.4	3.7
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	72.7	75.8	90.9	100.0	97.0	93.9	87.9	81.8	63.6	66.7	75.8	72.7
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	15.2	18.2	9.1	0.0	3.0	6.1	9.1	15.2	9.1	0.0	12.1	15.2
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
X<-1.0 (Total %)	12.1	3.0	0.0	0.0	0.0	0.0	3.0	0.0	27.3	30.3	9.1	12.1
Net Change in % Exceedance:	3.0	15.2	9.1	0.0	3.0	6.1	6.1	15.2	-18.2	-30.3	3.0	3.0
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	0.0

Table 201 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Sacramento River at Verona, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	74.4	78.0	93.9	100.0	95.1	98.8	91.5	75.6	80.5	84.1	84.1	79.3
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	8.5	11.0	4.9	0.0	3.7	1.2	6.1	19.5	2.4	0.0	6.1	4.9
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0
X<-1.0 (Total %)	13.4	8.5	0.0	0.0	1.2	0.0	2.4	3.7	12.2	12.2	8.5	14.6
Net Change in % Exceedance:	-4.9	2.4	4.9	0.0	2.4	1.2	3.7	15.9	-9.8	-12.2	-2.4	-9.8
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.4	0.0	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	66.7	69.7	90.9	100.0	90.9	97.0	84.8	63.6	75.8	72.7	69.7	69.7
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	12.1	9.1	9.1	0.0	6.1	3.0	15.2	27.3	3.0	0.0	15.2	9.1
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	0.0	0.0
X<-1.0 (Total %)	18.2	18.2	0.0	0.0	3.0	0.0	0.0	6.1	12.1	24.2	15.2	21.2
Net Change in % Exceedance:	-6.1	-9.1	9.1	0.0	3.0	3.0	15.2	21.2	-9.1	-24.2	0.0	-12.1
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.1	0.0	0.0

Table 202 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Sacramento River at Freeport, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	86.6	80.5	84.1	92.7	59.8	46.3	52.4	67.1	86.6	84.1	86.6	87.8
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	7.3	8.5	4.9	1.2	1.2	37.8	39.0	28.0	2.4	4.9	7.3	7.3
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	4.9	8.5	9.8	6.1	37.8	14.6	4.9	4.9	9.8	9.8	3.7	3.7
Net Change in % Exceedance:	2.4	0.0	-4.9	-4.9	-36.6	23.2	34.1	23.2	-7.3	-4.9	3.7	3.7
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	93.9	75.8	87.9	100.0	72.7	57.6	78.8	54.5	84.8	63.6	66.7	78.8
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	0.0	9.1	6.1	0.0	0.0	21.2	21.2	36.4	0.0	12.1	18.2	12.1
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	6.1	12.1	3.0	0.0	27.3	21.2	0.0	9.1	12.1	21.2	9.1	9.1
Net Change in % Exceedance:	-6.1	-3.0	3.0	0.0	-27.3	0.0	21.2	27.3	-12.1	-9.1	9.1	3.0
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 203 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Sacramento River below Keswick Dam, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	96.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	94.4	97.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	88.6	96.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	94.8	56.1	85.0	98.7	98.8	98.8	98.8	98.8	98.8	98.8
48	97.4	98.8	62.2	2.0	43.9	86.0	98.2	58.5	15.9	98.8	98.8	93.5
49	96.9	98.8	40.2	1.2	28.0	74.4	75.6	11.6	8.1	78.0	98.8	92.8
50	96.3	98.8	20.1	1.2	13.4	58.5	13.4	1.8	4.7	23.2	80.5	89.7
52	93.6	89.7	7.8	1.2	4.3	35.4	1.2	1.2	1.2	9.4	35.4	75.6
53	91.1	81.7	3.3	1.2	1.6	23.2	1.2	1.2	1.2	7.9	21.5	61.0
54	84.1	63.4	1.6	1.2	1.2	11.0	1.2	1.2	1.2	6.0	16.7	52.8
55	75.6	35.4	1.2	1.2	1.2	6.1	1.2	1.2	1.2	5.5	12.0	40.9
56	62.2	24.4	1.2	1.2	1.2	2.4	1.2	1.2	1.2	5.1	9.8	23.2
57	39.0	14.6	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.4	9.4	20.4
58	30.5	7.5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	9.1	15.5
59	21.5	3.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.8	8.8	13.4
60	17.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	8.1	11.7
61	11.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.0	9.6
62	3.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.6	8.5
63	2.9	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.3	8.1
64	1.9	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.0	7.6
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.7	6.1
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.2
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	93.6	54.9	83.8	97.5	97.6	97.6	97.6	97.6	97.6	97.6
50-64	94.4	97.6	18.9	0.0	12.2	57.3	12.2	0.6	3.5	22.0	75.5	82.1
55-56	13.4	11.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.4	2.2	17.7
59-64	19.6	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	3.8	5.8
59-68	20.3	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	7.6	12.2
59-75	20.3	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	7.6	12.2
60-70	16.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	10.5
61-71	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	8.4
63-69	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	6.9
63-77	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	6.9
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	4.9
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	81.4	97.6	97.6	93.2	95.9	97.6	97.6	97.6	97.6	97.6	90.7	87.1
61-77	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	8.4

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	96.6	98.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	94.4	97.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	87.8	96.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	94.8	56.1	84.1	98.6	98.8	98.8	98.8	98.8	98.8	98.8
48	97.4	98.8	62.2	2.0	43.9	86.0	98.2	58.5	17.1	98.8	98.8	93.5
49	96.9	98.8	40.2	1.2	24.4	73.2	73.2	10.4	8.3	78.0	98.8	92.8
50	96.3	98.8	20.1	1.2	13.4	59.8	13.4	1.8	4.8	23.2	81.7	89.5
52	94.2	89.6	7.8	1.2	4.3	35.4	1.2	1.2	1.2	9.6	32.9	74.4
53	91.5	81.7	3.3	1.2	1.6	23.2	1.2	1.2	1.2	8.6	21.5	62.6
54	86.9	62.2	1.6	1.2	1.2	11.0	1.2	1.2	1.2	6.0	16.5	52.4
55	75.6	36.6	1.2	1.2	1.2	6.1	1.2	1.2	1.2	5.6	10.8	36.6
56	61.0	24.4	1.2	1.2	1.2	2.4	1.2	1.2	1.2	5.3	9.6	23.2
57	37.8	14.6	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.9	9.3	20.4
58	30.5	7.5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	9.1	15.6
59	21.5	3.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.8	8.8	13.1
60	17.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	8.1	11.8
61	10.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.9	9.6
62	4.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.6	8.4
63	2.9	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.3	7.9
64	2.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.0	7.4
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.7	6.1
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.3
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	93.6	54.9	82.9	97.4	97.6	97.6	97.6	97.6	97.6	97.6
50-64	94.3	97.6	18.9	0.0	12.2	58.6	12.2	0.6	3.6	22.0	76.7	82.1
55-56	14.6	12.2	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.3	1.2	13.4
59-64	19.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	3.8	5.7
59-68	20.3	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	7.6	11.9
59-75	20.3	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	7.6	11.9
60-70	15.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9	10.6
61-71	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	8.4
63-69	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	6.7
63-77	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	6.7
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	4.9
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	81.7	97.6	97.6	93.2	95.9	97.6	97.6	97.6	97.6	97.6	90.7	87.0
61-77	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	8.4

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	-0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	-0.9	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	-3.6	-1.2	-2.4	-1.2	0.2	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.1	0.0	1.2	-0.2
52	0.6	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-2.5	-1.2
53	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	1.6
54	2.8	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.4
55	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-1.2	-4.3
56	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-0.2	0.0
57	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	-0.1	0.0
58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3
60	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
61	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
62	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
64	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	0.0	-0.9	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
50-64	-0.1	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.1	0.0	1.2	0.0
55-56	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-1.0	-4.3
59-64	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
59-68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3
59-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3
60-70	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
61-71	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0
63-69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
63-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
61-77	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0

Table 204 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Sacramento River at Balls Ferry, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	96.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	94.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.4	88.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	92.7	47.6	89.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	36.6	1.2	49.4	96.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.5	98.8	22.0	1.2	25.6	92.7	97.6	97.6	98.8	98.8	98.8	98.6
50	97.1	98.8	11.0	1.2	14.0	72.4	90.2	92.7	91.9	98.8	98.8	97.8
52	95.7	88.1	3.5	1.2	2.4	40.2	42.7	39.0	22.0	75.6	98.8	95.2
53	95.2	68.3	1.9	1.2	1.2	28.0	22.0	21.3	6.0	40.2	85.4	90.2
54	92.9	40.9	1.2	1.2	1.2	11.6	7.3	5.7	4.3	13.4	67.1	78.7
55	82.9	28.3	1.2	1.2	1.2	7.7	1.2	2.4	1.6	11.2	43.9	63.4
56	72.6	18.0	1.2	1.2	1.2	3.4	1.2	1.2	1.2	9.1	22.6	51.2
57	50.0	9.1	1.2	1.2	1.2	2.6	1.2	1.2	1.2	7.6	14.6	42.1
58	34.1	4.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.8	11.0	34.1
59	22.6	1.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.3	9.7	21.3
60	18.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.2	9.3	16.6
61	7.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.1	9.0	14.6
62	3.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	8.6	11.8
63	2.6	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.0	9.1
64	1.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.6	8.1
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.2	7.5
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.7	4.1
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	91.5	46.4	88.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	95.4	97.6	9.8	0.0	12.8	71.2	89.0	91.5	90.7	97.6	93.2	89.7
55-56	10.3	10.3	0.0	0.0	0.0	4.3	0.0	1.2	0.4	2.1	21.3	12.2
59-64	20.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	4.1	13.2
59-68	21.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	8.5	20.1
59-75	21.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	8.5	20.1
60-70	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	8.1	15.4
61-71	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	7.8	13.4
63-69	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.9
63-77	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.9
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	6.3
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	80.1	97.6	97.6	93.3	97.6	97.6	97.6	97.6	97.6	95.6	89.5	82.2
61-77	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	7.8	13.4

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	96.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	94.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.4	88.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	92.7	47.6	89.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	35.4	1.2	48.8	96.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.5	98.8	22.0	1.2	24.4	92.7	97.6	97.6	98.8	98.8	98.8	98.6
50	97.1	98.8	11.0	1.2	14.0	72.4	90.2	92.7	91.9	98.8	98.8	97.8
52	95.7	88.1	3.5	1.2	2.4	40.2	42.7	39.0	22.0	75.6	98.8	95.2
53	95.0	68.3	1.9	1.2	1.2	28.0	22.0	21.1	6.0	42.7	84.1	89.0
54	93.2	40.2	1.2	1.2	1.2	11.6	8.5	5.4	5.0	14.6	65.9	78.7
55	84.1	29.3	1.2	1.2	1.2	7.7	1.2	2.4	1.8	11.2	41.5	62.2
56	72.0	18.0	1.2	1.2	1.2	3.4	1.2	1.2	1.2	9.3	22.0	50.0
57	50.0	8.3	1.2	1.2	1.2	2.6	1.2	1.2	1.2	7.6	13.4	40.7
58	35.0	4.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.9	11.0	34.6
59	22.6	1.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.2	9.6	22.0
60	17.5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.3	9.3	16.5
61	7.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.2	9.0	14.3
62	4.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	8.6	11.7
63	2.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.0	8.8
64	1.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.6	8.0
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.2	7.4
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.4	4.0
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	91.5	46.4	88.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	95.3	97.6	9.8	0.0	12.8	71.2	89.0	91.5	90.7	97.6	93.2	89.8
55-56	12.1	11.3	0.0	0.0	0.0	4.3	0.0	1.2	0.6	1.9	19.5	12.2
59-64	20.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	4.0	14.0
59-68	21.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	8.4	20.8
59-75	21.4	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	8.4	20.8
60-70	16.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	8.1	15.3
61-71	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.8	13.1
63-69	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.6
63-77	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.6
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	6.2
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	81.3	97.6	97.6	93.3	97.6	97.6	97.6	97.6	97.6	94.5	89.5	82.3
61-77	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	7.8	13.1

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	-1.2	0.0	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	2.5	-1.3	-1.2
54	0.3	-0.7	0.0	0.0	0.0	0.0	1.2	-0.3	0.7	1.2	-1.2	0.0
55	1.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	-2.4	-1.2
56	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-0.6	-1.2
57	0.0	-0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	-1.4
58	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.5
59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.7
60	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	-0.1
61	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.3
62	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
63	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3
64	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-0.1
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-64	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
55-56	1.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-0.2	-1.8	0.0
59-64	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.8
59-68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.7
59-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.7
60-70	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	-0.1
61-71	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.3
63-69	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3
63-77	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1	0.0	0.1
61-77	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.3

Table 205 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Sacramento River at Jellys Ferry, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	97.7	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	96.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	93.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	93.3	57.3	97.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	27.4	1.2	54.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	9.1	1.2	25.0	97.3	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	98.6	5.9	1.2	6.1	93.9	98.8	98.8	98.8	98.8	98.8	98.8
52	96.5	84.1	1.9	1.2	1.2	53.7	92.7	98.8	96.3	98.8	98.8	97.6
53	95.8	57.9	1.2	1.2	1.2	29.3	73.2	97.1	86.0	97.9	98.8	96.7
54	95.3	29.3	1.2	1.2	1.2	9.5	53.7	87.8	61.0	78.7	98.8	93.1
55	91.9	19.5	1.2	1.2	1.2	3.6	28.0	56.1	34.1	53.7	86.6	84.1
56	80.5	12.6	1.2	1.2	1.2	2.7	9.8	29.3	18.3	26.8	70.7	74.4
57	63.4	6.1	1.2	1.2	1.2	1.2	1.2	14.6	7.3	11.4	40.2	56.1
58	40.2	1.8	1.2	1.2	1.2	1.2	1.2	8.5	1.2	10.2	22.0	46.7
59	23.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	1.2	7.3	13.2	39.0
60	18.9	1.2	1.2	1.2	1.2	1.2	1.2	2.0	1.2	6.4	10.8	27.4
61	5.9	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.4	9.6	19.5
62	3.7	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.3	9.1	15.2
63	2.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.4	8.6	12.8
64	1.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.5	8.5
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.6	7.7
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.1	4.9
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	92.1	56.1	95.8	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	97.4	97.4	4.7	0.0	4.9	92.7	97.6	97.6	97.6	97.6	92.3	90.3
55-56	11.4	6.9	0.0	0.0	0.0	0.9	18.2	26.8	15.8	26.9	15.9	9.7
59-64	21.8	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	6.1	6.7	30.5
59-68	22.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	6.1	12.0	37.8
59-75	22.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	6.1	12.0	37.8
60-70	17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	5.2	9.6	26.2
61-71	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	8.4	18.3
63-69	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	7.4	11.6
63-77	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	7.4	11.6
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	6.5
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	79.9	97.6	97.6	95.4	97.6	97.6	97.6	96.8	97.6	92.4	88.0	71.4
61-77	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	8.4	18.3

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	97.7	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	96.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	93.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	93.3	57.3	97.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	27.4	1.2	54.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	9.1	1.2	23.2	97.3	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	98.6	5.9	1.2	6.1	93.9	98.8	98.8	98.8	98.8	98.8	98.8
52	96.5	84.1	1.9	1.2	1.2	53.7	92.7	98.8	96.3	98.8	98.8	97.6
53	95.9	57.3	1.2	1.2	1.2	29.3	74.4	97.1	86.0	97.9	98.8	96.7
54	95.3	31.7	1.2	1.2	1.2	9.5	53.7	87.8	59.8	78.9	98.8	93.1
55	92.1	19.5	1.2	1.2	1.2	3.6	28.0	54.9	35.4	54.9	85.4	85.4
56	81.7	12.6	1.2	1.2	1.2	2.7	9.8	29.3	18.3	26.8	70.7	73.7
57	61.0	6.1	1.2	1.2	1.2	1.2	1.2	14.6	7.3	11.6	37.8	56.1
58	40.9	1.8	1.2	1.2	1.2	1.2	1.2	8.5	1.2	10.4	19.5	45.7
59	23.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	1.2	7.3	12.9	37.8
60	17.1	1.2	1.2	1.2	1.2	1.2	1.2	2.0	1.2	6.5	10.7	28.0
61	6.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.5	9.5	19.5
62	4.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.9	9.1	15.0
63	2.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.6	8.7	13.6
64	1.5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.7	8.4
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.7	7.7
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.1	3.9
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	92.1	56.1	95.8	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	97.3	97.4	4.7	0.0	4.9	92.7	97.6	97.6	97.6	97.6	92.1	90.4
55-56	10.4	6.9	0.0	0.0	0.0	0.9	18.2	25.6	17.1	28.1	14.7	11.7
59-64	21.7	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	6.1	6.2	29.4
59-68	22.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	6.1	11.7	36.6
59-75	22.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	6.1	11.7	36.6
60-70	15.9	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	5.3	9.5	26.8
61-71	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	8.3	18.3
63-69	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	7.5	12.4
63-77	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	7.5	12.4
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	6.5
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	81.7	97.6	97.6	95.4	97.6	97.6	97.6	96.8	97.6	92.3	88.1	70.8
61-77	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	8.3	18.3

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	-1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.1	-0.6	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0
54	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.2	0.0	0.0
55	0.2	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	1.3	1.2	-1.2	1.3
56	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.7
57	-2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-2.4	0.0
58	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-2.5	-1.0
59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-1.2
60	-1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	0.6
61	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	0.0
62	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	-0.2
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.8
64	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-0.1
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-64	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.1
55-56	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	1.3	1.2	-1.2	2.0
59-64	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.5	-1.1
59-68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-1.2
59-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-1.2
60-70	-1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	0.6
61-71	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	0.0
63-69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.8
63-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.8
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.1	-0.6
61-77	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	0.0

Table 206 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Sacramento River at Bend Bridge, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	97.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	96.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	93.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	91.5	54.9	97.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	26.4	1.2	54.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	9.1	1.2	26.8	97.3	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	98.3	5.7	1.2	6.1	93.9	98.8	98.8	98.8	98.8	98.8	98.8
52	96.6	80.5	1.7	1.2	1.2	57.3	94.4	98.8	98.8	98.8	98.8	98.0
53	95.9	53.7	1.2	1.2	1.2	30.5	79.3	98.3	92.1	98.8	98.8	97.1
54	95.4	29.3	1.2	1.2	1.2	9.8	57.3	94.3	79.9	91.1	98.8	95.1
55	92.3	19.2	1.2	1.2	1.2	3.7	31.1	67.1	50.0	69.5	91.5	90.2
56	81.7	12.2	1.2	1.2	1.2	2.8	11.5	40.2	25.6	40.2	75.6	75.4
57	64.6	4.9	1.2	1.2	1.2	1.2	1.8	19.5	9.8	14.6	53.7	61.0
58	40.9	1.2	1.2	1.2	1.2	1.2	1.2	11.3	1.8	10.8	28.0	50.0
59	25.0	1.2	1.2	1.2	1.2	1.2	1.2	4.5	1.2	9.5	15.2	41.0
60	19.5	1.2	1.2	1.2	1.2	1.2	1.2	2.6	1.2	6.9	12.0	29.3
61	6.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.9	9.8	21.3
62	4.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.8	9.3	15.6
63	2.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.7	8.8	14.0
64	1.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	7.7	8.8
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.8	7.8
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.3	5.3
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	90.3	53.7	95.8	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	97.4	97.1	4.5	0.0	4.9	92.7	97.6	97.6	97.6	97.6	91.1	90.0
55-56	10.6	7.0	0.0	0.0	0.0	0.9	19.6	26.9	24.4	29.3	15.9	14.8
59-64	23.6	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	8.3	7.5	32.2
59-68	23.8	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	8.3	14.0	39.8
59-75	23.8	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	8.3	14.0	39.8
60-70	18.3	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	5.7	10.8	28.1
61-71	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	8.6	20.1
63-69	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	7.6	12.8
63-77	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	7.6	12.8
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	6.6
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	79.3	97.6	97.6	95.3	97.6	97.6	97.6	96.2	97.6	91.9	86.8	69.5
61-77	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	8.6	20.1

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	97.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	96.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	93.7	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	91.5	54.9	97.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	26.4	1.2	54.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	9.1	1.2	25.6	97.3	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	98.3	5.7	1.2	6.1	93.9	98.8	98.8	98.8	98.8	98.8	98.8
52	96.6	80.5	1.7	1.2	1.2	56.1	94.4	98.8	98.8	98.8	98.8	98.0
53	95.9	52.4	1.2	1.2	1.2	31.7	78.0	98.3	93.3	98.8	98.8	97.1
54	95.4	30.5	1.2	1.2	1.2	9.8	57.3	94.5	81.1	91.1	98.8	95.1
55	92.4	19.2	1.2	1.2	1.2	3.7	31.1	68.3	47.6	70.7	91.5	90.2
56	82.9	12.2	1.2	1.2	1.2	2.8	11.5	41.5	26.8	41.5	76.8	74.0
57	62.2	4.9	1.2	1.2	1.2	1.2	1.8	17.1	11.0	13.4	54.9	62.6
58	41.5	1.2	1.2	1.2	1.2	1.2	1.2	10.1	2.0	11.1	25.6	47.6
59	24.4	1.2	1.2	1.2	1.2	1.2	1.2	4.5	1.2	9.5	15.0	41.0
60	18.3	1.2	1.2	1.2	1.2	1.2	1.2	2.6	1.2	6.8	12.0	30.5
61	6.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.5	9.6	21.7
62	4.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.2	9.3	15.5
63	2.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	8.9	14.0
64	1.5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	8.1	8.5
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.9	7.8
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.3	4.3
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	90.3	53.7	95.8	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	97.3	97.1	4.5	0.0	4.9	92.7	97.6	97.6	97.6	97.6	90.7	90.3
55-56	9.5	7.0	0.0	0.0	0.0	0.9	19.6	26.8	20.8	29.2	14.7	16.2
59-64	22.9	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	8.3	6.9	32.5
59-68	23.2	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	8.3	13.8	39.8
59-75	23.2	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	8.3	13.8	39.8
60-70	17.1	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	5.6	10.8	29.3
61-71	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	8.4	20.5
63-69	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	7.7	12.8
63-77	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	7.7	12.8
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	6.6
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	80.5	97.6	97.6	95.3	97.6	97.6	97.6	96.2	97.6	92.0	86.8	68.3
61-77	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	8.4	20.5

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	-1.3	0.0	0.0	0.0	1.2	-1.3	0.0	1.2	0.0	0.0	0.0
54	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.2	1.2	0.0	0.0	0.0
55	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.2	-2.4	1.2	0.0	0.0
56	1.2	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.2	1.3	1.2	-1.4
57	-2.4	0.0	0.0	0.0	0.0	0.0	0.0	-2.4	1.2	-1.2	1.2	1.6
58	0.6	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.2	0.3	-2.4	-2.4
59	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0
60	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	1.2
61	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	-0.2	0.4
62	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	-0.1
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.1	0.0
64	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	-0.3
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-64	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.3
55-56	-1.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-3.6	-0.1	-1.2	1.4
59-64	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	0.3
59-68	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0
59-75	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0
60-70	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	1.2
61-71	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	-0.2	0.4
63-69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.1	0.0
63-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.1	0.0
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-1.2
61-77	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	-0.2	0.4

Table 207 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Sacramento River below Red Bluff, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	97.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	96.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.2	93.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	91.5	52.4	97.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	19.5	1.2	56.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	8.8	1.2	26.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	97.7	3.7	1.2	7.3	94.2	98.8	98.8	98.8	98.8	98.8	98.8
52	98.0	76.2	1.3	1.2	1.2	60.4	95.6	98.8	98.8	98.8	98.8	98.8
53	96.1	48.8	1.2	1.2	1.2	31.7	88.6	98.8	98.8	98.8	98.8	98.2
54	95.7	28.9	1.2	1.2	1.2	12.2	69.5	98.6	94.7	98.8	98.8	97.2
55	95.2	18.7	1.2	1.2	1.2	6.1	47.6	91.5	84.1	92.7	98.8	93.9
56	88.1	11.3	1.2	1.2	1.2	3.1	15.9	67.7	57.9	76.2	92.7	88.4
57	69.5	4.4	1.2	1.2	1.2	2.1	5.5	42.7	36.0	50.0	81.7	76.0
58	42.7	1.2	1.2	1.2	1.2	1.2	1.4	19.5	15.9	20.7	66.5	56.1
59	25.6	1.2	1.2	1.2	1.2	1.2	1.2	12.2	3.0	12.0	36.6	48.8
60	18.3	1.2	1.2	1.2	1.2	1.2	1.2	4.3	1.4	10.1	15.9	41.5
61	6.1	1.2	1.2	1.2	1.2	1.2	1.2	2.4	1.2	7.2	12.7	29.3
62	5.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.9	10.4	21.5
63	2.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.5	9.3	15.9
64	1.4	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.8	8.8	13.9
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	7.3	8.3
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.8	5.7
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.6	1.5
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	90.3	51.2	96.0	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	97.4	96.5	2.5	0.0	6.1	93.0	97.6	97.6	97.6	97.0	90.0	84.9
55-56	7.1	7.4	0.0	0.0	0.0	3.0	31.7	23.8	26.2	16.5	6.1	5.5
59-64	24.2	0.0	0.0	0.0	0.0	0.0	0.0	11.0	1.8	10.2	27.8	34.9
59-68	24.4	0.0	0.0	0.0	0.0	0.0	0.0	11.0	1.8	10.8	35.0	47.3
59-75	24.4	0.0	0.0	0.0	0.0	0.0	0.0	11.0	1.8	10.8	35.4	47.6
60-70	17.1	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.2	8.9	14.7	40.3
61-71	4.9	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	6.0	11.5	28.1
63-69	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	8.1	14.7
63-77	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	8.1	14.7
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	7.1
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	80.5	97.6	97.6	95.2	97.6	97.6	97.6	94.5	97.4	88.7	82.9	57.3
61-77	4.9	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	6.0	11.5	28.1

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	97.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	96.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.2	93.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	91.5	52.4	97.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	19.5	1.2	56.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	8.8	1.2	26.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	97.7	3.7	1.2	7.3	94.2	98.8	98.8	98.8	98.8	98.8	98.8
52	98.0	75.6	1.3	1.2	1.2	60.4	95.6	98.8	98.8	98.8	98.8	98.8
53	96.1	48.8	1.2	1.2	1.2	31.7	88.6	98.8	98.8	98.8	98.8	98.2
54	95.7	29.9	1.2	1.2	1.2	12.2	69.5	98.6	94.8	98.8	98.8	97.2
55	95.2	18.7	1.2	1.2	1.2	6.1	47.6	91.5	84.1	92.7	98.8	93.9
56	88.1	11.3	1.2	1.2	1.2	3.1	15.9	67.7	60.4	76.2	93.9	88.4
57	68.3	4.4	1.2	1.2	1.2	2.1	5.5	42.7	36.0	51.2	81.7	75.6
58	43.9	1.2	1.2	1.2	1.2	1.2	1.4	18.3	15.9	20.7	66.5	56.1
59	25.6	1.2	1.2	1.2	1.2	1.2	1.2	11.0	4.3	12.0	35.4	48.2
60	15.9	1.2	1.2	1.2	1.2	1.2	1.2	4.3	1.5	10.2	15.9	41.5
61	6.5	1.2	1.2	1.2	1.2	1.2	1.2	2.4	1.2	7.3	12.5	28.7
62	5.0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.8	9.7	22.2
63	2.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.0	9.3	15.9
64	1.5	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.4	8.9	13.8
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	7.3	8.3
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.8	5.7
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.7	1.5
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	90.3	51.2	96.0	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	97.3	96.5	2.5	0.0	6.1	93.0	97.6	97.6	97.6	95.4	89.9	85.0
55-56	7.1	7.4	0.0	0.0	0.0	3.0	31.7	23.8	23.7	16.5	4.9	5.5
59-64	24.1	0.0	0.0	0.0	0.0	0.0	0.0	9.8	3.1	8.6	26.5	34.4
59-68	24.4	0.0	0.0	0.0	0.0	0.0	0.0	9.8	3.1	10.8	32.7	46.7
59-75	24.4	0.0	0.0	0.0	0.0	0.0	0.0	9.8	3.1	10.8	34.2	47.0
60-70	14.7	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.3	9.0	14.7	40.3
61-71	5.3	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	6.1	11.3	27.5
63-69	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	8.1	14.7
63-77	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	8.1	14.7
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	7.1
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	82.9	97.6	97.6	95.2	97.6	97.6	97.6	94.5	97.3	88.6	82.9	57.3
61-77	5.3	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	6.1	11.3	27.5

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	1.2	0.0
57	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	-0.4
58	1.2	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0
59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	1.3	0.0	-1.2	-0.6
60	-2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
61	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.2	-0.6
62	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.7	0.7
63	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
64	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.1	-0.1
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-64	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.6	-0.1	0.1
55-56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.5	0.0	-1.2	0.0
59-64	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	1.3	-1.6	-1.3	-0.5
59-68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	1.3	0.0	-2.3	-0.6
59-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	1.3	0.0	-1.2	-0.6
60-70	-2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
61-71	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.2	-0.6
63-69	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
63-77	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0
61-77	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.2	-0.6

Table 208 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Sacramento River at Wilkins Slough, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	97.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.0	96.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	96.2	94.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	93.1	84.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	63.4	34.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.7	2.4	1.2	63.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	97.5	2.0	1.2	36.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	96.3	1.5	1.2	17.1	97.6	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	61.0	1.2	1.2	2.8	75.6	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	29.3	1.2	1.2	1.2	60.4	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	18.9	1.2	1.2	1.2	31.7	96.1	98.8	98.8	98.8	98.8	98.8
55	98.8	6.9	1.2	1.2	1.2	18.3	95.1	98.8	98.8	98.8	98.8	98.8
56	98.8	1.5	1.2	1.2	1.2	13.4	91.5	98.8	98.8	98.8	98.8	98.8
57	97.8	1.2	1.2	1.2	1.2	4.3	79.3	98.8	98.8	98.8	98.8	98.8
58	87.4	1.2	1.2	1.2	1.2	3.0	70.7	98.8	98.8	98.8	98.8	98.8
59	69.5	1.2	1.2	1.2	1.2	2.1	54.9	98.4	98.8	98.8	98.8	98.8
60	46.3	1.2	1.2	1.2	1.2	1.2	38.6	97.7	98.8	98.8	98.8	97.9
61	26.0	1.2	1.2	1.2	1.2	1.2	22.6	91.3	98.8	98.8	98.8	92.7
62	11.2	1.2	1.2	1.2	1.2	1.2	11.0	87.2	98.8	98.8	98.8	90.2
63	4.7	1.2	1.2	1.2	1.2	1.2	4.2	80.1	98.5	98.8	98.8	78.0
64	3.5	1.2	1.2	1.2	1.2	1.2	1.2	62.2	97.6	98.8	98.8	63.8
65	2.0	1.2	1.2	1.2	1.2	1.2	1.2	48.2	95.3	96.3	98.8	57.3
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	32.1	84.9	93.9	96.6	48.8
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	8.5	53.7	70.7	78.0	25.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	26.8	51.2	56.1	14.6
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	12.2	34.8	31.1	6.5
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.3	20.7	22.0	4.0
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.5	8.8	10.2	2.9
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.9	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	62.2	32.9	97.6	97.6	97.6	97.6	97.6	95.9	97.6	97.6
50-64	95.3	95.1	0.3	0.0	15.9	96.4	97.6	36.6	1.2	0.0	0.0	35.0
55-56	0.0	5.4	0.0	0.0	0.0	4.9	3.6	0.0	0.0	0.0	0.0	0.0
59-64	66.0	0.0	0.0	0.0	0.0	0.9	53.7	36.2	1.2	0.0	0.0	35.0
59-68	68.3	0.0	0.0	0.0	0.0	0.9	53.7	89.9	45.1	28.1	20.8	73.6
59-75	68.3	0.0	0.0	0.0	0.0	0.9	53.7	97.2	97.6	95.9	97.6	97.6
60-70	45.1	0.0	0.0	0.0	0.0	0.0	37.4	96.5	86.6	64.0	67.7	91.4
61-71	24.8	0.0	0.0	0.0	0.0	0.0	21.4	90.1	96.5	78.1	76.8	88.7
63-69	3.5	0.0	0.0	0.0	0.0	0.0	3.0	78.9	71.7	47.6	42.7	63.4
63-77	3.5	0.0	0.0	0.0	0.0	0.0	3.0	78.9	97.3	97.6	97.6	76.8
65-82	0.8	0.0	0.0	0.0	0.0	0.0	0.0	47.0	94.1	95.1	97.6	56.1
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	33.6	29.9	5.3
42-60	52.5	97.6	95.0	92.9	97.6	97.6	60.2	1.1	0.0	0.0	0.0	0.9
61-77	24.8	0.0	0.0	0.0	0.0	0.0	21.4	90.1	97.6	97.6	97.6	91.5

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	97.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.0	96.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	96.2	94.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	93.1	84.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	63.4	34.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.7	2.4	1.2	63.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	97.5	2.0	1.2	36.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	96.3	1.5	1.2	17.1	97.6	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	60.4	1.2	1.2	2.7	75.6	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	29.9	1.2	1.2	1.2	60.4	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	18.9	1.2	1.2	1.2	31.7	96.1	98.8	98.8	98.8	98.8	98.8
55	98.8	6.9	1.2	1.2	1.2	18.3	95.1	98.8	98.8	98.8	98.8	98.8
56	98.8	1.5	1.2	1.2	1.2	13.4	91.5	98.8	98.8	98.8	98.8	98.8
57	97.8	1.2	1.2	1.2	1.2	4.3	79.3	98.8	98.8	98.8	98.8	98.8
58	87.2	1.2	1.2	1.2	1.2	3.0	70.7	98.8	98.8	98.8	98.8	98.8
59	68.3	1.2	1.2	1.2	1.2	2.1	56.1	98.4	98.8	98.8	98.8	98.8
60	47.6	1.2	1.2	1.2	1.2	1.2	38.6	97.7	98.8	98.8	98.8	97.9
61	26.0	1.2	1.2	1.2	1.2	1.2	22.6	91.2	98.8	98.8	98.8	92.7
62	11.2	1.2	1.2	1.2	1.2	1.2	12.2	87.2	98.8	98.8	98.8	90.2
63	4.7	1.2	1.2	1.2	1.2	1.2	4.3	79.9	98.5	98.8	98.8	79.3
64	3.5	1.2	1.2	1.2	1.2	1.2	1.2	62.2	97.6	98.8	98.8	63.0
65	2.0	1.2	1.2	1.2	1.2	1.2	1.2	48.2	95.3	96.3	98.8	57.3
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	32.3	85.0	93.9	96.6	48.2
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	8.5	54.9	70.7	78.0	25.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	25.6	54.9	56.1	14.6
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	13.4	34.1	30.5	6.1
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.0	20.7	21.1	4.0
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.6	8.9	10.0	2.9
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	1.6	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.1	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	62.2	32.9	97.6	97.6	97.6	97.6	97.6	95.7	97.6	97.6
50-64	95.3	95.1	0.3	0.0	15.9	96.4	97.6	36.6	1.2	0.0	0.0	35.8
55-56	0.0	5.4	0.0	0.0	0.0	4.9	3.6	0.0	0.0	0.0	0.0	0.0
59-64	64.8	0.0	0.0	0.0	0.0	0.9	54.9	36.2	1.2	0.0	0.0	35.8
59-68	67.1	0.0	0.0	0.0	0.0	0.9	54.9	89.9	43.9	28.1	20.8	73.6
59-75	67.1	0.0	0.0	0.0	0.0	0.9	54.9	97.2	97.6	95.7	97.6	97.6
60-70	46.4	0.0	0.0	0.0	0.0	0.0	37.4	96.5	85.4	64.7	68.3	91.8
61-71	24.8	0.0	0.0	0.0	0.0	0.0	21.4	90.0	95.8	78.1	77.7	88.7
63-69	3.5	0.0	0.0	0.0	0.0	0.0	3.1	78.7	72.9	43.9	42.7	64.7
63-77	3.5	0.0	0.0	0.0	0.0	0.0	3.1	78.7	97.3	97.6	97.6	78.1
65-82	0.8	0.0	0.0	0.0	0.0	0.0	0.0	47.0	94.1	95.1	97.6	56.1
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.2	32.9	29.3	4.9
42-60	51.2	97.6	95.0	92.9	97.6	97.6	60.2	1.1	0.0	0.0	0.0	0.9
61-77	24.8	0.0	0.0	0.0	0.0	0.0	21.4	90.0	97.6	97.6	97.6	91.5

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	-0.6	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59	-1.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0
60	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0
62	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.2	0.0	0.0	0.0	1.3
64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.8
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.0	0.0	-0.6
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	3.7	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	-0.7	-0.6	-0.4
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	-0.9	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	-0.2	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0
50-64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8
55-56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59-64	-1.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.8
59-68	-1.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0	-1.2	0.0	0.0	0.0
59-75	-1.2	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	-0.2	0.0	0.0
60-70	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.7	0.6	0.4
61-71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.7	0.0	0.9	0.0
63-69	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.2	1.2	-3.7	0.0	1.3
63-77	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.2	0.0	0.0	0.0	1.3
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	-0.7	-0.6	-0.4
42-60	-1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0

Table 209 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Sacramento River at Feather River, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	97.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.2	96.7	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	96.1	93.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	90.2	85.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	64.6	51.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	3.7	1.2	82.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.0	2.0	1.2	59.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	96.3	1.4	1.2	34.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	61.0	1.2	1.2	4.7	81.7	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	32.9	1.2	1.2	1.2	69.5	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	21.3	1.2	1.2	1.2	52.4	98.8	98.8	98.8	98.8	98.8	98.8
55	98.8	4.9	1.2	1.2	1.2	31.7	97.5	98.8	98.8	98.8	98.8	98.8
56	98.8	1.7	1.2	1.2	1.2	14.6	96.3	98.8	98.8	98.8	98.8	98.8
57	98.8	1.2	1.2	1.2	1.2	7.3	90.2	98.8	98.8	98.8	98.8	98.8
58	97.0	1.2	1.2	1.2	1.2	3.0	79.3	98.8	98.8	98.8	98.8	98.8
59	81.7	1.2	1.2	1.2	1.2	2.2	72.0	98.8	98.8	98.8	98.8	98.8
60	60.4	1.2	1.2	1.2	1.2	1.2	61.0	98.4	98.8	98.8	98.8	98.8
61	30.5	1.2	1.2	1.2	1.2	1.2	44.5	97.9	98.8	98.8	98.8	98.8
62	18.3	1.2	1.2	1.2	1.2	1.2	30.5	95.4	98.8	98.8	98.8	98.0
63	7.5	1.2	1.2	1.2	1.2	1.2	15.2	84.1	98.8	98.8	98.8	93.9
64	4.3	1.2	1.2	1.2	1.2	1.2	9.1	77.4	98.8	98.8	98.8	91.6
65	2.1	1.2	1.2	1.2	1.2	1.2	2.4	65.9	98.8	98.8	98.8	84.1
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	54.9	98.8	98.8	98.8	66.5
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	17.9	88.4	98.3	98.8	40.9
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	11.0	76.8	97.2	97.6	28.0
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.7	61.0	88.6	82.9	17.9
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	34.1	79.3	59.8	7.3
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.6	15.9	53.7	47.0	5.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	11.0	6.1	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.4	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.0	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	63.4	50.0	97.6	97.6	97.6	97.6	97.6	93.4	97.6	97.6
50-64	94.5	95.1	0.2	0.0	32.9	97.6	89.7	21.4	0.0	0.0	0.0	7.2
55-56	0.0	3.2	0.0	0.0	0.0	17.1	1.2	0.0	0.0	0.0	0.0	0.0
59-64	77.4	0.0	0.0	0.0	0.0	1.0	62.9	21.4	0.0	0.0	0.0	7.2
59-68	80.5	0.0	0.0	0.0	0.0	1.0	70.8	80.9	10.4	0.5	0.0	57.9
59-75	80.5	0.0	0.0	0.0	0.0	1.0	70.8	97.6	97.6	93.4	97.6	97.6
60-70	59.2	0.0	0.0	0.0	0.0	0.0	59.8	92.7	37.8	10.2	15.9	80.9
61-71	29.3	0.0	0.0	0.0	0.0	0.0	43.3	95.5	64.7	19.5	39.0	91.5
63-69	6.3	0.0	0.0	0.0	0.0	0.0	14.0	73.1	22.0	1.6	1.2	65.9
63-77	6.3	0.0	0.0	0.0	0.0	0.0	14.0	82.9	97.6	95.8	97.6	92.7
65-82	0.9	0.0	0.0	0.0	0.0	0.0	1.2	64.7	97.6	97.6	97.6	82.9
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	59.8	87.4	81.7	16.7
42-60	38.4	97.6	94.9	92.4	97.6	97.6	37.8	0.4	0.0	0.0	0.0	0.0
61-77	29.3	0.0	0.0	0.0	0.0	0.0	43.3	96.7	97.6	95.8	97.6	97.6

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	97.4	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.2	96.7	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	96.1	93.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	90.2	85.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	64.6	51.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	3.7	1.2	82.9	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.0	2.0	1.2	59.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	96.3	1.4	1.2	34.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	61.0	1.2	1.2	4.7	81.7	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	34.1	1.2	1.2	1.2	69.5	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	21.3	1.2	1.2	1.2	52.4	98.8	98.8	98.8	98.8	98.8	98.8
55	98.8	4.9	1.2	1.2	1.2	31.7	97.5	98.8	98.8	98.8	98.8	98.8
56	98.8	1.7	1.2	1.2	1.2	14.6	96.3	98.8	98.8	98.8	98.8	98.8
57	98.8	1.2	1.2	1.2	1.2	6.1	90.2	98.8	98.8	98.8	98.8	98.8
58	97.0	1.2	1.2	1.2	1.2	3.0	79.3	98.8	98.8	98.8	98.8	98.8
59	80.5	1.2	1.2	1.2	1.2	2.2	72.0	98.8	98.8	98.8	98.8	98.8
60	60.2	1.2	1.2	1.2	1.2	1.2	61.0	98.4	98.8	98.8	98.8	98.8
61	31.7	1.2	1.2	1.2	1.2	1.2	44.5	97.9	98.8	98.8	98.8	98.8
62	18.3	1.2	1.2	1.2	1.2	1.2	30.5	95.4	98.8	98.8	98.8	98.0
63	7.5	1.2	1.2	1.2	1.2	1.2	15.2	84.1	98.8	98.8	98.8	93.9
64	4.5	1.2	1.2	1.2	1.2	1.2	9.1	77.6	98.8	98.8	98.8	91.8
65	2.1	1.2	1.2	1.2	1.2	1.2	2.4	65.9	98.8	98.8	98.8	82.9
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	55.3	98.8	98.8	98.8	67.7
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	17.7	88.4	98.2	98.8	40.9
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	11.0	76.8	97.3	97.6	28.0
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.7	61.0	89.0	82.9	17.7
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	35.4	79.3	59.8	7.3
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.6	15.9	53.7	47.0	5.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	11.0	7.3	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.8	1.5	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.0	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	63.4	50.0	97.6	97.6	97.6	97.6	97.6	93.0	97.3	97.6
50-64	94.3	95.1	0.2	0.0	32.9	97.6	89.7	21.2	0.0	0.0	0.0	7.0
55-56	0.0	3.2	0.0	0.0	0.0	17.1	1.2	0.0	0.0	0.0	0.0	0.0
59-64	76.0	0.0	0.0	0.0	0.0	1.0	62.9	21.2	0.0	0.0	0.0	7.0
59-68	79.3	0.0	0.0	0.0	0.0	1.0	70.8	81.1	10.4	0.6	0.0	57.9
59-75	79.3	0.0	0.0	0.0	0.0	1.0	70.8	97.6	97.6	93.0	97.3	97.6
60-70	59.0	0.0	0.0	0.0	0.0	0.0	59.8	92.7	37.8	9.8	15.9	81.1
61-71	30.5	0.0	0.0	0.0	0.0	0.0	43.3	95.5	63.4	19.5	39.0	91.5
63-69	6.3	0.0	0.0	0.0	0.0	0.0	14.0	73.1	22.0	1.5	1.2	65.9
63-77	6.3	0.0	0.0	0.0	0.0	0.0	14.0	82.9	97.6	95.8	97.6	92.7
65-82	0.9	0.0	0.0	0.0	0.0	0.0	1.2	64.7	97.6	97.6	97.6	81.7
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	59.8	87.8	81.7	16.5
42-60	38.6	97.6	94.9	92.4	97.6	97.6	37.8	0.4	0.0	0.0	0.0	0.0
61-77	30.5	0.0	0.0	0.0	0.0	0.0	43.3	96.7	97.6	95.8	97.6	97.6

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
64	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	1.2
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	-0.1	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	-0.2
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	-0.3	0.0
50-64	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	-0.2
55-56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59-64	-1.4	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	-0.2
59-68	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0
59-75	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	-0.3	0.0
60-70	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.2
61-71	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.3	0.0	0.0	0.0
63-69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0
63-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	-0.2
42-60	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61-77	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 210 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Sacramento River at Freeport, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	97.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	96.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	97.0	94.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	91.5	87.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	74.4	56.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	11.0	1.2	86.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.3	2.2	1.2	56.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	97.6	1.6	1.2	36.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	80.5	1.2	1.2	7.7	85.4	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	59.8	1.2	1.2	2.3	70.7	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	34.1	1.2	1.2	1.2	54.9	98.8	98.8	98.8	98.8	98.8	98.8
55	98.8	15.9	1.2	1.2	1.2	32.9	97.6	98.8	98.8	98.8	98.8	98.8
56	98.8	4.1	1.2	1.2	1.2	20.7	95.7	98.8	98.8	98.8	98.8	98.8
57	98.8	2.4	1.2	1.2	1.2	11.2	91.7	98.8	98.8	98.8	98.8	98.8
58	98.8	1.2	1.2	1.2	1.2	3.7	80.0	98.8	98.8	98.8	98.8	98.8
59	92.7	1.2	1.2	1.2	1.2	2.8	72.0	98.8	98.8	98.8	98.8	98.8
60	79.3	1.2	1.2	1.2	1.2	1.8	59.5	98.8	98.8	98.8	98.8	98.8
61	52.4	1.2	1.2	1.2	1.2	1.2	42.1	97.7	98.8	98.8	98.8	98.8
62	30.5	1.2	1.2	1.2	1.2	1.2	29.3	93.9	98.8	98.8	98.8	98.8
63	17.1	1.2	1.2	1.2	1.2	1.2	16.5	83.5	98.8	98.8	98.8	97.6
64	7.1	1.2	1.2	1.2	1.2	1.2	11.0	70.7	98.8	98.8	98.8	93.1
65	3.2	1.2	1.2	1.2	1.2	1.2	5.1	58.5	98.8	98.8	98.8	89.8
66	1.6	1.2	1.2	1.2	1.2	1.2	1.2	46.7	97.7	98.8	98.8	80.5
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	14.6	82.9	98.8	98.8	43.5
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	10.6	69.5	97.6	96.0	31.1
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.7	52.4	89.0	80.5	18.0
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	31.7	74.4	59.8	8.5
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	18.3	51.2	46.3	2.1
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.2	8.3	7.9	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.5	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.5	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	73.2	54.9	97.6	97.6	97.6	97.6	97.6	94.3	97.6	97.6
50-64	91.7	96.4	0.4	0.0	34.8	97.6	87.8	28.1	0.0	0.0	0.0	5.7
55-56	0.0	11.8	0.0	0.0	0.0	12.2	1.9	0.0	0.0	0.0	0.0	0.0
59-64	85.6	0.0	0.0	0.0	0.0	1.6	61.0	28.1	0.0	0.0	0.0	5.7
59-68	91.5	0.0	0.0	0.0	0.0	1.6	70.8	84.2	15.9	0.0	0.0	55.3
59-75	91.5	0.0	0.0	0.0	0.0	1.6	70.8	97.6	97.6	94.3	97.6	97.6
60-70	78.1	0.0	0.0	0.0	0.0	0.6	58.3	92.1	46.4	9.8	18.3	80.8
61-71	51.2	0.0	0.0	0.0	0.0	0.0	40.9	94.2	67.1	24.4	39.0	90.3
63-69	15.9	0.0	0.0	0.0	0.0	0.0	15.3	72.9	29.3	1.2	2.8	66.5
63-77	15.9	0.0	0.0	0.0	0.0	0.0	15.3	82.3	97.6	97.3	97.6	96.4
65-82	2.0	0.0	0.0	0.0	0.0	0.0	3.9	57.3	97.6	97.6	97.6	88.6
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	51.2	87.8	79.3	16.8
42-60	19.5	97.6	95.8	92.9	97.6	97.0	39.3	0.0	0.0	0.0	0.0	0.0
61-77	51.2	0.0	0.0	0.0	0.0	0.0	40.9	96.5	97.6	97.3	97.6	97.6

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	97.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	96.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	97.0	94.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	91.5	87.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	74.4	57.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	12.2	1.2	87.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.3	2.2	1.2	58.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	97.6	1.6	1.2	36.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	80.5	1.2	1.2	7.3	84.1	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	58.5	1.2	1.2	2.3	69.5	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	32.9	1.2	1.2	1.2	53.7	98.8	98.8	98.8	98.8	98.8	98.8
55	98.8	14.6	1.2	1.2	1.2	34.1	97.4	98.8	98.8	98.8	98.8	98.8
56	98.8	4.0	1.2	1.2	1.2	23.2	95.1	98.8	98.8	98.8	98.8	98.8
57	98.8	1.8	1.2	1.2	1.2	10.7	91.7	98.8	98.8	98.8	98.8	98.8
58	98.8	1.2	1.2	1.2	1.2	3.6	79.9	98.8	98.8	98.8	98.8	98.8
59	93.3	1.2	1.2	1.2	1.2	2.8	71.1	98.8	98.8	98.8	98.8	98.8
60	76.8	1.2	1.2	1.2	1.2	1.8	57.3	98.8	98.8	98.8	98.8	98.8
61	52.4	1.2	1.2	1.2	1.2	1.2	39.0	97.7	98.8	98.8	98.8	98.8
62	31.7	1.2	1.2	1.2	1.2	1.2	26.8	93.9	98.8	98.8	98.8	98.8
63	17.1	1.2	1.2	1.2	1.2	1.2	15.9	82.9	98.8	98.8	98.8	97.4
64	7.0	1.2	1.2	1.2	1.2	1.2	10.4	70.1	98.8	98.8	98.8	93.1
65	3.3	1.2	1.2	1.2	1.2	1.2	4.9	57.3	98.8	98.8	98.8	89.8
66	1.5	1.2	1.2	1.2	1.2	1.2	1.2	46.3	97.7	98.8	98.8	80.5
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	14.2	82.9	98.8	98.8	43.5
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	10.3	69.5	97.6	96.0	31.1
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.9	51.2	89.0	79.3	17.8
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	31.7	74.4	61.0	8.5
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	18.3	50.0	46.3	2.1
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.2	8.3	7.3	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.5	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.5	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	73.2	56.1	97.6	97.6	97.6	97.6	97.6	94.3	97.6	97.6
50-64	91.8	96.4	0.4	0.0	34.8	97.6	88.4	28.7	0.0	0.0	0.0	5.7
55-56	0.0	10.6	0.0	0.0	0.0	10.9	2.3	0.0	0.0	0.0	0.0	0.0
59-64	86.3	0.0	0.0	0.0	0.0	1.6	60.7	28.7	0.0	0.0	0.0	5.7
59-68	92.1	0.0	0.0	0.0	0.0	1.6	69.9	84.6	15.9	0.0	0.0	55.3
59-75	92.1	0.0	0.0	0.0	0.0	1.6	69.9	97.6	97.6	94.3	97.6	97.6
60-70	75.6	0.0	0.0	0.0	0.0	0.6	56.1	91.9	47.6	9.8	19.5	81.0
61-71	51.2	0.0	0.0	0.0	0.0	0.0	37.8	94.2	67.1	24.4	37.8	90.3
63-69	15.9	0.0	0.0	0.0	0.0	0.0	14.7	72.6	29.3	1.2	2.8	66.3
63-77	15.9	0.0	0.0	0.0	0.0	0.0	14.7	81.7	97.6	97.3	97.6	96.2
65-82	2.1	0.0	0.0	0.0	0.0	0.0	3.7	56.1	97.6	97.6	97.6	88.6
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	50.0	87.8	78.1	16.6
42-60	22.0	97.6	95.8	92.9	97.6	97.0	41.5	0.0	0.0	0.0	0.0	0.0
61-77	51.2	0.0	0.0	0.0	0.0	0.0	37.8	96.5	97.6	97.3	97.6	97.6

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	1.2	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	-0.4	-1.3	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	-1.3	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	-1.2	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0
55	0.0	-1.3	0.0	0.0	0.0	1.2	-0.2	0.0	0.0	0.0	0.0	0.0
56	0.0	-0.1	0.0	0.0	0.0	2.5	-0.6	0.0	0.0	0.0	0.0	0.0
57	0.0	-0.6	0.0	0.0	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
59	0.6	0.0	0.0	0.0	0.0	0.0	-0.9	0.0	0.0	0.0	0.0	0.0
60	-2.5	0.0	0.0	0.0	0.0	0.0	-2.2	0.0	0.0	0.0	0.0	0.0
61	0.0	0.0	0.0	0.0	0.0	0.0	-3.1	0.0	0.0	0.0	0.0	0.0
62	1.2	0.0	0.0	0.0	0.0	0.0	-2.5	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-0.6	0.0	0.0	0.0	-0.2
64	-0.1	0.0	0.0	0.0	0.0	0.0	-0.6	-0.6	0.0	0.0	0.0	0.0
65	0.1	0.0	0.0	0.0	0.0	0.0	-0.2	-1.2	0.0	0.0	0.0	0.0
66	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-1.2	0.0	-1.2	-0.2
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-64	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.0
55-56	0.0	-1.2	0.0	0.0	0.0	-1.3	0.4	0.0	0.0	0.0	0.0	0.0
59-64	0.7	0.0	0.0	0.0	0.0	0.0	-0.3	0.6	0.0	0.0	0.0	0.0
59-68	0.6	0.0	0.0	0.0	0.0	0.0	-0.9	0.4	0.0	0.0	0.0	0.0
59-75	0.6	0.0	0.0	0.0	0.0	0.0	-0.9	0.0	0.0	0.0	0.0	0.0
60-70	-2.5	0.0	0.0	0.0	0.0	0.0	-2.2	-0.2	1.2	0.0	1.2	0.2
61-71	0.0	0.0	0.0	0.0	0.0	0.0	-3.1	0.0	0.0	0.0	-1.2	0.0
63-69	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-0.3	0.0	0.0	0.0	-0.2
63-77	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-0.6	0.0	0.0	0.0	-0.2
65-82	0.1	0.0	0.0	0.0	0.0	0.0	-0.2	-1.2	0.0	0.0	0.0	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-1.2	0.0	-1.2	-0.2
42-60	2.5	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0
61-77	0.0	0.0	0.0	0.0	0.0	0.0	-3.1	0.0	0.0	0.0	0.0	0.0

Table 211 E504ELD-J602F3ELD

Spring-run Chinook Salmon in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	March through September	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Below the Thermalito Afterbay Outlet		10	Lower 40%						0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%						0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	64		All Years						0.0	0.0	0.0	0.0	0.0	0.0	0.0
				68		All Years						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Below the Thermalito Afterbay Outlet	64		All Years						0.0	0.0	0.0	0.0	0.0	0.0	2.4
				68		All Years						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Mouth of the Lower Feather River	64		All Years						0.0	0.0	0.0	0.0	0.0	0.0	0.1
				68		All Years						0.0	0.0	0.0	0.0	0.0	0.0	0.0
Adult Holding	March through September	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Below the Thermalito Afterbay Outlet		10	Lower 40%						0.0	0.0	0.0	3.0	-3.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	61		All Years						0.0	0.0	0.0	0.0	1.2	-1.2	0.0
				65		All Years						0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Below the Thermalito Afterbay Outlet	61		All Years						0.0	0.0	0.0	0.0	0.0	0.0	-0.6
				65		All Years						0.0	0.0	0.0	0.0	0.0	0.0	1.3
Spawning and Embryo Incubation	September and October	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	All Years	0.0											0.0
			Below the Thermalito Afterbay Outlet		10	All Years	0.0											0.0
	September through February	Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	56		All Years	-0.2	-0.1	0.0	0.0	0.0							0.0
				58		All Years	0.0	0.4	0.0	0.0	0.0							0.0
			Below the Thermalito Afterbay Outlet	56		All Years	0.0	0.1	0.0	0.0	0.0							0.0
				58		All Years	-1.2	0.0	0.0	0.0	0.0							0.0
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	61		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
			Mouth of the Lower Feather River	61		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Smolt Emigration	October through June	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0			
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0			
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	63		All Years	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
			Mouth of the Lower Feather River	63		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

Table 212 E504ELD-J602F3ELD

Fall-run Chinook Salmon in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Staging	July through December	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	Lower 40%	0.0	0.0	0.0							0.0	0.0	0.0
			Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0							-3.0	3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0							0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	64		All Years	0.0	0.0	0.0							0.0	0.0	0.0
				68		All Years	0.0	0.0	0.0							0.0	0.0	0.0
			Below the Thermalito Afterbay Outlet	64		All Years	0.0	0.0	0.0							0.0	0.0	2.4
				68		All Years	0.0	0.0	0.0							0.0	0.0	0.0
			Mouth of the Lower Feather River	64		All Years	0.0	0.0	0.0							0.0	0.0	0.1
				68		All Years	0.0	0.0	0.0							0.0	0.0	0.0
Spawning and Embryo Incubation	October through December	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	All Years	0.0	0.0	0.0									
			Below the Thermalito Afterbay Outlet		10	All Years	0.0	-2.4	0.0									
	October through March	Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	56		All Years	-0.2	-0.1	0.0	0.0	0.0	0.0						
				58		All Years	0.0	0.4	0.0	0.0	0.0	0.0						
			Below the Thermalito Afterbay Outlet	56		All Years	0.0	0.1	0.0	0.0	0.0	-0.6						
				58		All Years	-1.2	0.0	0.0	0.0	0.0	0.0						
Juvenile Rearing and Downstream Movement	November through June	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0			
			Mouth of the Lower Feather River		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0			
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	61		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
				65		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
			Mouth of the Lower Feather River	61		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
				65		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

Table 213 E504ELD-J602F3ELD

Steelhead in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	August through March	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					3.0	0.0
		Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	64		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Below the Thermalito Afterbay Outlet	64		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	2.4
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Mouth of the Lower Feather River	64		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.1
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
Adult Holding	August through March	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0					3.0	0.0
		Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	61		All Years	0.1	0.0	0.0	0.0	0.0	0.0					-1.2	0.0
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	0.0
			Below the Thermalito Afterbay Outlet	61		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	-0.6
				65		All Years	0.0	0.0	0.0	0.0	0.0	0.0					0.0	1.3
Spawning and Embryo Incubation	January through April	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	All Years				0.0	0.0	0.0	0.0					
			Below the Thermalito Afterbay Outlet		10	All Years				0.0	0.0	0.0	0.0					
	January through May	Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	54		All Years				0.0	0.0	0.0	0.0	0.0				
				57		All Years				0.0	0.0	0.0	0.0	0.0				
			Below the Thermalito Afterbay Outlet	54		All Years				0.0	0.0	0.0	0.0	0.0				
				57		All Years				0.0	0.0	0.0	0.0	0.0				
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Below the Thermalito Afterbay Outlet	65		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
				68		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smolt Emigration	October through April	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	52		All Years	0.0	0.0	0.0	0.0	0.4	0.0	0.0					
				55		All Years	0.0	0.3	0.0	0.0	0.0	0.0	0.0					
			Mouth of the Lower Feather River	52		All Years	0.0	0.0	0.0	0.0	1.2	0.0	0.0					
				55		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0					

Table 214 E504ELD-J602F3ELD

Green Sturgeon in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Holding	February through November	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0			0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0			0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	61		All Years	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6
			Mouth of the Lower Feather River	61		All Years	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spawning and Embryo Incubation	March through August	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%						0.0	0.0	0.0	3.0	-3.0	3.0	
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	63		All Years						0.0	0.0	0.0	0.0	0.0	0.0	
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	66		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2
			Mouth of the Lower Feather River	66		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	-1.2

Table 215 E504ELD-J602F3ELD

White Sturgeon in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Holding	November through May	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
			Mouth of the Lower Feather River		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	77		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
			Mouth of the Feather River	77		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Spawning and Embryo Incubation	February through June	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%					0.0	0.0	0.0	0.0	3.0			
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	61		All Years					0.0	0.0	0.0	0.0	0.0			
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	66		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2
			Mouth of the Feather River	66		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	-1.2

Table 216 E504ELD-J602F3ELD

River Lamprey in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	September through June	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0			0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0			0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	42-60[1]		All Years	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	-1.3	0.0			1.2
			Mouth of the Lower Feather River	42-60		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0
Spawning and Embryo Incubation	February through July	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	Lower 40%					0.0	0.0	0.0	0.0	0.0	0.0		
			Below the Thermalito Afterbay Outlet		10	Lower 40%					0.0	0.0	0.0	0.0	3.0	-3.0		
		Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	50-64		All Years					1.2	0.0	0.0	0.0	0.0	0.0		
			Below the Thermalito Afterbay Outlet	50-64		All Years					1.2	0.0	0.0	0.0	0.0	0.0		
Ammocoete Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Mouth of the Lower Feather River	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 217 E504ELD-J602F3ELD

Pacific Lamprey in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	January through June	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%				0.0	0.0	0.0	0.0	0.0	3.0			
			Mouth of the Lower Feather River		10	Lower 40%				0.0	0.0	0.0	0.0	0.0	-3.0			
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	42-60[1]		All Years				0.0	0.0	0.0	0.0	-1.3	0.0			
			Mouth of the Lower Feather River	42-60		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
Spawning and Embryo Incubation	March through August	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	Lower 40%						0.0	0.0	0.0	0.0	0.0	0.0	
			Below the Thermalito Afterbay Outlet		10	Lower 40%						0.0	0.0	0.0	3.0	-3.0	3.0	
		Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	50-64		All Years						0.0	0.0	0.0	0.0	0.0	0.0	
			Below the Thermalito Afterbay Outlet	50-64		All Years						0.0	0.0	0.0	0.0	0.0	0.0	
Ammocoete Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Mouth of the Lower Feather River	72		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 218 E504ELD-J602F3ELD

Hardhead in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adults and Other Lifestages	Year-round	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Lower Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	61-77[1]		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Mouth of the Lower Feather River	61-77		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spawning	April through June	Mean Monthly Flow (cfs)	Low Flow Channel below the Fish Barrier Dam		10	Lower 40%							0.0	0.0	0.0			
			Below the Thermalito Afterbay Outlet		10	Lower 40%							0.0	0.0	3.0			
		Mean Monthly Water Temperature (°F)	Low Flow Channel below the Fish Barrier Dam	59-64		All Years							0.0	0.0	0.0			
			Below the Thermalito Afterbay Outlet	59-64		All Years							0.0	0.0	-1.2			

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 219 E504ELD-J602F3ELD

American Shad in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Spawning	April through June	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%							0.0	0.0	3.0			
			Mouth of the Feather River		10	Lower 40%							0.0	0.0	-3.0			
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	60-70[1]		All Years							0.0	0.0	0.3			
			Mouth of the Feather River	60-70		All Years							0.0	0.0	0.0			
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	63-77		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
			Mouth of the Feather River	63-77		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 220 E504ELD-J602F3ELD

Striped Bass in the Lower Feather River

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration and Spawning	April through June	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%							0.0	0.0	3.0			
			Mouth of the Feather River		10	Lower 40%							0.0	0.0	-3.0			
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	59-68[1]		All Years							0.0	0.0	0.0			
			Mouth of the Feather River	59-68		All Years							0.0	0.0	0.0			
Juvenile Rearing and Downstream Movement	Year-round	Mean Monthly Flow (cfs)	Below the Thermalito Afterbay Outlet		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0
			Mouth of the Feather River		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0
		Mean Monthly Water Temperature (°F)	Below the Thermalito Afterbay Outlet	61-71		All Years	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	-1.3	0.0	0.0	0.0	1.2
			Mouth of the Feather River	61-71		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Table 221 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Feather River at Thermalito Low Flow Channel, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change in % Exceedance:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1 (Total %)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1 (Total %)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change in % Exceedance:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 222 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Feather River below Thermalito, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	93.9	92.7	97.6	98.8	93.9	100.0	98.8	79.3	69.5	82.9	63.4	80.5
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	1.2	0.0	1.2	0.0
X>1.0 (Total %)	1.2	0.0	1.2	1.2	2.4	0.0	1.2	20.7	15.9	7.3	15.9	4.9
X<=-10.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0
X<-1.0 (Total %)	4.9	7.3	1.2	0.0	3.7	0.0	0.0	0.0	11.0	8.5	20.7	14.6
Net Change in % Exceedance:	-3.7	-7.3	0.0	1.2	-1.2	0.0	1.2	20.7	4.9	-1.2	-4.9	-9.8
Net Change in 10% Exceedance	0.0	-2.4	0.0	0.0	0.0	0.0	0.0	2.4	1.2	-1.2	1.2	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	66.7	66.7	45.5	63.6
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	3.0	0.0
X>1 (Total %)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.3	9.1	36.4	3.0
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0
X<-1 (Total %)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.2	18.2	33.3
Net Change in % Exceedance:	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.3	-12.1	18.2	-30.3
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	-3.0	3.0	0.0

Table 223 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Feather River at Mouth, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	93.9	87.8	97.6	98.8	98.8	98.8	98.8	78.0	74.4	89.0	75.6	84.1
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
X>1.0 (Total %)	0.0	0.0	1.2	1.2	0.0	0.0	1.2	22.0	14.6	3.7	9.8	4.9
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0
X<-1.0 (Total %)	3.7	11.0	1.2	0.0	1.2	1.2	0.0	0.0	11.0	7.3	14.6	9.8
Net Change in % Exceedance:	-3.7	-11.0	0.0	1.2	-1.2	-1.2	1.2	22.0	3.7	-3.7	-4.9	-4.9
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	1.2	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	100.0	100.0	100.0	100.0	100.0	97.0	97.0	69.7	69.7	72.7	66.7	69.7
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0
X>1 (Total %)	0.0	0.0	0.0	0.0	0.0	0.0	3.0	30.3	3.0	9.1	15.2	3.0
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0
X<-1 (Total %)	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	27.3	18.2	18.2	24.2
Net Change in % Exceedance:	0.0	0.0	0.0	0.0	0.0	-3.0	3.0	30.3	-24.2	-9.1	-3.0	-21.2
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0	0.0	3.0	0.0

Table 224 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Feather River below Fish Barrier Dam, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	98.8	97.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	93.1	41.5	61.0	82.9	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	59.8	17.1	37.8	63.4	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	98.8	42.7	7.3	12.8	41.5	89.0	98.8	98.8	98.8	98.8	98.8
52	98.8	69.5	11.6	1.2	1.2	12.8	23.2	98.8	98.8	98.8	98.8	98.8
53	67.1	21.3	4.1	1.2	1.2	7.3	5.5	98.8	98.8	98.8	98.8	98.8
54	19.5	14.9	2.1	1.2	1.2	1.2	1.8	95.1	98.8	98.8	98.8	97.6
55	10.6	10.2	1.2	1.2	1.2	1.2	1.2	72.0	98.8	98.8	98.8	36.6
56	8.4	6.8	1.2	1.2	1.2	1.2	1.2	34.1	98.8	98.8	98.8	22.0
57	5.7	4.9	1.2	1.2	1.2	1.2	1.2	1.2	86.6	98.8	98.8	11.6
58	4.1	3.0	1.2	1.2	1.2	1.2	1.2	1.2	34.1	98.8	98.8	7.1
59	2.3	2.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	98.8	98.8	3.2
60	2.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.8	98.3	62.2	2.1
61	1.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	37.8	34.1	1.6
62	1.6	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	11.6	8.5	1.2
63	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.7	1.2	1.2
64	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	97.6	96.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	97.6	97.6	41.5	6.1	11.6	40.3	87.8	97.6	97.6	97.6	97.6	97.6
55-56	2.2	3.4	0.0	0.0	0.0	0.0	0.0	37.9	0.0	0.0	0.0	14.6
59-64	1.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	97.6	97.6	2.0
59-68	1.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	97.6	97.6	2.0
59-75	1.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	97.6	97.6	2.0
60-70	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	97.1	61.0	0.9
61-71	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.6	32.9	0.4
63-69	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
63-77	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	96.7	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.0	0.5	36.6	96.7
61-77	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.6	32.9	0.4

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	98.8	97.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	93.1	41.5	61.0	82.9	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	59.8	17.1	39.0	63.4	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	98.8	40.2	7.3	14.0	41.5	89.0	98.8	98.8	98.8	98.8	98.8
52	98.8	69.5	11.8	1.2	1.2	11.6	23.2	98.8	98.8	98.8	98.8	98.8
53	65.9	21.3	4.0	1.2	1.2	7.3	5.5	98.8	98.8	98.8	98.8	98.8
54	18.3	15.2	2.1	1.2	1.2	1.2	1.8	95.1	98.8	98.8	98.8	97.6
55	10.6	10.2	1.2	1.2	1.2	1.2	1.2	70.7	98.8	98.8	98.8	36.6
56	8.2	6.7	1.2	1.2	1.2	1.2	1.2	34.1	98.8	98.8	98.8	22.0
57	5.7	4.5	1.2	1.2	1.2	1.2	1.2	1.2	87.8	98.8	98.8	12.2
58	4.1	3.4	1.2	1.2	1.2	1.2	1.2	1.2	32.9	98.8	98.8	7.1
59	3.0	2.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	98.8	98.8	4.1
60	2.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.8	98.3	63.4	2.4
61	1.9	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	39.0	32.9	1.6
62	1.6	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	11.6	8.5	1.2
63	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.7	1.2	1.2
64	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	97.6	96.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
50-64	97.6	97.6	39.0	6.1	12.8	40.3	87.8	97.6	97.6	97.6	97.6	97.6
55-56	2.4	3.5	0.0	0.0	0.0	0.0	0.0	36.6	0.0	0.0	0.0	14.6
59-64	1.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	97.6	97.6	2.9
59-68	1.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	97.6	97.6	2.9
59-75	1.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	97.6	97.6	2.9
60-70	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	97.1	62.2	1.2
61-71	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.8	31.7	0.4
63-69	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
63-77	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	96.5	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.0	0.5	35.4	96.4
61-77	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.8	31.7	0.4

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	-2.5	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.2	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0
53	-1.2	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	-1.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.3	0.0	0.0	0.0	0.0
56	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	0.0	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.6
58	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0
59	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
60	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.3
61	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	-1.2	0.0
62	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-64	0.0	0.0	-2.5	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55-56	0.2	0.1	0.0	0.0	0.0	0.0	0.0	-1.3	0.0	0.0	0.0	0.0
59-64	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
59-68	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
59-75	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
60-70	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.3
61-71	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	-1.2	0.0
63-69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	-0.3
61-77	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	-1.2	0.0

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Feather River below Thermalito Afterbay, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	97.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	95.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	92.7	80.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	51.2	19.5	85.4	98.6	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	29.3	4.1	61.0	95.1	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	98.3	12.9	1.2	42.1	88.4	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	74.4	1.8	1.2	9.8	67.5	97.6	98.8	98.8	98.8	98.8	98.8
53	98.8	41.5	1.2	1.2	1.5	52.1	93.2	98.8	98.8	98.8	98.8	98.8
54	98.8	24.4	1.2	1.2	1.2	34.1	90.2	98.8	98.8	98.8	98.8	98.8
55	97.0	10.1	1.2	1.2	1.2	18.3	78.0	98.8	98.8	98.8	98.8	98.8
56	89.8	4.6	1.2	1.2	1.2	7.9	62.8	98.7	98.8	98.8	98.8	98.8
57	62.2	3.1	1.2	1.2	1.2	4.5	39.0	97.7	98.8	98.8	98.8	98.7
58	37.8	2.0	1.2	1.2	1.2	1.2	20.7	93.7	98.8	98.8	98.8	98.0
59	19.5	1.2	1.2	1.2	1.2	1.2	12.7	89.0	98.8	98.8	98.8	93.9
60	10.0	1.2	1.2	1.2	1.2	1.2	6.1	78.0	98.8	98.8	98.8	86.6
61	5.6	1.2	1.2	1.2	1.2	1.2	2.1	68.3	97.6	98.8	98.8	68.3
62	3.3	1.2	1.2	1.2	1.2	1.2	1.2	54.9	95.0	98.8	98.8	48.8
63	2.2	1.2	1.2	1.2	1.2	1.2	1.2	33.5	94.1	98.8	98.8	36.6
64	1.4	1.2	1.2	1.2	1.2	1.2	1.2	17.1	89.0	98.8	98.8	22.0
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	9.1	81.7	98.8	98.8	9.1
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.3	68.3	98.8	91.5	4.9
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.1	36.6	68.3	65.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.7	22.0	43.9	43.9	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	7.3	23.2	30.5	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.0	18.5	13.7	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.8	12.0	10.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.9	4.4	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.3	1.6	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.3	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	91.5	79.3	97.6	97.6	97.6	97.6	97.6	95.5	97.2	97.6
50-64	97.4	97.1	11.7	0.0	40.9	87.2	97.6	81.7	9.8	0.0	0.0	76.8
55-56	7.2	5.5	0.0	0.0	0.0	10.4	15.2	0.1	0.0	0.0	0.0	0.0
59-64	18.1	0.0	0.0	0.0	0.0	0.0	11.5	71.9	9.8	0.0	0.0	71.9
59-68	18.3	0.0	0.0	0.0	0.0	0.0	11.5	86.9	62.2	30.5	33.6	92.7
59-75	18.3	0.0	0.0	0.0	0.0	0.0	11.5	87.8	97.6	95.5	97.2	92.7
60-70	8.8	0.0	0.0	0.0	0.0	0.0	4.9	76.8	91.5	75.6	68.3	85.4
61-71	4.4	0.0	0.0	0.0	0.0	0.0	0.9	67.1	94.6	80.3	85.1	67.1
63-69	1.0	0.0	0.0	0.0	0.0	0.0	0.0	31.8	72.1	54.9	54.9	35.4
63-77	1.0	0.0	0.0	0.0	0.0	0.0	0.0	32.3	92.9	96.5	97.6	35.4
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	80.5	97.6	97.6	7.9
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	22.0	29.3	0.0
42-60	88.8	97.6	97.6	96.0	97.6	97.6	92.7	20.8	0.0	0.0	0.0	12.2
61-77	4.4	0.0	0.0	0.0	0.0	0.0	0.9	67.1	96.4	96.5	97.6	67.1

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	97.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	98.8	95.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	92.7	81.7	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	51.2	19.5	85.4	98.7	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	29.3	4.1	61.0	95.1	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	98.3	13.0	1.2	43.3	88.4	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	74.4	1.8	1.2	10.2	67.5	97.6	98.8	98.8	98.8	98.8	98.8
53	98.8	41.5	1.2	1.2	1.5	50.9	93.2	98.8	98.8	98.8	98.8	98.8
54	98.8	24.4	1.2	1.2	1.2	34.1	90.2	98.8	98.8	98.8	98.8	98.8
55	97.0	10.4	1.2	1.2	1.2	18.3	78.0	98.8	98.8	98.8	98.8	98.8
56	89.8	4.7	1.2	1.2	1.2	7.3	63.4	98.7	98.8	98.8	98.8	98.8
57	62.2	3.4	1.2	1.2	1.2	4.5	39.0	97.7	98.8	98.8	98.8	98.7
58	36.6	2.0	1.2	1.2	1.2	1.2	20.7	93.7	98.8	98.8	98.8	98.0
59	20.7	1.2	1.2	1.2	1.2	1.2	12.7	89.0	98.8	98.8	98.8	93.9
60	10.7	1.2	1.2	1.2	1.2	1.2	6.1	79.3	98.8	98.8	98.8	85.4
61	5.6	1.2	1.2	1.2	1.2	1.2	2.1	68.3	97.6	98.8	98.8	67.7
62	3.3	1.2	1.2	1.2	1.2	1.2	1.2	54.9	95.0	98.8	98.8	48.8
63	2.1	1.2	1.2	1.2	1.2	1.2	1.2	33.5	94.1	98.8	98.8	36.6
64	1.4	1.2	1.2	1.2	1.2	1.2	1.2	17.1	89.0	98.8	98.8	24.4
65	1.2	1.2	1.2	1.2	1.2	1.2	1.2	9.1	81.7	98.8	98.8	10.4
66	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.3	69.5	98.8	91.5	6.1
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.1	36.6	68.3	65.2	1.2
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.7	23.2	45.1	46.3	1.2
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	7.6	23.2	32.9	1.2
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.0	18.5	14.0	1.2
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.8	12.0	10.2	1.2
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	5.0	4.4	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.3	1.6	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.3	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	91.5	80.5	97.6	97.6	97.6	97.6	97.6	95.5	97.2	97.6
50-64	97.4	97.1	11.8	0.0	42.1	87.2	97.6	81.7	9.8	0.0	0.0	74.4
55-56	7.2	5.7	0.0	0.0	0.0	11.0	14.6	0.1	0.0	0.0	0.0	0.0
59-64	19.3	0.0	0.0	0.0	0.0	0.0	11.5	71.9	9.8	0.0	0.0	69.5
59-68	19.5	0.0	0.0	0.0	0.0	0.0	11.5	86.9	62.2	30.5	33.6	92.7
59-75	19.5	0.0	0.0	0.0	0.0	0.0	11.5	87.8	97.6	95.5	97.2	92.7
60-70	9.5	0.0	0.0	0.0	0.0	0.0	4.9	78.1	91.2	75.6	65.9	84.2
61-71	4.4	0.0	0.0	0.0	0.0	0.0	0.9	67.1	94.6	80.3	84.8	66.5
63-69	0.9	0.0	0.0	0.0	0.0	0.0	0.0	31.8	70.9	53.7	52.5	35.4
63-77	0.9	0.0	0.0	0.0	0.0	0.0	0.0	32.3	92.9	96.5	97.6	35.4
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.9	80.5	97.6	97.6	9.2
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.4	22.0	31.7	0.0
42-60	88.1	97.6	97.6	96.0	97.6	97.6	92.7	19.5	0.0	0.0	0.0	13.4
61-77	4.4	0.0	0.0	0.0	0.0	0.0	0.9	67.1	96.4	96.5	97.6	66.5

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.1	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	0.0	0.1	0.0	0.0	0.0	-0.6	0.6	0.0	0.0	0.0	0.0	0.0
57	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58	-1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	0.7	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	-1.2
61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6
62	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.2
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	2.4	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	2.4	0.0
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-64	0.0	0.0	0.1	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	-2.4
55-56	0.0	0.2	0.0	0.0	0.0	0.6	-0.6	0.0	0.0	0.0	0.0	0.0
59-64	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.4
59-68	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59-75	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-70	0.7	0.0	0.0	0.0	0.0	0.0	0.0	1.3	-0.3	0.0	-2.4	-1.2
61-71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	-0.6
63-69	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	-1.2	-2.4	0.0
63-77	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	2.4	0.0
42-60	-0.7	0.0	0.0	0.0	0.0	0.0	0.0	-1.3	0.0	0.0	0.0	1.2
61-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6

Table 226 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Feather River at the Mouth, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	95.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	96.3	93.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	82.1	68.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	19.5	8.5	92.7	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	6.1	1.2	76.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	96.7	1.8	1.2	50.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	61.0	1.2	1.2	12.2	91.5	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	37.2	1.2	1.2	3.7	76.8	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	15.9	1.2	1.2	2.5	62.2	98.8	98.8	98.8	98.8	98.8	98.8
55	98.8	4.3	1.2	1.2	1.2	39.6	98.8	98.8	98.8	98.8	98.8	98.8
56	98.8	1.2	1.2	1.2	1.2	26.8	97.3	98.8	98.8	98.8	98.8	98.8
57	98.8	1.2	1.2	1.2	1.2	11.3	93.1	98.8	98.8	98.8	98.8	98.8
58	95.1	1.2	1.2	1.2	1.2	3.5	79.3	98.8	98.8	98.8	98.8	98.8
59	87.8	1.2	1.2	1.2	1.2	1.6	72.6	98.8	98.8	98.8	98.8	98.8
60	67.1	1.2	1.2	1.2	1.2	1.2	62.2	98.8	98.8	98.8	98.8	98.8
61	46.3	1.2	1.2	1.2	1.2	1.2	41.5	98.5	98.8	98.8	98.8	98.8
62	24.4	1.2	1.2	1.2	1.2	1.2	29.9	94.3	98.8	98.8	98.8	98.6
63	12.8	1.2	1.2	1.2	1.2	1.2	19.8	87.8	98.8	98.8	98.8	97.3
64	6.6	1.2	1.2	1.2	1.2	1.2	14.6	76.8	98.8	98.8	98.8	94.8
65	3.3	1.2	1.2	1.2	1.2	1.2	6.9	66.8	98.8	98.8	98.8	92.3
66	1.6	1.2	1.2	1.2	1.2	1.2	1.2	61.0	97.4	98.8	98.8	82.9
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	24.8	91.1	98.8	98.8	49.4
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	16.5	84.1	98.8	98.2	31.1
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	7.9	70.7	98.8	91.1	26.4
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.3	62.2	91.5	75.6	19.5
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	43.9	79.3	64.6	9.8
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.0	12.2	32.9	27.4	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	8.1	20.7	21.1	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.6	2.4	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	80.9	67.1	97.6	97.6	97.6	97.6	90.7	78.1	77.7	97.6
50-64	92.2	95.5	0.6	0.0	48.8	97.6	84.2	22.0	0.0	0.0	0.0	4.0
55-56	0.0	3.1	0.0	0.0	0.0	12.8	1.5	0.0	0.0	0.0	0.0	0.0
59-64	81.2	0.0	0.0	0.0	0.0	0.4	58.0	22.0	0.0	0.0	0.0	4.0
59-68	86.6	0.0	0.0	0.0	0.0	0.4	71.4	74.0	7.7	0.0	0.0	49.4
59-75	86.6	0.0	0.0	0.0	0.0	0.4	71.4	97.6	90.7	78.1	77.7	97.6
60-70	65.9	0.0	0.0	0.0	0.0	0.0	61.0	90.9	28.1	0.0	7.7	72.4
61-71	45.1	0.0	0.0	0.0	0.0	0.0	40.3	92.2	36.6	7.3	23.2	79.3
63-69	11.6	0.0	0.0	0.0	0.0	0.0	18.6	71.3	14.7	0.0	0.6	66.2
63-77	11.6	0.0	0.0	0.0	0.0	0.0	18.6	86.6	97.6	94.2	96.4	96.1
65-82	2.1	0.0	0.0	0.0	0.0	0.0	5.7	65.6	97.6	97.6	97.6	91.1
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	69.5	97.6	89.9	25.2
42-60	31.7	97.6	97.6	94.3	97.6	97.6	36.6	0.0	0.0	0.0	0.0	0.0
61-77	45.1	0.0	0.0	0.0	0.0	0.0	40.3	97.3	97.6	94.2	96.4	97.6

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	98.8	95.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	96.3	93.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	82.1	68.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	19.5	8.5	92.7	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.8	6.1	1.2	76.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	96.7	1.8	1.2	50.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	61.0	1.2	1.2	13.4	91.5	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	37.2	1.2	1.2	3.7	76.8	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	14.6	1.2	1.2	2.5	62.2	98.8	98.8	98.8	98.8	98.8	98.8
55	98.8	4.3	1.2	1.2	1.2	39.6	98.8	98.8	98.8	98.8	98.8	98.8
56	98.8	1.2	1.2	1.2	1.2	26.8	97.3	98.8	98.8	98.8	98.8	98.8
57	98.8	1.2	1.2	1.2	1.2	11.3	93.1	98.8	98.8	98.8	98.8	98.8
58	95.1	1.2	1.2	1.2	1.2	3.5	79.3	98.8	98.8	98.8	98.8	98.8
59	87.8	1.2	1.2	1.2	1.2	1.6	72.6	98.8	98.8	98.8	98.8	98.8
60	67.1	1.2	1.2	1.2	1.2	1.2	62.2	98.8	98.8	98.8	98.8	98.8
61	46.3	1.2	1.2	1.2	1.2	1.2	41.5	98.5	98.8	98.8	98.8	98.8
62	24.4	1.2	1.2	1.2	1.2	1.2	29.9	94.3	98.8	98.8	98.8	98.6
63	12.8	1.2	1.2	1.2	1.2	1.2	19.8	87.8	98.8	98.8	98.8	97.3
64	6.6	1.2	1.2	1.2	1.2	1.2	14.6	76.8	98.8	98.8	98.8	94.9
65	3.3	1.2	1.2	1.2	1.2	1.2	6.9	66.8	98.8	98.8	98.8	92.7
66	1.6	1.2	1.2	1.2	1.2	1.2	1.2	59.8	97.4	98.8	98.8	81.7
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	24.8	91.1	98.8	98.8	49.4
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	16.5	84.1	98.8	98.2	31.7
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	7.9	70.7	98.8	91.1	26.4
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.3	62.2	91.5	75.6	19.5
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	43.9	79.3	65.9	9.8
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.0	12.2	32.9	28.7	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	8.1	20.7	21.1	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.6	2.4	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	80.9	67.1	97.6	97.6	97.6	97.6	90.7	78.1	77.7	97.6
50-64	92.2	95.5	0.6	0.0	48.8	97.6	84.2	22.0	0.0	0.0	0.0	3.9
55-56	0.0	3.1	0.0	0.0	0.0	12.8	1.5	0.0	0.0	0.0	0.0	0.0
59-64	81.2	0.0	0.0	0.0	0.0	0.4	58.0	22.0	0.0	0.0	0.0	3.9
59-68	86.6	0.0	0.0	0.0	0.0	0.4	71.4	74.0	7.7	0.0	0.0	49.4
59-75	86.6	0.0	0.0	0.0	0.0	0.4	71.4	97.6	90.7	78.1	77.7	97.6
60-70	65.9	0.0	0.0	0.0	0.0	0.0	61.0	90.9	28.1	0.0	7.7	72.4
61-71	45.1	0.0	0.0	0.0	0.0	0.0	40.3	92.2	36.6	7.3	23.2	79.3
63-69	11.6	0.0	0.0	0.0	0.0	0.0	18.6	71.3	14.7	0.0	0.6	65.6
63-77	11.6	0.0	0.0	0.0	0.0	0.0	18.6	86.6	97.6	94.2	96.4	96.1
65-82	2.1	0.0	0.0	0.0	0.0	0.0	5.7	65.6	97.6	97.6	97.6	91.5
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.7	69.5	97.6	89.9	25.2
42-60	31.7	97.6	97.6	94.3	97.6	97.6	36.6	0.0	0.0	0.0	0.0	0.0
61-77	45.1	0.0	0.0	0.0	0.0	0.0	40.3	97.3	97.6	94.2	96.4	97.6

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	-1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
66	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	-1.2
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
55-56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59-64	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1
59-68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59-75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61-71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63-69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6
63-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42-60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 227 E504ELD-J602F3ELD

Delta Smelt in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult	December through May	Mean Monthly Water Temperature (°F)	Sacramento River at Freeport	59-68		All Years			0.0	0.0	0.0	0.0	-0.9	0.4				
		Mean Monthly Flow (cfs)	Yolo Bypass		10	All Years			0.0	-8.5	0.0	0.0	0.0	0.0				
	September through November	Mean Monthly X_2 (RKm)	X_2 between 74 km and 81 km	74-81		Wet and Above Normal Water Years	-2.6	0.0										0.0
	December through February	Mean Monthly OMR Flow (cfs)	Old and Middle Rivers	<-5000 cfs		All Years			0.0	0.0	0.0							
Egg and Embryo	February through May	Mean Monthly Water Temperature (°F)	Sacramento River at Freeport	59-68		All Years					0.0	0.0	-0.9	0.4				
Larval	March through June	Mean Monthly Water Temperature (°F)	Sacramento River at Freeport	59-68		All Years						0.0	-0.9	0.4	0.0			
		Mean Monthly OMR Flow (cfs)	Old and Middle Rivers	<-1500 cfs		Dry and Critical Water Years						0.0	0.0	0.0	3.3			
		Mean Monthly Delta Outflow (cfs)	Delta		10	All Years						0.0	0.0	0.0	0.0			
Juvenile	May through July	Mean Monthly Water Temperature (°F)	Sacramento River at Freeport	59-68		All Years								0.4	0.0	0.0		
		Mean Monthly X_2 (RKm)	Changes in X_2 between RKm 65 and 80	0.5 RKm		All Years								0.0	-8.5	-1.2		

Table 228 E504ELD-J602F3ELD

Longfin Smelt in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult	December through March	Mean Monthly OMR Flow (cfs)	Old and Middle Rivers	<-5000 cfs		All Years			0.0	0.0	0.0	0.0						
Larvae and Juvenile	April and May	Mean Monthly OMR Flow (cfs)	Old and Middle Rivers	<-1500 cfs		Dry and Critical Water Years							0.0	0.0				
				< 0 cfs		Dry and Critical Water Years							0.0	0.0				
	January through June	Mean Monthly X_2 (RKm)	X_2	< 75 RKm		All Years				0.0	0.0	0.0	0.0	0.0	0.0			
				< 75 RKm		Dry and Critical Water Years				0.0	0.0	0.0	0.0	0.0	0.0			

Table 229 E504ELD-J602F3ELD

Winter-run Chinook Salmon in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Juvenile Rearing and Emigration	November through May	Mean Monthly Flow (cfs)	Rio Vista		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
		Mean Monthly Flow (cfs)	Yolo Bypass		10	All Years		-1.2	0.0	-8.5	0.0	0.0	0.0	0.0				
		Mean Monthly Delta Outflow (cfs)	Delta		10	All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0				
		Mean Monthly OMR Flow (cfs)	Old and Middle Rivers	<2500 cfs		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0				

Table 230 E504ELD-J602F3ELD

Spring-run Chinook Salmon in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Juvenile Rearing and Emigration	November through June	Mean Monthly Flow (cfs)	Rio Vista		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
		Mean Monthly Flow (cfs)	Yolo Bypass		10	All Years		-1.2	0.0	-8.5	0.0	0.0	0.0	0.0	0.0			
		Mean Monthly Delta Outflow (cfs)	Delta		10	All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
		Mean Monthly OMR Flow (cfs)	Old and Middle Rivers	<2500 cfs		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			

Table 231 E504ELD-J602F3ELD

Fall- and Late Fall-run Chinook Salmon in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Juvenile Rearing and Emigration	November through June	Mean Monthly Flow (cfs)	Rio Vista		10	Lower 40%		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
		Mean Monthly Flow (cfs)	Yolo Bypass		10	All Years		-1.2	0.0	-8.5	0.0	0.0	0.0	0.0	0.0			
		Mean Monthly Delta Outflow (cfs)	Delta		10	All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
		Mean Monthly OMR Flow (cfs)	Old and Middle Rivers	<2500 cfs		All Years		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Adult (San Joaquin River)	December through February	Mean Monthly OMR Flow (cfs)	Old and Middle Rivers	<-5000 cfs		All Years			-1.2	1.2	0.0							

Table 232 E504ELD-J602F3ELD

Steelhead in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Juvenile Rearing and Emigration	October through July	Mean Monthly Flow (cfs)	Rio Vista		10	Lower 40%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		Mean Monthly Flow (cfs)	Yolo Bypass		10	All Years	0.0	-1.2	0.0	-8.5	0.0	0.0	0.0	0.0	0.0	0.0		
		Mean Monthly Delta Outflow (cfs)	Delta		10	All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
		Mean Monthly OMR Flow (cfs)	Old and Middle Rivers	<2500 cfs		All Years	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

Table 233 E504ELD-J602F3ELD

Green Sturgeon in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Juvenile Rearing and Emigration	Year-round	Mean Monthly Flow (cfs)	Yolo Bypass		10	All Years	0.0	-1.2	0.0	-8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7

Table 234 E504ELD-J602F3ELD

White Sturgeon in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Juvenile Rearing and Emigration	April through June	Mean Monthly Flow (cfs)	Yolo Bypass		10	All Years							0.0	0.0	0.0			

Table 235 E504ELD-J602F3ELD

Splittail in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Spawning and Embryo Incubation	February through May	Mean Monthly Flow (cfs)	Yolo Bypass		10	All Years					0.0	0.0	0.0	0.0				
Juvenile Rearing and Emigration	April through July	Mean Monthly Flow (cfs)	Yolo Bypass		10	All Years							0.0	0.0	0.0	0.0		

Table 236 E504ELD-J602F3ELD

American Shad in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Egg and Larvae	April through June	Mean Monthly X_2 (RKm)	Changes in X_2	1 RKm		All Years							0.0	0.0	-3.7			

Table 237 E504ELD-J602F3ELD

Striped Bass in the Delta

Lifestage	Evaluation Period	Indicator of Potential Impact	Location	Metric		Range	Net Change in Probability of Exceedance under With-Project (J602F3 ELD) relative to the CEQA Existing Condition (E504 ELD)											
			Description	Value	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Egg and Larvae	April through June	Mean Monthly X_2 (RKm)	Changes in X_2	1 RKm		All Years							0.0	0.0	-3.7			

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)

Sacramento River at Freeport, Monthly Temperature

Exceedance of Water Temperature Index Values and Probability of Occurring within the Water Temperature Index Ranges

CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	97.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	96.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	97.0	94.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	91.5	87.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	74.4	56.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	11.0	1.2	86.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.3	2.2	1.2	56.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	97.6	1.6	1.2	36.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	80.5	1.2	1.2	7.7	85.4	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	59.8	1.2	1.2	2.3	70.7	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	34.1	1.2	1.2	1.2	54.9	98.8	98.8	98.8	98.8	98.8	98.8
55	98.8	15.9	1.2	1.2	1.2	32.9	97.6	98.8	98.8	98.8	98.8	98.8
56	98.8	4.1	1.2	1.2	1.2	20.7	95.7	98.8	98.8	98.8	98.8	98.8
57	98.8	2.4	1.2	1.2	1.2	11.2	91.7	98.8	98.8	98.8	98.8	98.8
58	98.8	1.2	1.2	1.2	1.2	3.7	80.0	98.8	98.8	98.8	98.8	98.8
59	92.7	1.2	1.2	1.2	1.2	2.8	72.0	98.8	98.8	98.8	98.8	98.8
60	79.3	1.2	1.2	1.2	1.2	1.8	59.5	98.8	98.8	98.8	98.8	98.8
61	52.4	1.2	1.2	1.2	1.2	1.2	42.1	97.7	98.8	98.8	98.8	98.8
62	30.5	1.2	1.2	1.2	1.2	1.2	29.3	93.9	98.8	98.8	98.8	98.8
63	17.1	1.2	1.2	1.2	1.2	1.2	16.5	83.5	98.8	98.8	98.8	97.6
64	7.1	1.2	1.2	1.2	1.2	1.2	11.0	70.7	98.8	98.8	98.8	93.1
65	3.2	1.2	1.2	1.2	1.2	1.2	5.1	58.5	98.8	98.8	98.8	89.8
66	1.6	1.2	1.2	1.2	1.2	1.2	1.2	46.7	97.7	98.8	98.8	80.5
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	14.6	82.9	98.8	98.8	43.5
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	10.6	69.5	97.6	96.0	31.1
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.7	52.4	89.0	80.5	18.0
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	31.7	74.4	59.8	8.5
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	18.3	51.2	46.3	2.1
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.2	8.3	7.9	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.5	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.5	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	73.2	54.9	97.6	97.6	97.6	97.6	97.6	94.3	97.6	97.6
50-64	91.7	96.4	0.4	0.0	34.8	97.6	87.8	28.1	0.0	0.0	0.0	5.7
55-56	0.0	11.8	0.0	0.0	0.0	12.2	1.9	0.0	0.0	0.0	0.0	0.0
59-64	85.6	0.0	0.0	0.0	0.0	1.6	61.0	28.1	0.0	0.0	0.0	5.7
59-68	91.5	0.0	0.0	0.0	0.0	1.6	70.8	84.2	15.9	0.0	0.0	55.3
59-75	91.5	0.0	0.0	0.0	0.0	1.6	70.8	97.6	97.6	94.3	97.6	97.6
60-70	78.1	0.0	0.0	0.0	0.0	0.6	58.3	92.1	46.4	9.8	18.3	80.8
61-71	51.2	0.0	0.0	0.0	0.0	0.0	40.9	94.2	67.1	24.4	39.0	90.3
63-69	15.9	0.0	0.0	0.0	0.0	0.0	15.3	72.9	29.3	1.2	2.8	66.5
63-77	15.9	0.0	0.0	0.0	0.0	0.0	15.3	82.3	97.6	97.3	97.6	96.4
65-82	2.0	0.0	0.0	0.0	0.0	0.0	3.9	57.3	97.6	97.6	97.6	88.6
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.5	51.2	87.8	79.3	16.8
42-60	19.5	97.6	95.8	92.9	97.6	97.0	39.3	0.0	0.0	0.0	0.0	0.0
61-77	51.2	0.0	0.0	0.0	0.0	0.0	40.9	96.5	97.6	97.3	97.6	97.6

With-Project (J602F3 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	98.8	98.8	98.8	97.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
41	98.8	98.8	98.8	96.6	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
42	98.8	98.8	97.0	94.1	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
43	98.8	98.8	91.5	87.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
45	98.8	98.8	74.4	57.3	98.8	98.8	98.8	98.8	98.8	98.8	98.8	98.8
48	98.8	98.8	12.2	1.2	87.2	98.8	98.8	98.8	98.8	98.8	98.8	98.8
49	98.8	98.3	2.2	1.2	58.5	98.8	98.8	98.8	98.8	98.8	98.8	98.8
50	98.8	97.6	1.6	1.2	36.0	98.8	98.8	98.8	98.8	98.8	98.8	98.8
52	98.8	80.5	1.2	1.2	7.3	84.1	98.8	98.8	98.8	98.8	98.8	98.8
53	98.8	58.5	1.2	1.2	2.3	69.5	98.8	98.8	98.8	98.8	98.8	98.8
54	98.8	32.9	1.2	1.2	1.2	53.7	98.8	98.8	98.8	98.8	98.8	98.8
55	98.8	14.6	1.2	1.2	1.2	34.1	97.4	98.8	98.8	98.8	98.8	98.8
56	98.8	4.0	1.2	1.2	1.2	23.2	95.1	98.8	98.8	98.8	98.8	98.8
57	98.8	1.8	1.2	1.2	1.2	10.7	91.7	98.8	98.8	98.8	98.8	98.8
58	98.8	1.2	1.2	1.2	1.2	3.6	79.9	98.8	98.8	98.8	98.8	98.8
59	93.3	1.2	1.2	1.2	1.2	2.8	71.1	98.8	98.8	98.8	98.8	98.8
60	76.8	1.2	1.2	1.2	1.2	1.8	57.3	98.8	98.8	98.8	98.8	98.8
61	52.4	1.2	1.2	1.2	1.2	1.2	39.0	97.7	98.8	98.8	98.8	98.8
62	31.7	1.2	1.2	1.2	1.2	1.2	26.8	93.9	98.8	98.8	98.8	98.8
63	17.1	1.2	1.2	1.2	1.2	1.2	15.9	82.9	98.8	98.8	98.8	97.4
64	7.0	1.2	1.2	1.2	1.2	1.2	10.4	70.1	98.8	98.8	98.8	93.1
65	3.3	1.2	1.2	1.2	1.2	1.2	4.9	57.3	98.8	98.8	98.8	89.8
66	1.5	1.2	1.2	1.2	1.2	1.2	1.2	46.3	97.7	98.8	98.8	80.5
68	1.2	1.2	1.2	1.2	1.2	1.2	1.2	14.2	82.9	98.8	98.8	43.5
69	1.2	1.2	1.2	1.2	1.2	1.2	1.2	10.3	69.5	97.6	96.0	31.1
70	1.2	1.2	1.2	1.2	1.2	1.2	1.2	6.9	51.2	89.0	79.3	17.8
71	1.2	1.2	1.2	1.2	1.2	1.2	1.2	3.5	31.7	74.4	61.0	8.5
72	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.4	18.3	50.0	46.3	2.1
74	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.2	8.3	7.3	1.2
75	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	4.5	1.2	1.2
77	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.5	1.2	1.2
82	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
86	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
88	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
98	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
45-75	97.6	97.6	73.2	56.1	97.6	97.6	97.6	97.6	97.6	94.3	97.6	97.6
50-64	91.8	96.4	0.4	0.0	34.8	97.6	88.4	28.7	0.0	0.0	0.0	5.7
55-56	0.0	10.6	0.0	0.0	0.0	10.9	2.3	0.0	0.0	0.0	0.0	0.0
59-64	86.3	0.0	0.0	0.0	0.0	1.6	60.7	28.7	0.0	0.0	0.0	5.7
59-68	92.1	0.0	0.0	0.0	0.0	1.6	69.9	84.6	15.9	0.0	0.0	55.3
59-75	92.1	0.0	0.0	0.0	0.0	1.6	69.9	97.6	97.6	94.3	97.6	97.6
60-70	75.6	0.0	0.0	0.0	0.0	0.6	56.1	91.9	47.6	9.8	19.5	81.0
61-71	51.2	0.0	0.0	0.0	0.0	0.0	37.8	94.2	67.1	24.4	37.8	90.3
63-69	15.9	0.0	0.0	0.0	0.0	0.0	14.7	72.6	29.3	1.2	2.8	66.3
63-77	15.9	0.0	0.0	0.0	0.0	0.0	14.7	81.7	97.6	97.3	97.6	96.2
65-82	2.1	0.0	0.0	0.0	0.0	0.0	3.7	56.1	97.6	97.6	97.6	88.6
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.7	50.0	87.8	78.1	16.6
42-60	22.0	97.6	95.8	92.9	97.6	97.0	41.5	0.0	0.0	0.0	0.0	0.0
61-77	51.2	0.0	0.0	0.0	0.0	0.0	37.8	96.5	97.6	97.3	97.6	97.6

With-Project (J602F3 ELD) - CEQA Existing Condition (E504 ELD)

Index Value or Range	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
41	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
42	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
43	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	0.0	0.0	1.2	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	-0.4	-1.3	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	-1.3	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	-1.2	0.0	0.0	0.0	-1.2	0.0	0.0	0.0	0.0	0.0	0.0
55	0.0	-1.3	0.0	0.0	0.0	1.2	-0.2	0.0	0.0	0.0	0.0	0.0
56	0.0	-0.1	0.0	0.0	0.0	2.5	-0.6	0.0	0.0	0.0	0.0	0.0
57	0.0	-0.6	0.0	0.0	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	0.0
58	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0
59	0.6	0.0	0.0	0.0	0.0	0.0	-0.9	0.0	0.0	0.0	0.0	0.0
60	-2.5	0.0	0.0	0.0	0.0	0.0	-2.2	0.0	0.0	0.0	0.0	0.0
61	0.0	0.0	0.0	0.0	0.0	0.0	-3.1	0.0	0.0	0.0	0.0	0.0
62	1.2	0.0	0.0	0.0	0.0	0.0	-2.5	0.0	0.0	0.0	0.0	0.0
63	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-0.6	0.0	0.0	0.0	-0.2
64	-0.1	0.0	0.0	0.0	0.0	0.0	-0.6	-0.6	0.0	0.0	0.0	0.0
65	0.1	0.0	0.0	0.0	0.0	0.0	-0.2	-1.2	0.0	0.0	0.0	0.0
66	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0
68	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.4	0.0	0.0	0.0	0.0
69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	0.0	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-1.2	0.0	-1.2	-0.2
71	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0
72	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.2	0.0	0.0
74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	0.0
75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-75	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-64	0.1	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.0
55-56	0.0	-1.2	0.0	0.0	0.0	-1.3	0.4	0.0	0.0	0.0	0.0	0.0
59-64	0.7	0.0	0.0	0.0	0.0	0.0	-0.3	0.6	0.0	0.0	0.0	0.0
59-68	0.6	0.0	0.0	0.0	0.0	0.0	-0.9	0.4	0.0	0.0	0.0	0.0
59-75	0.6	0.0	0.0	0.0	0.0	0.0	-0.9	0.0	0.0	0.0	0.0	0.0
60-70	-2.5	0.0	0.0	0.0	0.0	0.0	-2.2	-0.2	1.2	0.0	1.2	0.2
61-71	0.0	0.0	0.0	0.0	0.0	0.0	-3.1	0.0	0.0	0.0	-1.2	0.0
63-69	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-0.3	0.0	0.0	0.0	-0.2
63-77	0.0	0.0	0.0	0.0	0.0	0.0	-0.6	-0.6	0.0	0.0	0.0	-0.2
65-82	0.1	0.0	0.0	0.0	0.0	0.0	-0.2	-1.2	0.0	0.0	0.0	0.0
70-82	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	-1.2	0.0	-1.2	-0.2
42-60	2.5	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0
61-77	0.0	0.0	0.0	0.0	0.0	0.0	-3.1	0.0	0.0	0.0	0.0	0.0

Table 239 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Sacramento River at Rio Vista, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	78.0	70.7	84.1	92.7	62.2	46.3	48.8	62.2	86.6	82.9	84.1	86.6
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.4	0.0	0.0	0.0	0.0
X>1.0 (Total %)	11.0	14.6	7.3	0.0	1.2	37.8	43.9	30.5	3.7	6.1	8.5	8.5
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	7.3	13.4	8.5	6.1	34.1	14.6	3.7	4.9	7.3	9.8	7.3	3.7
Net Change in % Exceedance:	3.7	1.2	-1.2	-6.1	-32.9	23.2	40.2	25.6	-3.7	-3.7	1.2	4.9
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.4	0.0	0.0	0.0	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	93.9	69.7	90.9	100.0	72.7	60.6	72.7	51.5	84.8	60.6	60.6	75.8
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1 (Total %)	0.0	12.1	9.1	0.0	0.0	21.2	27.3	39.4	0.0	15.2	21.2	15.2
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1 (Total %)	6.1	18.2	0.0	0.0	27.3	18.2	0.0	9.1	15.2	21.2	18.2	6.1
Net Change in % Exceedance:	-6.1	-6.1	9.1	0.0	-27.3	3.0	27.3	30.3	-15.2	-6.1	3.0	9.1
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 240 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Yolo Bypass, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	98.8	96.3	91.5	82.9	87.8	92.7	98.8	100.0	100.0	100.0	100.0	89.0
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7
X>1.0 (Total %)	0.0	0.0	2.4	1.2	1.2	4.9	0.0	0.0	0.0	0.0	0.0	9.8
X<=-10.0	0.0	1.2	0.0	8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	1.2	3.7	6.1	15.9	7.3	2.4	0.0	0.0	0.0	0.0	0.0	1.2
Net Change in % Exceedance:	-1.2	-3.7	-3.7	-14.6	-6.1	2.4	0.0	0.0	0.0	0.0	0.0	8.5
Net Change in 10% Exceedance	0.0	-1.2	0.0	-8.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	100.0	100.0	100.0	72.7	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1 (Total %)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<=-10.0	0.0	0.0	0.0	21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1 (Total %)	0.0	0.0	0.0	27.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change in % Exceedance:	0.0	0.0	0.0	-27.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Change in 10% Exceedance	0.0	0.0	0.0	-21.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 241 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
Delta Outflow, Monthly Flow

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
-1.0 < X < 1.0	92.7	87.8	86.6	85.4	58.5	51.2	59.8	74.4	75.6	91.5	90.2	93.9
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1.0 (Total %)	2.4	3.7	3.7	7.3	2.4	37.8	32.9	22.0	0.0	7.3	7.3	2.4
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1.0 (Total %)	3.7	8.5	9.8	6.1	39.0	9.8	7.3	3.7	22.0	1.2	2.4	2.4
Net Change in % Exceedance:	-1.2	-4.9	-6.1	1.2	-36.6	28.0	25.6	18.3	-22.0	6.1	4.9	0.0
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low Flows (Upper 40% of Distribution)												
-1.0 < X < 1.0	93.9	97.0	97.0	81.8	69.7	72.7	72.7	57.6	63.6	84.8	84.8	87.9
X>=10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X>1 (Total %)	0.0	3.0	0.0	18.2	3.0	18.2	18.2	36.4	0.0	15.2	9.1	6.1
X<=-10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
X<-1 (Total %)	6.1	0.0	3.0	0.0	27.3	9.1	9.1	6.1	33.3	0.0	6.1	3.0
Net Change in % Exceedance:	-6.1	3.0	-3.0	18.2	-24.2	9.1	9.1	30.3	-33.3	15.2	3.0	3.0
Net Change in 10% Exceedance	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 242 E504ELD-J602F3ELD

Old and Middle River (OMR) Flow Criteria Summary Table

% of Years

All Years

<-5000 cfs	October	November	December	January	February	March	April	May	June	July	August	September
CEQA Existing Condition (E5	70	77	83	0	0	0	0	0	0	89	87	87
With-Project (J602F3 ELD)	68	78	83	0	0	0	0	0	0	89	87	87
Difference (% of Years)	**-1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

<2500 cfs	October	November	December	January	February	March	April	May	June	July	August	September
CEQA Existing Condition (E5	100	100	99	98	95	94	88	89	100	100	100	100
With-Project (J602F3 ELD)	100	100	99	98	95	94	88	89	100	100	100	100
Difference (% of Years)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Dry and Critical Water Years

<-1500 cfs	October	November	December	January	February	March	April	May	June	July	August	September
CEQA Existing Condition (E5	100	100	100	97	97	77	3	10	50	100	100	100
With-Project (J602F3 ELD)	100	100	100	97	97	77	3	10	53	100	100	100
Difference (% of Years)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**0**

<0 cfs												
CEQA Existing Condition (E5	100	100	100	100	100	100	90	97	100	100	100	100
With-Project (J602F3 ELD)	100	100	100	100	100	100	90	97	100	100	100	100
Difference (% of Years)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table 243 E504ELD-J602F3ELD

With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD)
X2 Position Summary Table

All Years												
< 75 RKm	October	November	December	January	February	March	April	May	June	July	August	September
CEQA Existing Condition (E504 ELD)	32.9	34.1	25.6	35.4	62.2	86.6	87.8	84.1	69.5	42.7	13.4	3.7
With-Project (J602F3 ELD)	32.9	34.1	25.6	35.4	62.2	86.6	87.8	84.1	69.5	42.7	13.4	3.7
Difference (% of Years)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
0.5 RKm or more (65-80)	October	November	December	January	February	March	April	May	June	July	August	September
Increase under Alt	0.0	1.2	2.4	0.0	0.0	3.7	1.2	2.4	0.0	1.2	0.0	0.0
Decrease under Alt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	8.5	2.4	0.0	0.0
Net Difference (% of Years)	**0.0**	**1.2**	**2.4**	**0.0**	**0.0**	**3.7**	**1.2**	**0.0**	**-8.5**	**-1.2**	**0.0**	**0.0**
1 RKm or more	October	November	December	January	February	March	April	May	June	July	August	September
Increase under Alt	0.0	0.0	1.2	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Decrease under Alt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0
Net Difference (% of Years)	**0.0**	**0.0**	**1.2**	**0.0**	**0.0**	**1.2**	**0.0**	**0.0**	**-3.7**	**0.0**	**0.0**	**0.0**
Dry and Critical Water Years												
< 75 RKm	October	November	December	January	February	March	April	May	June	July	August	September
CEQA Existing Condition (E504 ELD)	20.0	20.0	10.0	6.7	23.3	66.7	66.7	56.7	23.3	3.3	0.0	0.0
With-Project (J602F3 ELD)	20.0	20.0	10.0	6.7	23.3	66.7	66.7	56.7	20.0	0.0	0.0	0.0
Difference (% of Years)	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Wet and Above Normal Years												
X2 (74-81)	October	November	December	January	February	March	April	May	June	July	August	September
CEQA Existing Condition (E504 ELD)	39.5	34.2	44.7	21.1	2.6	0.0	0.0	0.0	0.0	26.3	73.7	0.0
With-Project (J602F3 ELD)	36.8	34.2	44.7	21.1	2.6	0.0	0.0	0.0	0.0	26.3	76.3	0.0
Difference (% of Years)	**-2.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.6**	**0.0**

Table 244 E504ELD-J602F3ELD

Long-term and Water Year Type Average of Shasta Reservoir End of Month Elevation Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

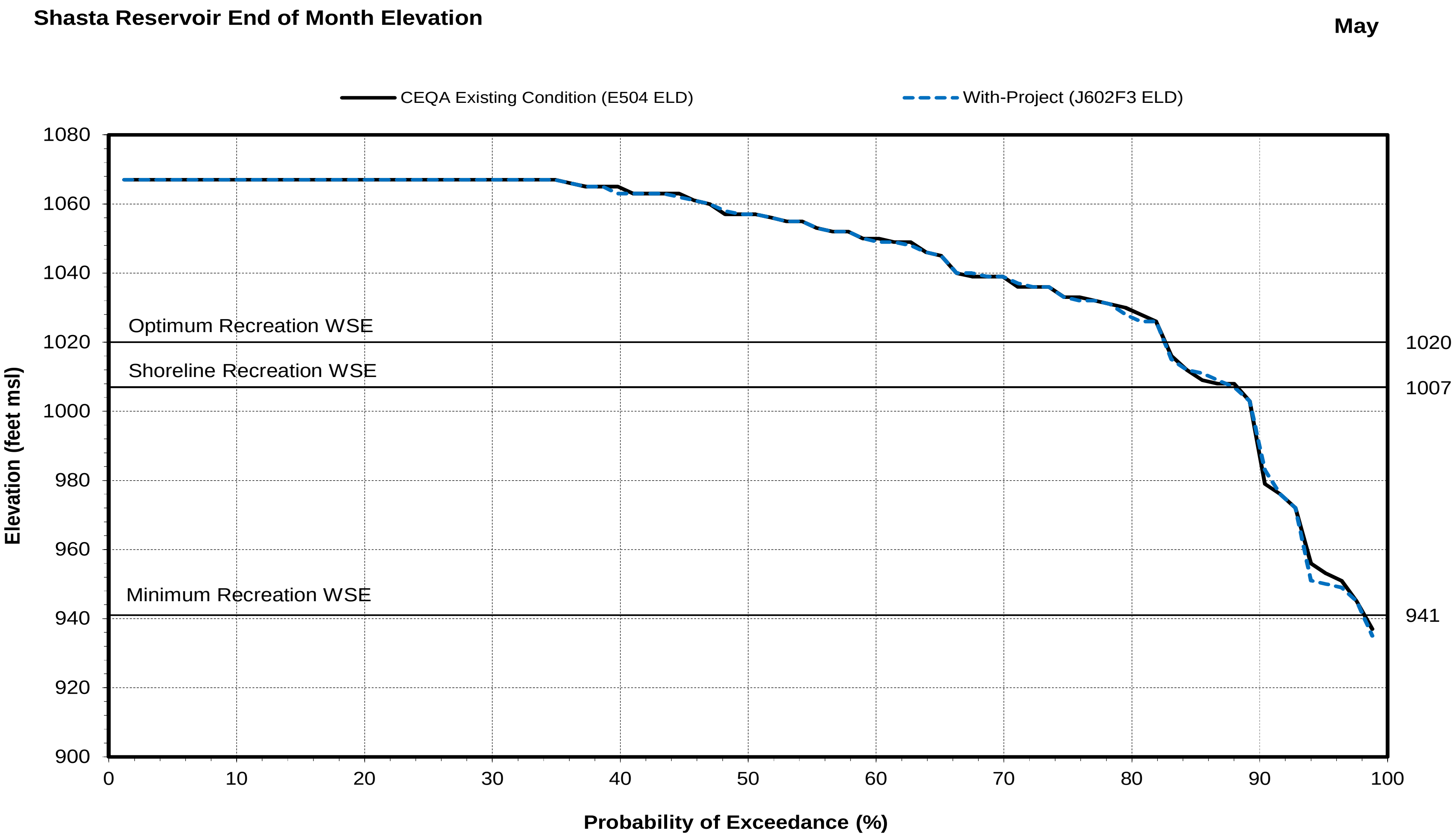
	Average Elevation (feet msl)											
Analysis Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period²												
CEQA Existing Condition (E504 ELD)	983	981	989	1,003	1,016	1,032	1,043	1,043	1,031	1,010	995	987
With-Project (J602F3 ELD)	983	981	989	1,003	1,016	1,031	1,043	1,043	1,031	1,011	995	987
Difference	0	0	0	0	0	-1	0	0	0	1	0	0
Percent Difference³	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	0.0	0.0
Water Year Types¹												
Wet												
CEQA Existing Condition (E504 ELD)	997	998	1,011	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,029	1,011
With-Project (J602F3 ELD)	998	998	1,011	1,024	1,033	1,042	1,059	1,064	1,057	1,042	1,028	1,010
Difference	1	0	0	0	0	0	0	0	0	0	-1	-1
Percent Difference	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1
Above Normal												
CEQA Existing Condition (E504 ELD)	975	972	983	1,010	1,023	1,046	1,062	1,064	1,052	1,029	1,015	1,009
With-Project (J602F3 ELD)	975	973	983	1,010	1,023	1,046	1,062	1,064	1,051	1,029	1,015	1,008
Difference	0	1	0	0	0	0	0	0	-1	0	0	-1
Percent Difference	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	-0.1
Below Normal												
CEQA Existing Condition (E504 ELD)	984	981	984	1,000	1,016	1,033	1,049	1,050	1,037	1,016	1,002	999
With-Project (J602F3 ELD)	984	981	984	1,000	1,017	1,033	1,049	1,050	1,038	1,016	1,002	999
Difference	0	0	0	0	1	0	0	0	1	0	0	0
Percent Difference	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Dry												
CEQA Existing Condition (E504 ELD)	980	979	987	996	1,013	1,034	1,039	1,036	1,021	999	985	982
With-Project (J602F3 ELD)	980	979	987	996	1,012	1,033	1,039	1,036	1,021	999	985	982
Difference	0	0	0	0	-1	-1	0	0	0	0	0	0
Percent Difference	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
Critical												
CEQA Existing Condition (E504 ELD)	962	957	960	967	977	990	988	982	963	934	911	907
With-Project (J602F3 ELD)	961	956	959	966	976	989	987	981	962	934	911	907
Difference	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0
Percent Difference	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0

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

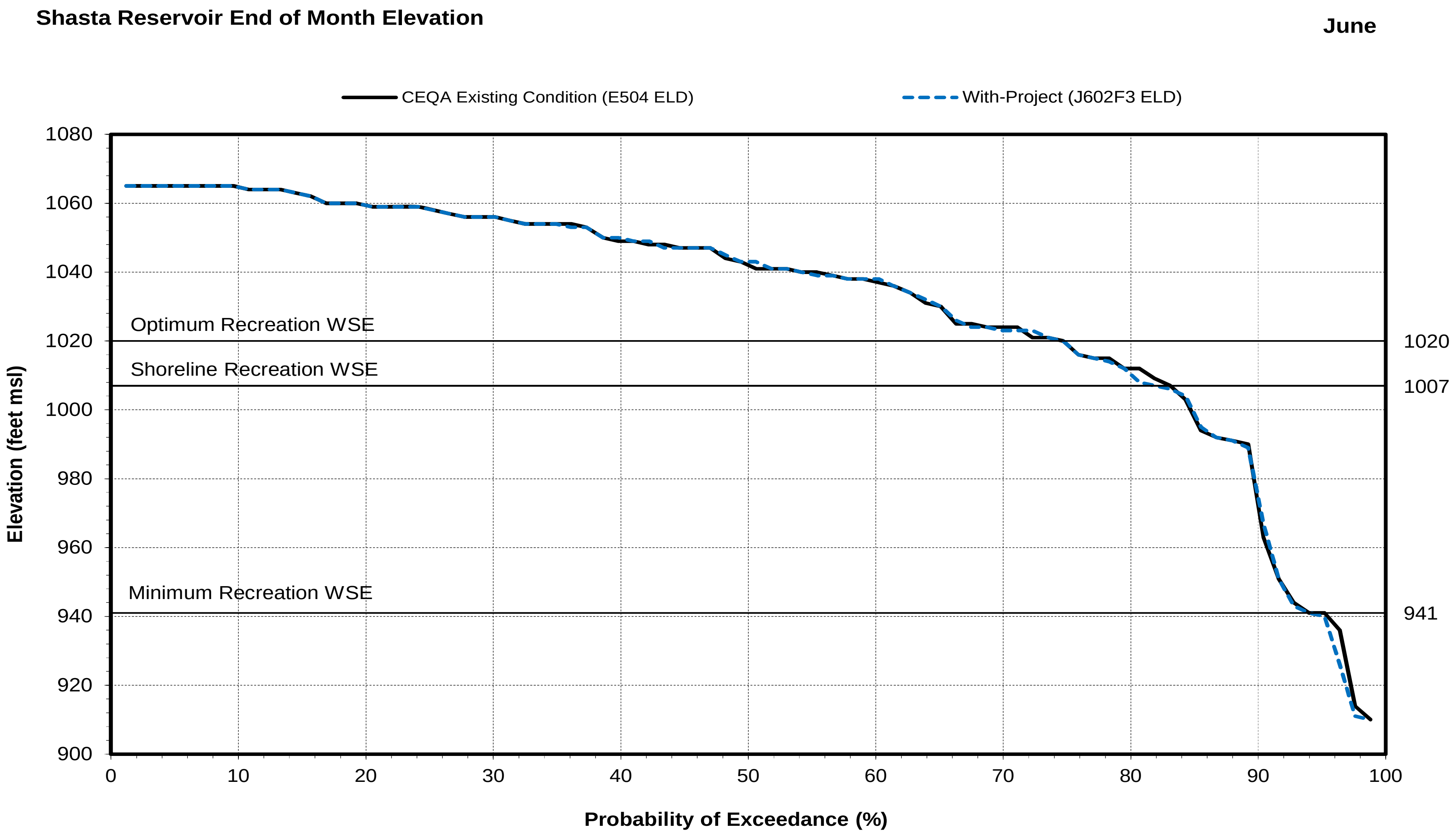
Figure 149 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

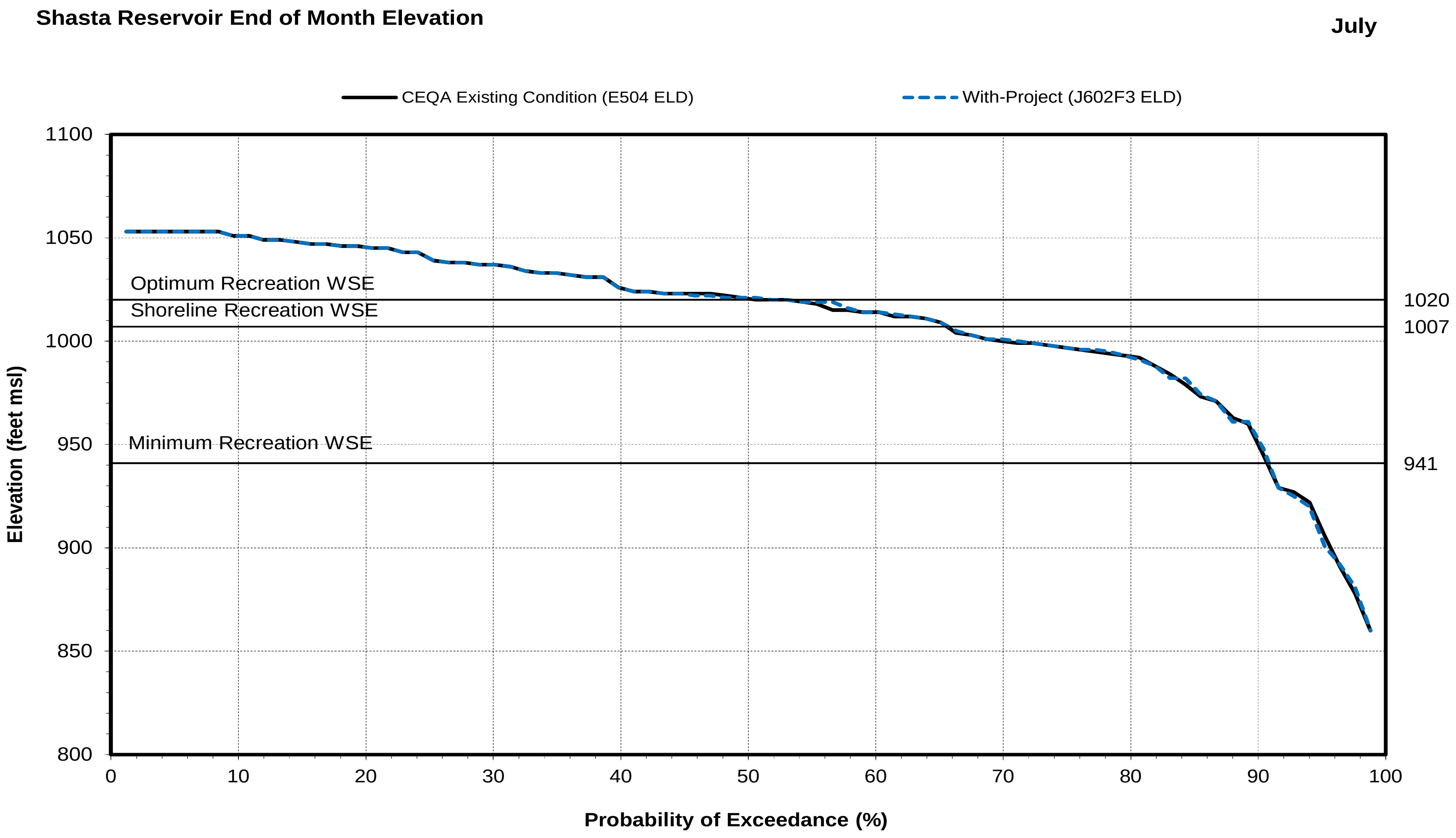
Figure 150 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

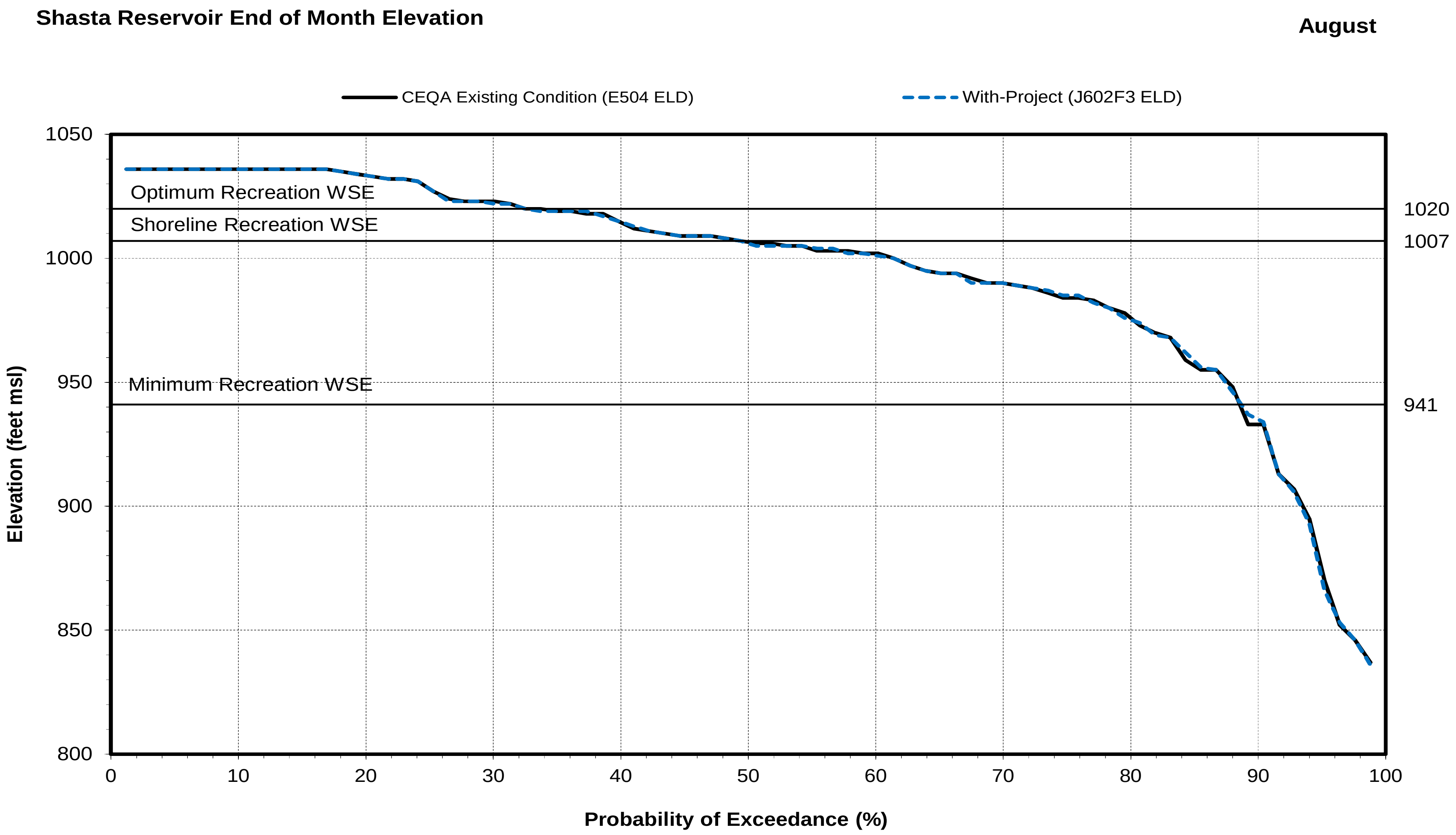
Figure 151 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

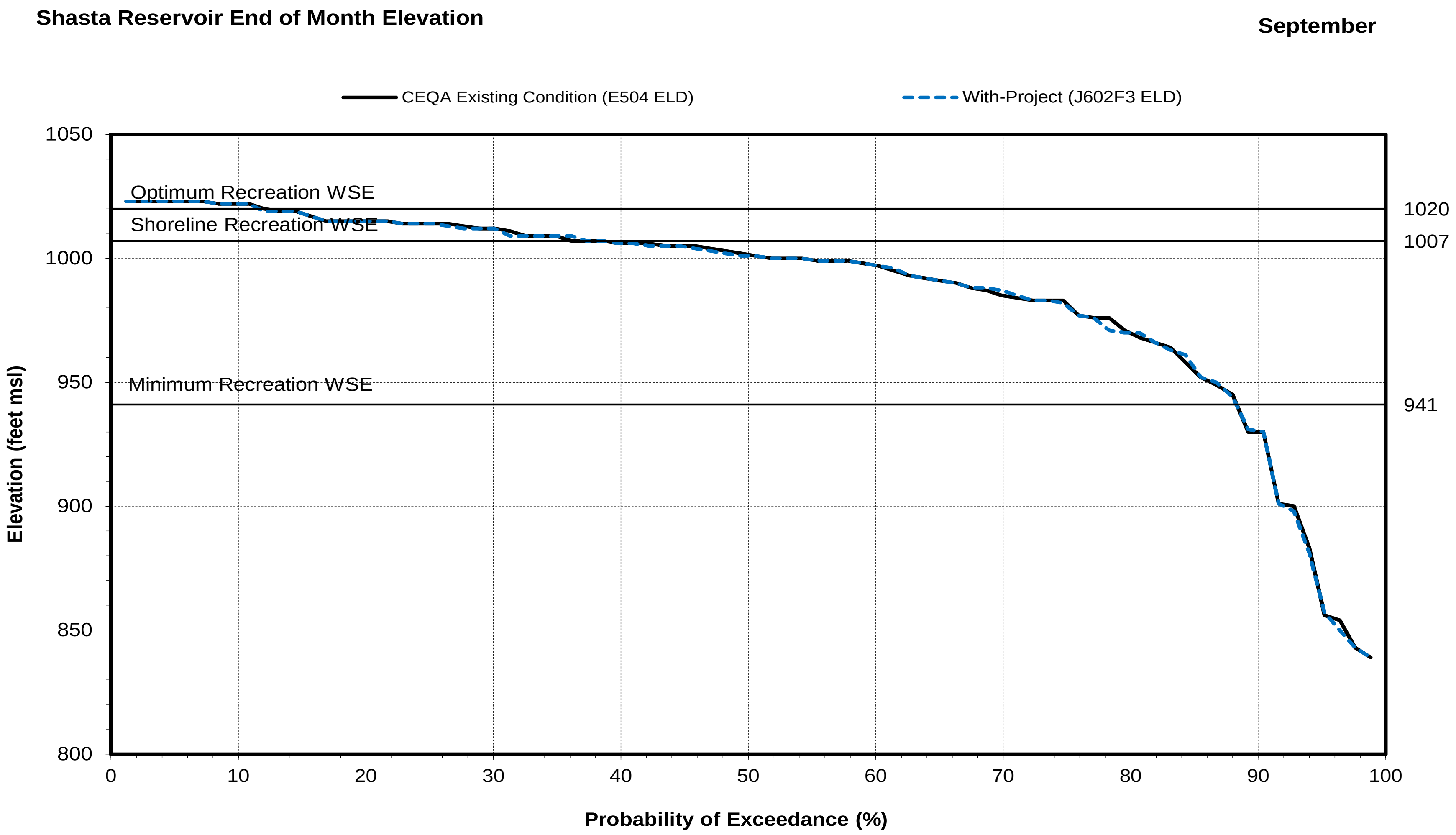
Figure 152 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 153 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 245 E504ELD-J602F3ELD

Long-term and Water Year Type Average Sacramento River Flow below Keswick Dam Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

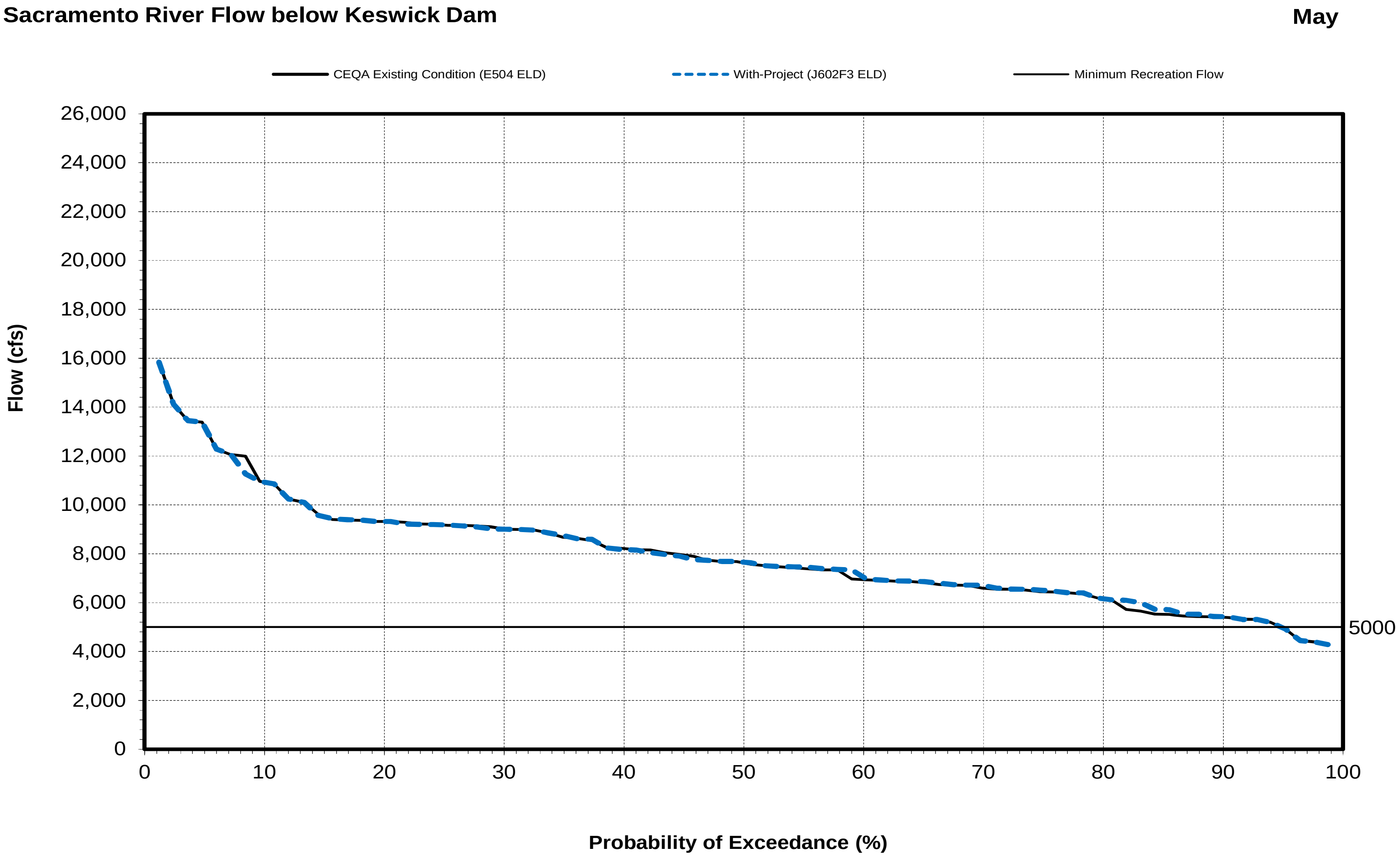
	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	6,236	6,906	6,630	8,252	10,232	8,466	6,980	7,964	10,719	13,080	10,285	8,057
With-Project (J602F3 ELD)	6,214	6,931	6,644	8,262	10,255	8,466	6,991	7,979	10,695	13,022	10,286	8,059
Difference	-22	25	14	10	23	0	11	15	-24	-58	1	2
Percent Difference[3]	-0.4	0.4	0.2	0.1	0.2	0.0	0.2	0.2	-0.2	-0.4	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	6,878	8,230	10,932	15,825	18,367	16,213	9,503	9,491	10,532	12,802	11,071	13,021
With-Project (J602F3 ELD)	6,764	8,230	10,943	15,857	18,416	16,215	9,513	9,478	10,547	12,806	11,085	13,020
Difference	-114	0	11	32	49	2	10	-13	15	4	14	-1
Percent Difference[3]	-1.7	0.0	0.1	0.2	0.3	0.0	0.1	-0.1	0.1	0.0	0.1	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	5,956	7,137	5,732	7,516	14,291	8,124	6,088	7,934	11,271	14,374	10,444	8,007
With-Project (J602F3 ELD)	5,933	7,195	5,774	7,514	14,285	8,110	6,094	8,029	11,236	14,373	10,432	8,067
Difference	-23	58	42	-2	-6	-14	6	95	-35	-1	-12	60
Percent Difference[3]	-0.4	0.8	0.7	0.0	0.0	-0.2	0.1	1.2	-0.3	0.0	-0.1	0.7
Below Normal												
CEQA Existing Condition (E504 ELD)	6,415	6,461	5,325	4,044	5,898	4,718	5,278	7,096	10,667	12,941	9,959	5,569
With-Project (J602F3 ELD)	6,411	6,452	5,324	4,044	5,866	4,710	5,280	7,105	10,583	12,949	9,945	5,577
Difference	-4	-9	-1	0	-32	-8	2	9	-84	8	-14	8
Percent Difference[3]	-0.1	-0.1	0.0	0.0	-0.5	-0.2	0.0	0.1	-0.8	0.1	-0.1	0.1
Dry												
CEQA Existing Condition (E504 ELD)	5,862	6,093	3,985	3,920	3,601	3,777	5,706	7,276	11,138	13,536	9,854	5,156
With-Project (J602F3 ELD)	5,895	6,146	3,985	3,921	3,658	3,778	5,733	7,294	11,103	13,381	9,940	5,126
Difference	33	53	0	1	57	1	27	18	-35	-155	86	-30
Percent Difference[3]	0.6	0.9	0.0	0.0	1.6	0.0	0.5	0.2	-0.3	-1.1	0.9	-0.6
Critical												
CEQA Existing Condition (E504 ELD)	5,475	5,543	3,700	3,984	3,547	3,431	6,304	6,731	10,002	11,866	9,451	4,607
With-Project (J602F3 ELD)	5,550	5,591	3,730	3,986	3,559	3,445	6,304	6,725	9,995	11,687	9,329	4,595
Difference	75	48	30	2	12	14	0	-6	-7	-179	-122	-12
Percent Difference[3]	1.4	0.9	0.8	0.1	0.3	0.4	0.0	-0.1	-0.1	-1.5	-1.3	-0.3

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

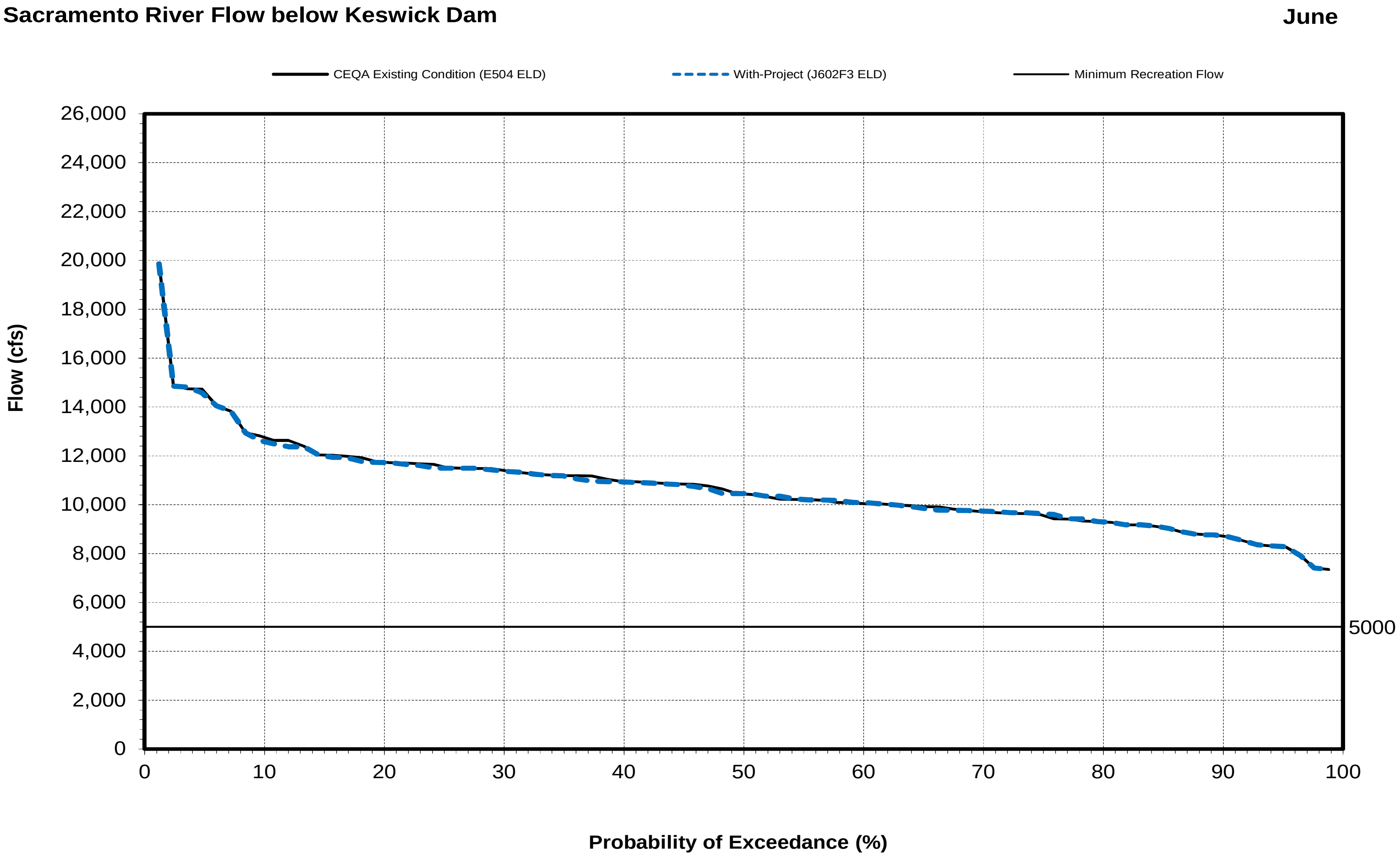
Figure 154 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

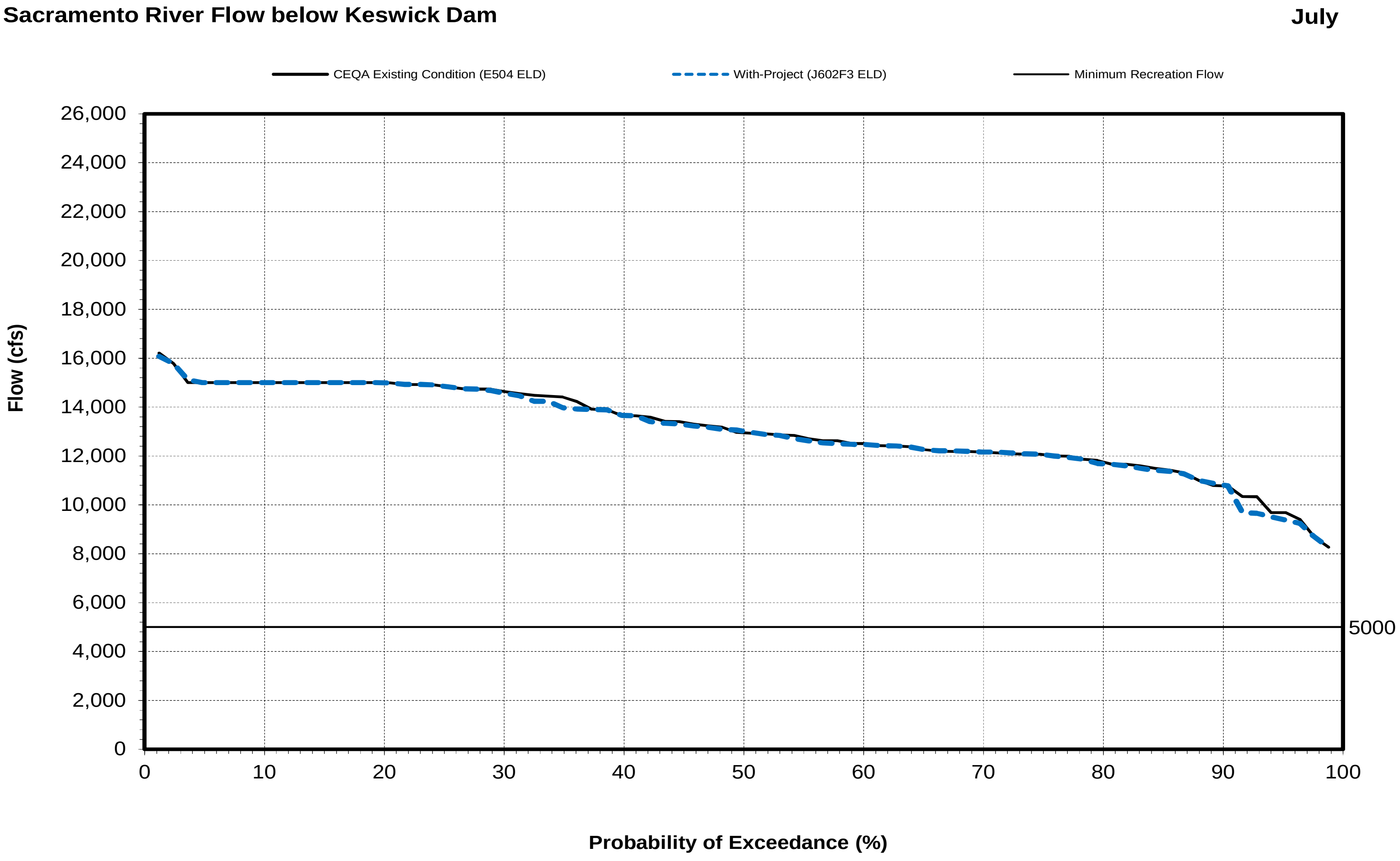
Figure 155 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

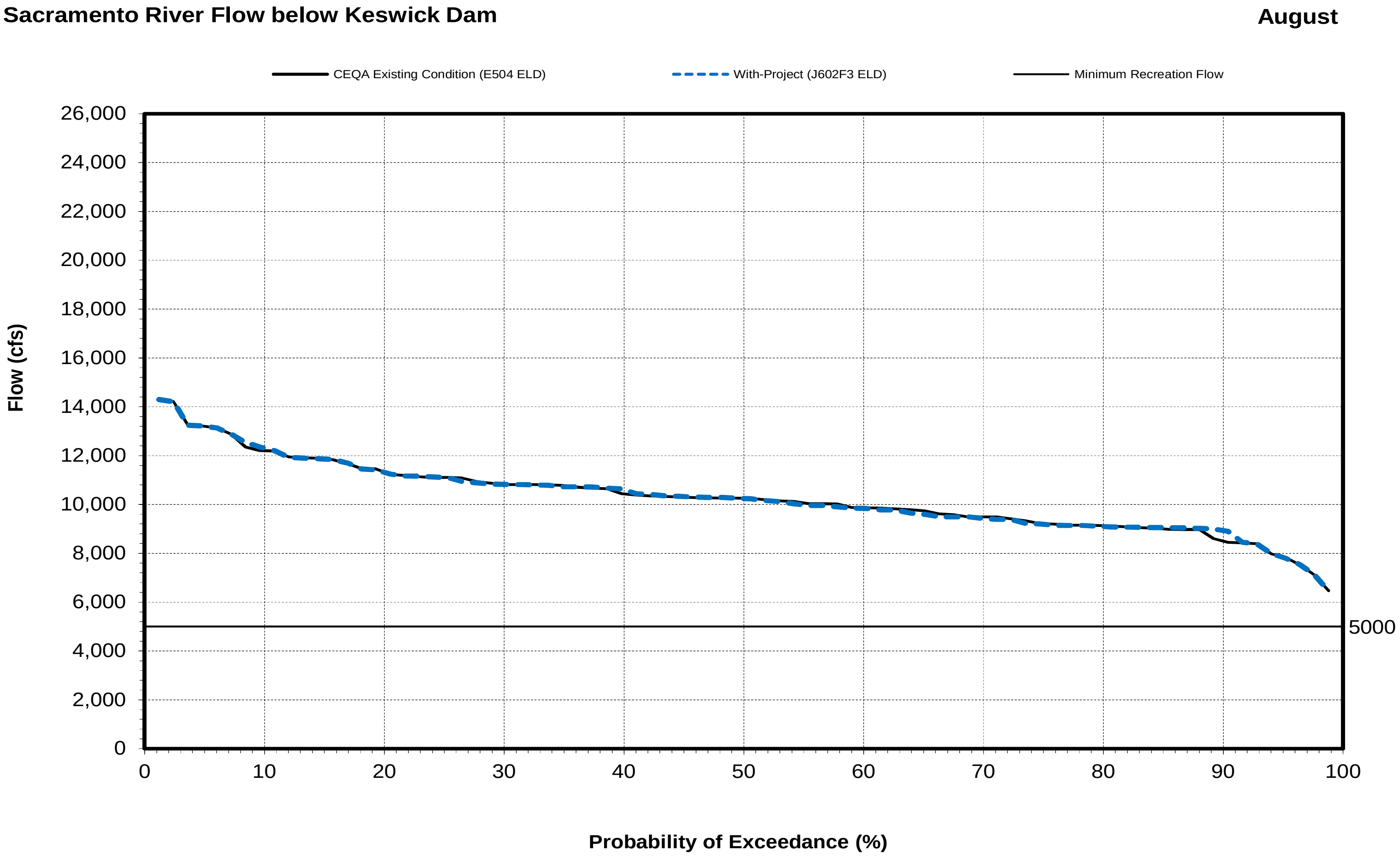
Figure 156 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

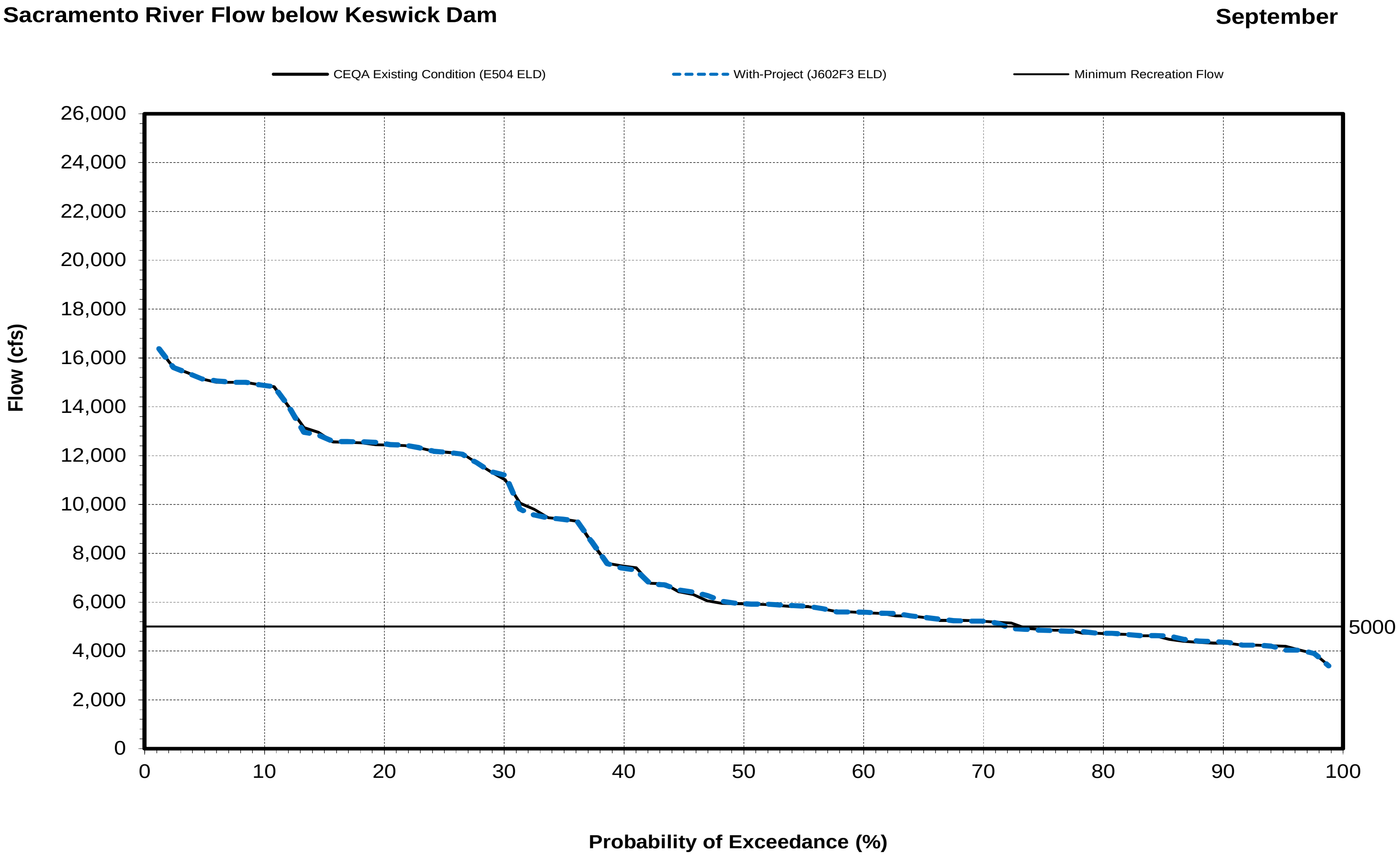
Figure 157 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 158 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 246 E504ELD-J602F3ELD

Long-term and Water Year Type Average Sacramento River Flow at Freeport Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

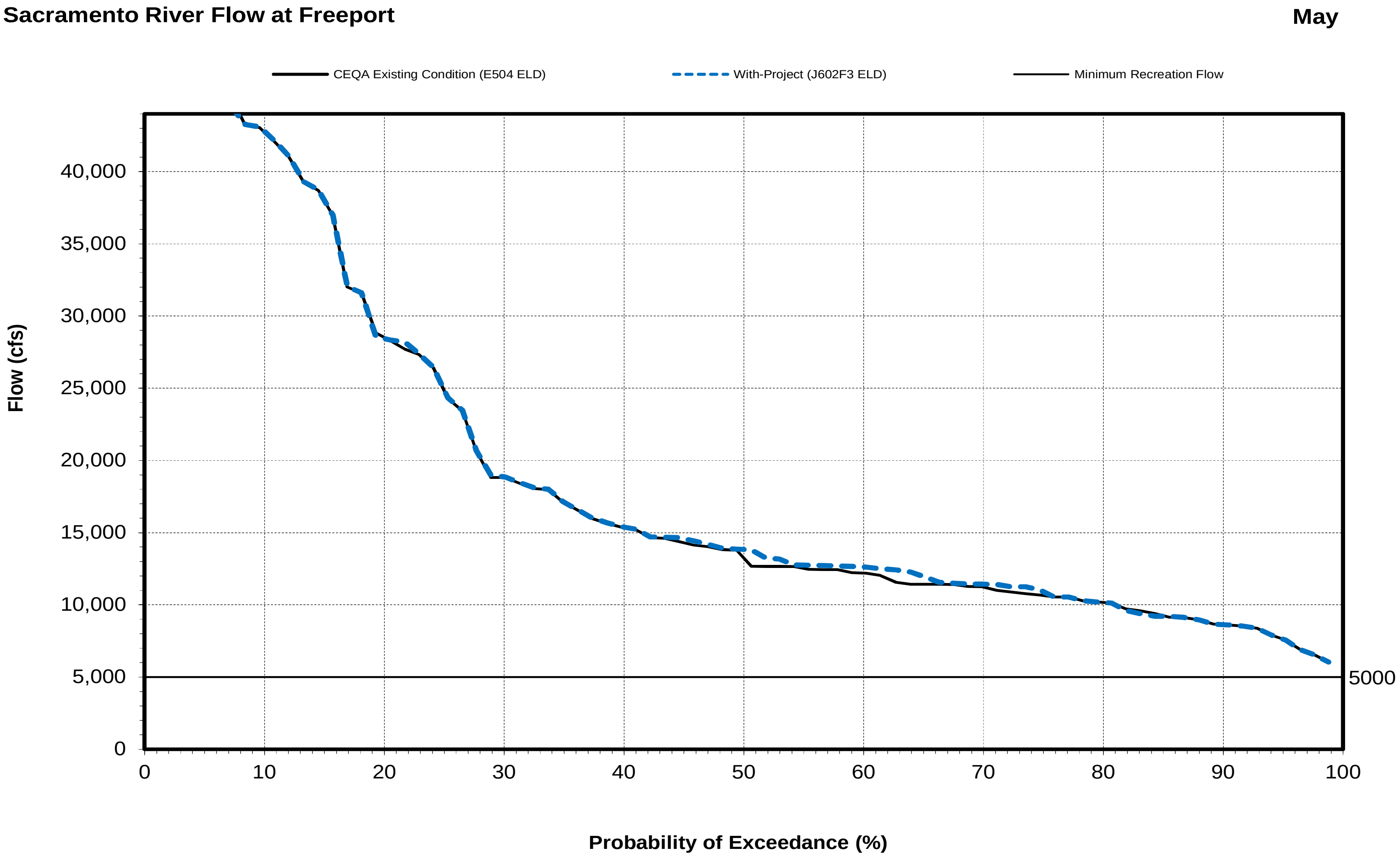
	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	11,591	16,172	22,778	31,105	37,719	32,012	23,404	19,340	16,682	19,211	14,364	18,196
With-Project (J602F3 ELD)	11,588	16,096	22,721	31,040	37,345	32,280	23,674	19,468	16,672	19,204	14,376	18,220
Difference	-3	-76	-57	-65	-374	268	270	128	-10	-7	12	24
Percent Difference[3]	0.0	-0.5	-0.3	-0.2	-1.0	0.8	1.2	0.7	-0.1	0.0	0.1	0.1
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	13,587	21,301	36,258	49,927	57,081	49,003	38,000	32,073	24,305	20,099	16,263	28,516
With-Project (J602F3 ELD)	13,512	21,139	36,099	49,867	56,388	50,009	38,505	32,093	24,307	20,093	16,264	28,526
Difference	-75	-162	-159	-60	-693	1,006	505	20	2	-6	1	10
Percent Difference[3]	-0.6	-0.8	-0.4	-0.1	-1.2	2.1	1.3	0.1	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	10,868	16,979	22,430	38,056	45,470	42,230	26,074	21,104	16,746	22,312	16,575	22,002
With-Project (J602F3 ELD)	10,867	16,789	22,371	37,752	45,103	42,481	26,565	21,408	16,682	22,297	16,577	22,104
Difference	-1	-190	-59	-304	-367	251	491	304	-64	-15	2	102
Percent Difference[3]	0.0	-1.1	-0.3	-0.8	-0.8	0.6	1.9	1.4	-0.4	-0.1	0.0	0.5
Below Normal												
CEQA Existing Condition (E504 ELD)	11,665	14,453	17,005	22,451	31,961	22,834	17,916	14,312	14,041	21,422	16,211	14,150
With-Project (J602F3 ELD)	11,671	14,371	17,001	22,450	31,490	22,843	18,096	14,592	14,002	21,426	16,186	14,081
Difference	6	-82	-4	-1	-471	9	180	280	-39	4	-25	-69
Percent Difference[3]	0.1	-0.6	0.0	0.0	-1.5	0.0	1.0	2.0	-0.3	0.0	-0.2	-0.5
Dry												
CEQA Existing Condition (E504 ELD)	10,582	13,584	15,767	17,092	23,263	20,286	13,355	11,136	12,474	18,787	12,008	11,161
With-Project (J602F3 ELD)	10,648	13,641	15,768	17,084	23,158	19,889	13,386	11,268	12,495	18,805	12,104	11,240
Difference	66	57	1	-8	-105	-397	31	132	21	18	96	79
Percent Difference[3]	0.6	0.4	0.0	0.0	-0.5	-2.0	0.2	1.2	0.2	0.1	0.8	0.7
Critical												
CEQA Existing Condition (E504 ELD)	9,419	10,141	11,172	14,489	16,421	13,279	10,587	8,161	9,496	12,240	9,413	7,305
With-Project (J602F3 ELD)	9,453	10,174	11,188	14,489	16,437	13,265	10,587	8,166	9,503	12,187	9,382	7,305
Difference	34	33	16	0	16	-14	0	5	7	-53	-31	0
Percent Difference[3]	0.4	0.3	0.1	0.0	0.1	-0.1	0.0	0.1	0.1	-0.4	-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 82-year simulation period

3 Relative difference of the monthly average

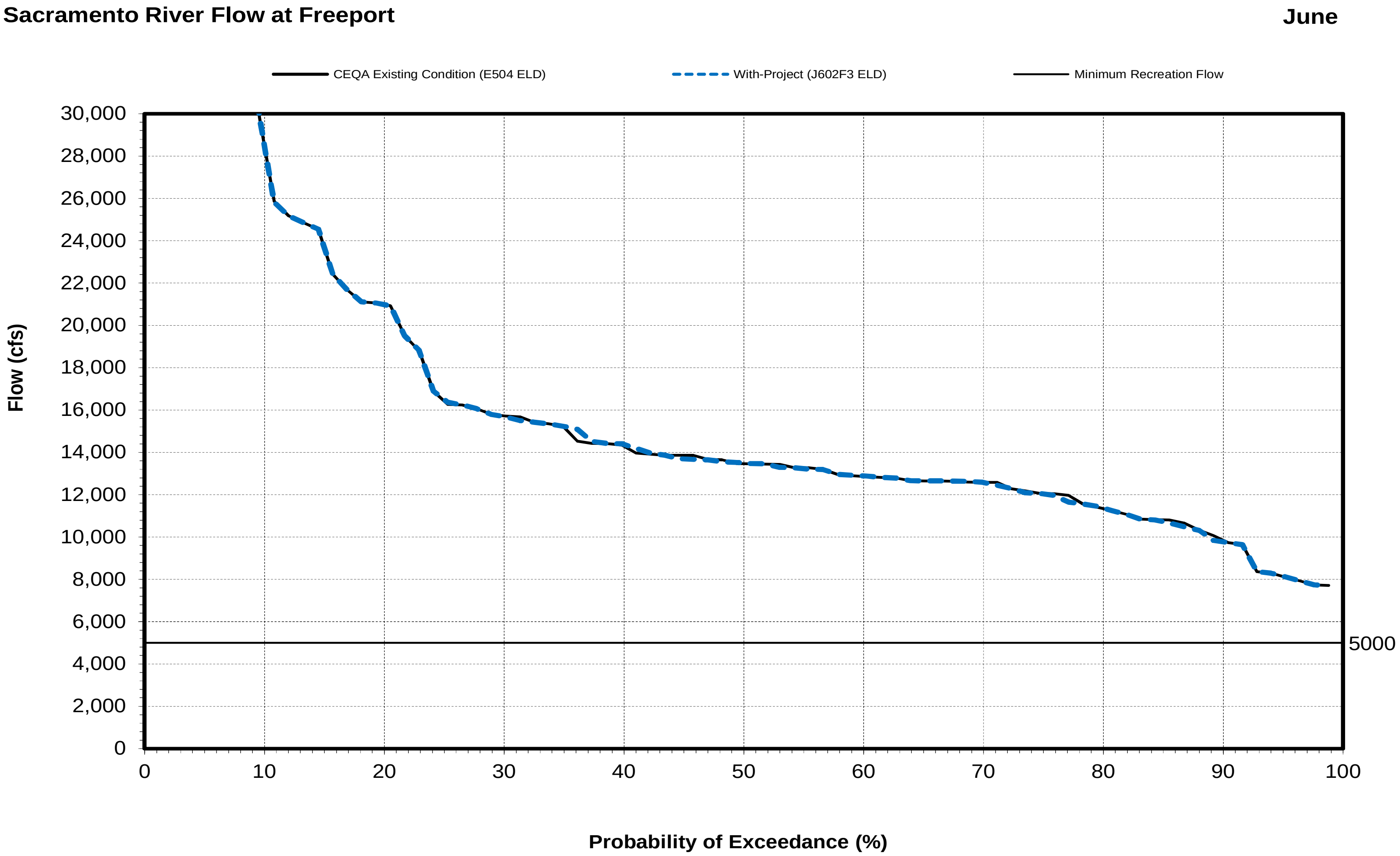
Figure 159 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

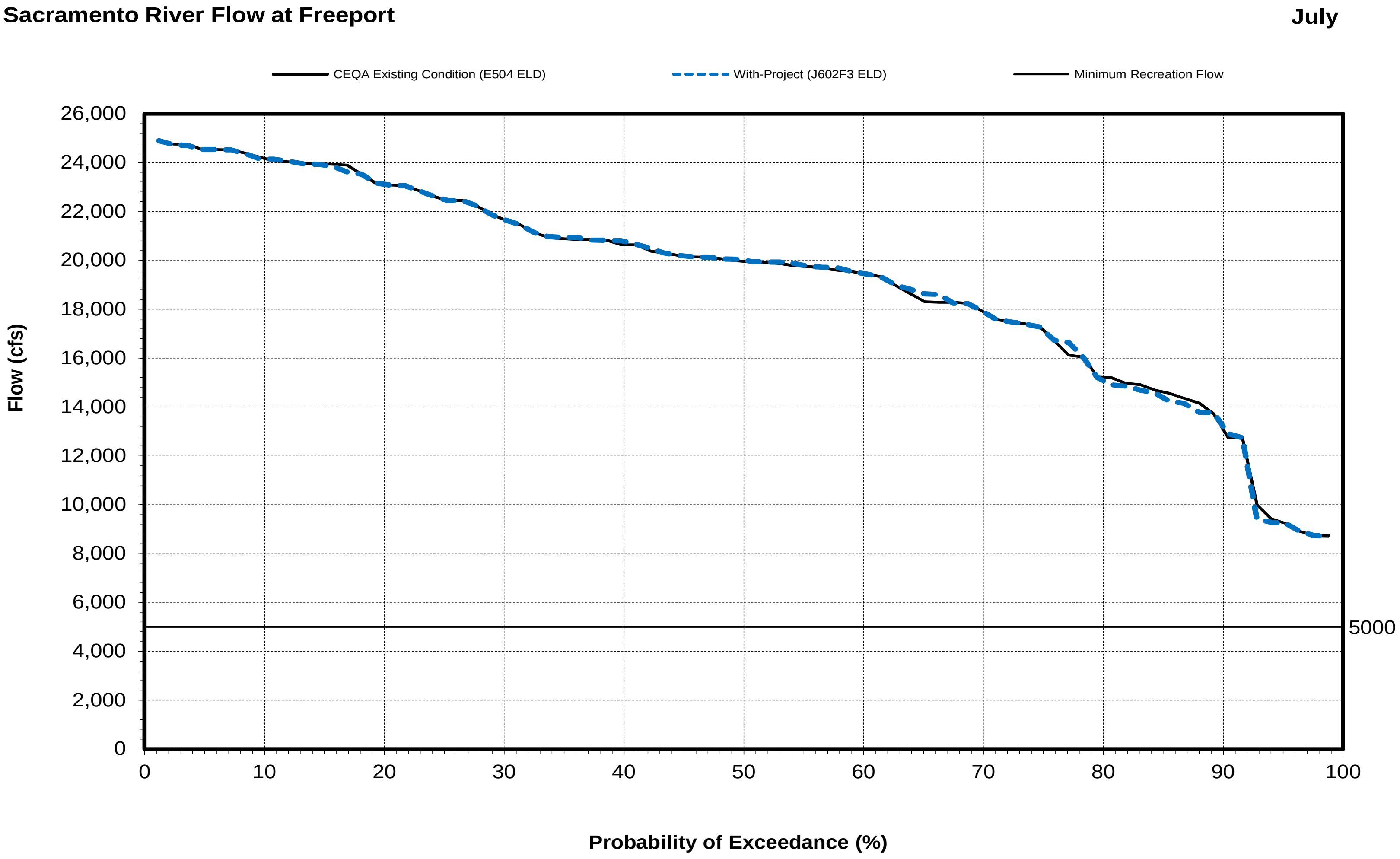
Figure 160 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

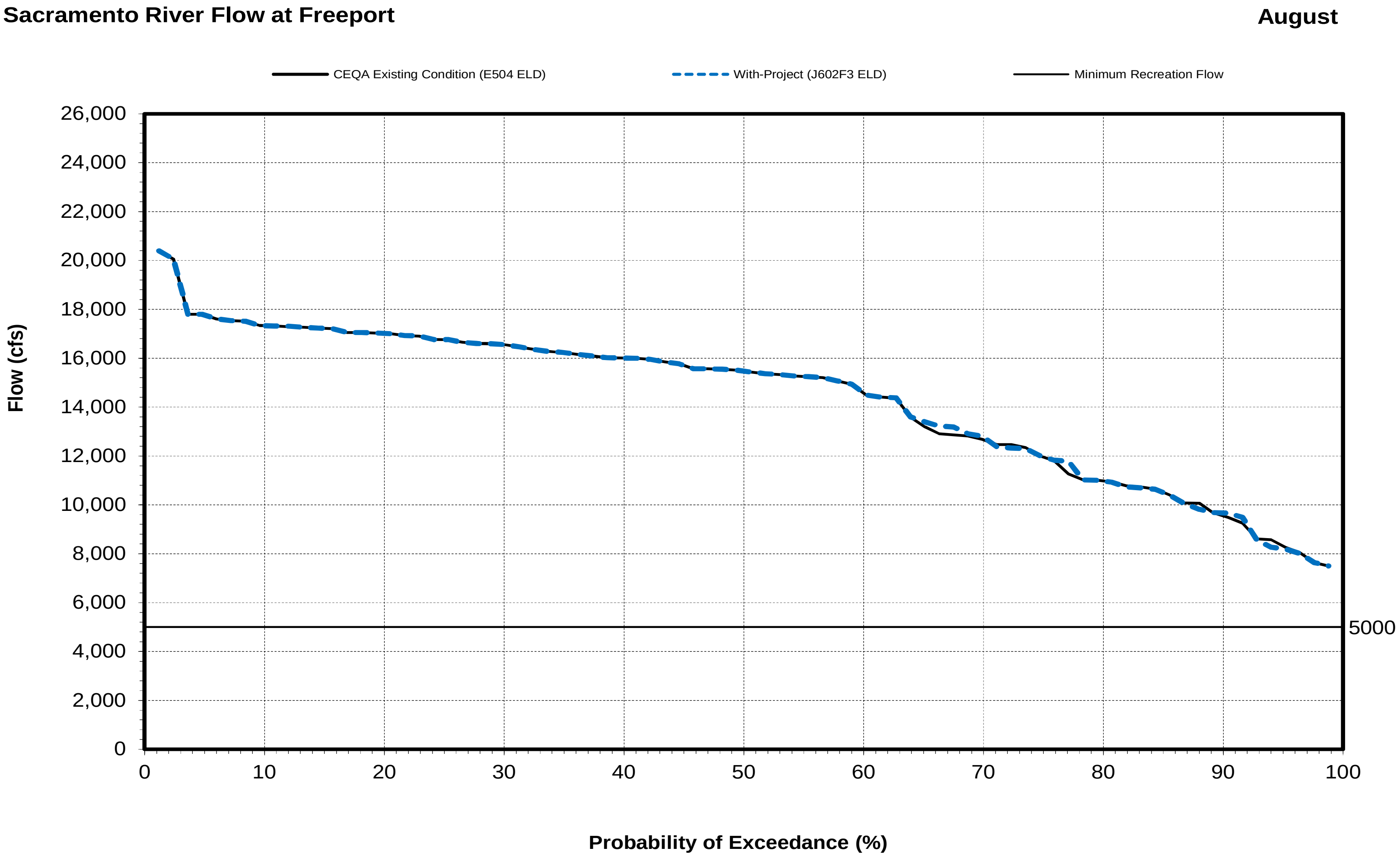
Figure 161 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

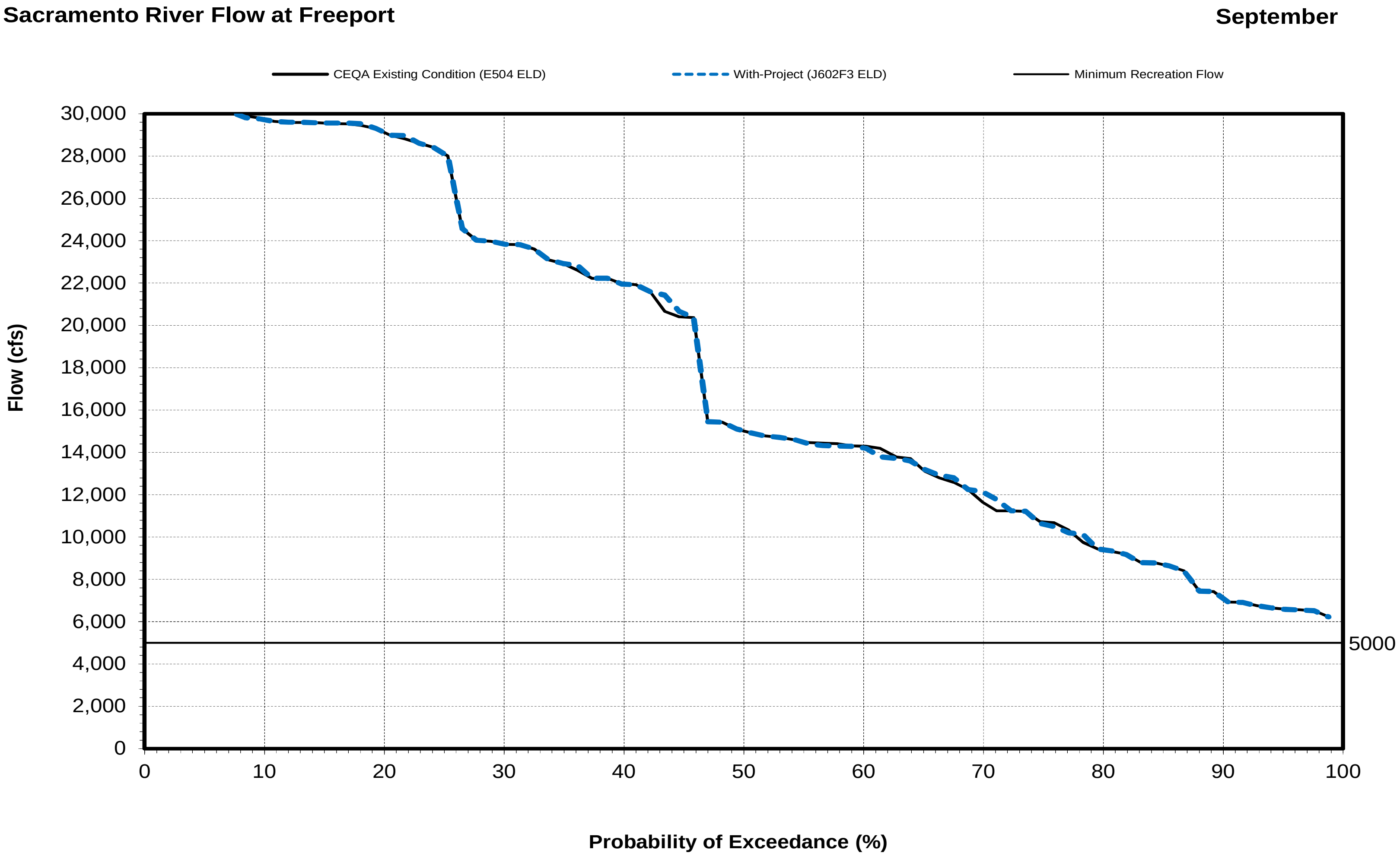
Figure 162 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Figure 163 E504ELD-J602F3ELD



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/27/2016

Table 247 E504ELD-J602F3ELD

Long-term Average Delta Outflow and Average Delta Outflow by Water Year Type Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

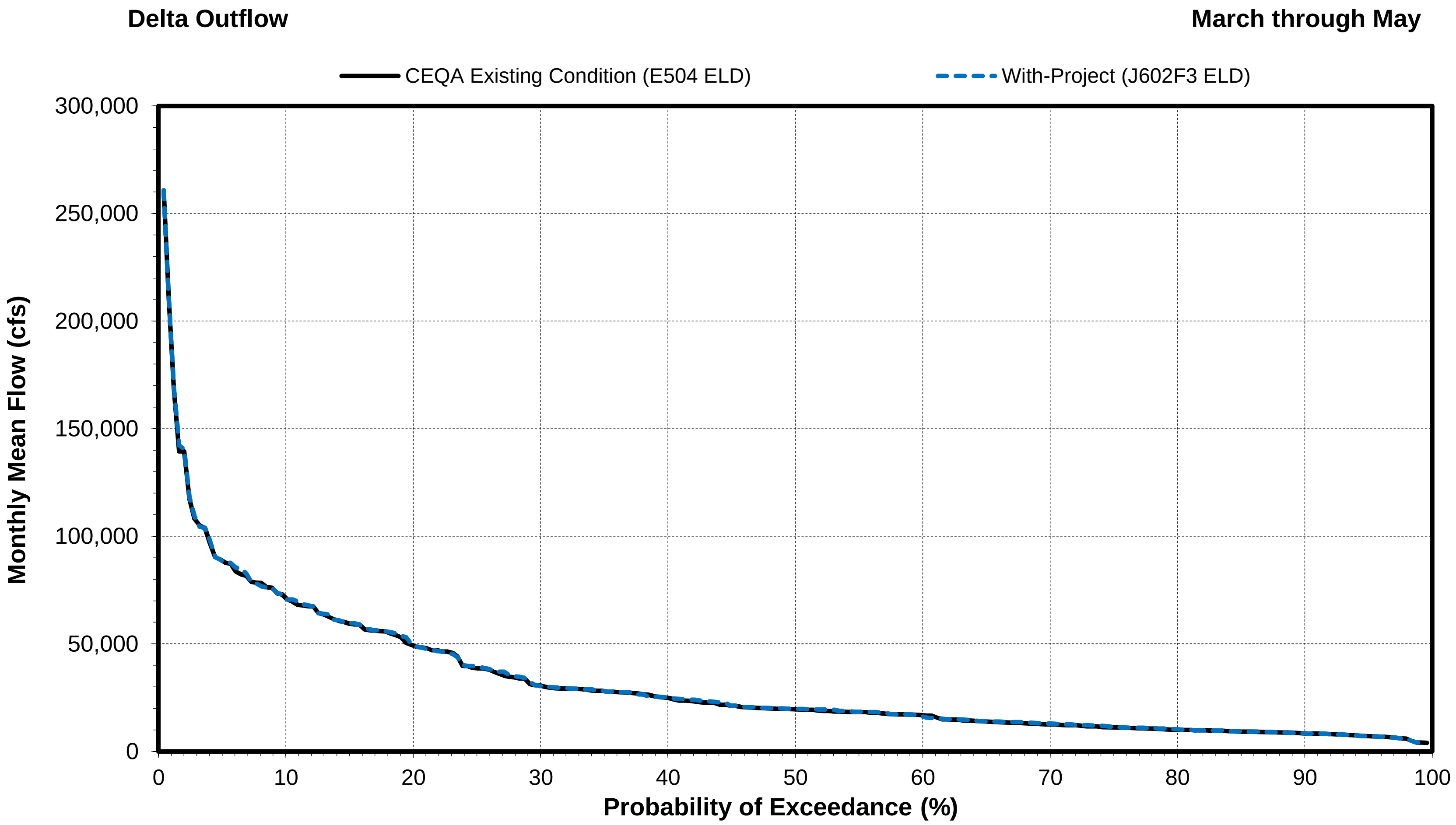
Analysis Period	Flow (cfs) March through May
Full Simulation Period[2]	
CEQA Existing Condition (E504 ELD)	31,561
With-Project (J602F3 ELD)	31,792
Difference	231
Percent Difference[3]	0.7
Water Year Types[1]	
Wet	
CEQA Existing Condition (E504 ELD)	57,809
With-Project (J602F3 ELD)	58,351
Difference	542
Percent Difference	0.9
Above Normal	
CEQA Existing Condition (E504 ELD)	35,686
With-Project (J602F3 ELD)	36,026
Difference	340
Percent Difference	1.0
Below Normal	
CEQA Existing Condition (E504 ELD)	20,207
With-Project (J602F3 ELD)	20,364
Difference	157
Percent Difference	0.8
Dry	
CEQA Existing Condition (E504 ELD)	14,748
With-Project (J602F3 ELD)	14,669
Difference	-79
Percent Difference	-0.5
Critical	
CEQA Existing Condition (E504 ELD)	9,031
With-Project (J602F3 ELD)	9,029
Difference	-2
Percent Difference	0.0

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

Figure 164 E504ELD-J602F3ELD



Folsom WCM: Comparison E504ELD-J602F3ELD (CEQA Existing Condition (E504 ELD) vs With-Project (J602F3 ELD))

Table 248 E504ELD-J602F3ELD

Long-term Average Annual Deliveries to CVP Contractors Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Deliveries (TAF) Annual
Long-term	
Full Simulation Period[2]	
CEQA Existing Condition (E504 ELD)	4,599
With-Project (J602F3 ELD)	4,607
Absolute Difference	8
Relative Difference[3]	0
Water Year Types[1]	
Wet	
CEQA Existing Condition (E504 ELD)	5,241
With-Project (J602F3 ELD)	5,251
Absolute Difference	10
Relative Difference	0
Above Normal	
CEQA Existing Condition (E504 ELD)	4,906
With-Project (J602F3 ELD)	4,928
Absolute Difference	22
Relative Difference	0
Below Normal	
CEQA Existing Condition (E504 ELD)	4,516
With-Project (J602F3 ELD)	4,522
Absolute Difference	6
Relative Difference	0
Dry	
CEQA Existing Condition (E504 ELD)	4,305
With-Project (J602F3 ELD)	4,311
Absolute Difference	6
Relative Difference	0
Critical	
CEQA Existing Condition (E504 ELD)	3,461
With-Project (J602F3 ELD)	3,462
Absolute Difference	1
Relative Difference	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 annual average

Model Output Index

Model Output Index

Model Output Index

Model Output Index

Model Output Index

Model Output Index

Model Output Index

Model Output Index

Model Output Index

Model Output Index

Model Output Index

Long-term and Water Year Type Average of Folsom Reservoir End of Month Storage Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Storage (TAF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (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												
CEQA Existing Condition (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												
CEQA Existing Condition (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												
CEQA Existing Condition (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												
CEQA Existing Condition (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												
CEQA Existing Condition (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

Folsom Reservoir End of Month Storage - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	712	709	-3	-0.4
2.4	712	709	-3	-0.4
3.6	712	709	-3	-0.4
4.8	712	709	-3	-0.4
6.0	712	709	-3	-0.4
7.2	712	709	-3	-0.4
8.4	697	696	-1	-0.1
9.6	674	668	-6	-0.9
10.8	639	639	0	0.0
12.0	623	623	0	0.0
13.3	611	611	0	0.0
14.5	608	608	0	0.0
15.7	599	599	0	0.0
16.9	595	592	-3	-0.5
18.1	592	592	0	0.0
19.3	592	592	0	0.0
20.5	592	592	0	0.0
21.7	592	592	0	0.0
22.9	592	592	0	0.0
24.1	592	592	0	0.0
25.3	592	592	0	0.0
26.5	591	591	0	0.0
27.7	590	588	-2	-0.3
28.9	587	587	0	0.0
30.1	587	587	0	0.0
31.3	586	586	0	0.0
32.5	579	585	6	1.0
33.7	577	577	0	0.0
34.9	576	577	1	0.2
36.1	576	576	0	0.0
37.3	561	573	12	2.1
38.6	560	560	0	0.0
39.8	558	558	0	0.0
41.0	556	556	0	0.0
42.2	554	553	-1	-0.2
43.4	553	552	-1	-0.2
44.6	548	549	1	0.2
45.8	546	542	-4	-0.7
47.0	542	538	-4	-0.7
48.2	538	532	-6	-1.1
49.4	522	519	-3	-0.6
50.6	519	515	-4	-0.8
51.8	514	515	1	0.2
53.0	504	514	10	2.0
54.2	501	504	3	0.6
55.4	499	499	0	0.0
56.6	492	492	0	0.0
57.8	483	490	7	1.4
59.0	480	476	-4	-0.8
60.2	477	473	-4	-0.8
61.4	459	467	8	1.7
62.7	451	448	-3	-0.7
63.9	445	447	2	0.4
65.1	411	431	20	4.9
66.3	409	431	22	5.4
67.5	396	421	25	6.3
68.7	396	400	4	1.0
69.9	392	396	4	1.0
71.1	385	395	10	2.6
72.3	381	394	13	3.4
73.5	379	384	5	1.3
74.7	378	383	5	1.3
75.9	372	378	6	1.6
77.1	369	378	9	2.4
78.3	368	368	0	0.0
79.5	365	365	0	0.0
80.7	359	350	-9	-2.5
81.9	350	349	-1	-0.3
83.1	349	347	-2	-0.6
84.3	328	326	-2	-0.6
85.5	324	324	0	0.0
86.7	318	307	-11	-3.5
88.0	308	303	-5	-1.6
89.2	302	302	0	0.0
90.4	301	300	-1	-0.3
91.6	300	288	-12	-4.0
92.8	287	280	-7	-2.4
94.0	283	275	-8	-2.8
95.2	263	263	0	0.0
96.4	255	251	-4	-1.6
97.6	195	192	-3	-1.5
98.8	107	107	0	0.0
Min	107	107	-12	-4.0
Max	712	709	25	6.3
Mean	490	491	1	0.1
Median	521	517	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	73.2
1.1<=X<10.0		15.9
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		11.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		40.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	567	567	0	0.0
2.4	567	567	0	0.0
3.6	567	567	0	0.0
4.8	567	567	0	0.0
6.0	567	567	0	0.0
7.2	567	567	0	0.0
8.4	567	567	0	0.0
9.6	567	567	0	0.0
10.8	565	567	2	0.4
12.0	561	567	6	1.1
13.3	556	567	11	2.0
14.5	555	567	12	2.2
15.7	552	567	15	2.7
16.9	551	567	16	2.9
18.1	550	560	10	1.8
19.3	540	555	15	2.8
20.5	528	552	24	4.5
21.7	526	550	24	4.6
22.9	521	537	16	3.1
24.1	518	528	10	1.9
25.3	515	523	8	1.6
26.5	512	521	9	1.8
27.7	510	518	8	1.6
28.9	509	511	2	0.4
30.1	504	510	6	1.2
31.3	502	507	5	1.0
32.5	496	503	7	1.4
33.7	491	497	6	1.2
34.9	490	496	6	1.2
36.1	485	491	6	1.2
37.3	481	490	9	1.9
38.6	480	490	10	2.1
39.8	472	483	11	2.3
41.0	470	480	10	2.1
42.2	467	472	5	1.1
43.4	466	472	6	1.3
44.6	464	470	6	1.3
45.8	460	468	8	1.7
47.0	458	468	10	2.2
48.2	456	467	11	2.4
49.4	454	464	10	2.2
50.6	454	463	9	2.0
51.8	453	460	7	1.5
53.0	450	457	7	1.6
54.2	449	456	7	1.6
55.4	446	456	10	2.2
56.6	443	454	11	2.5
57.8	442	451	9	2.0
59.0	440	449	9	2.0
60.2	439	447	8	1.8
61.4	437	442	5	1.1
62.7	436	442	6	1.4
63.9	427	440	13	3.0
65.1	418	439	21	5.0
66.3	416	434	18	4.3
67.5	401	411	10	2.5
68.7	399	411	12	3.0
69.9	398	405	7	1.8
71.1	394	403	9	2.3
72.3	386	400	14	3.6
73.5	378	393	15	4.0
74.7	373	392	19	5.1
75.9	363	388	25	6.9
77.1	353	363	10	2.8
78.3	352	353	1	0.3
79.5	350	353	3	0.9
80.7	349	350	1	0.3
81.9	346	345	-1	-0.3
83.1	345	330	-15	-4.3
84.3	339	330	-9	-2.7
85.5	330	323	-7	-2.1
86.7	323	316	-7	-2.2
88.0	317	309	-8	-2.5
89.2	316	305	-11	-3.5
90.4	288	288	0	0.0
91.6	282	282	0	0.0
92.8	279	280	1	0.4
94.0	275	277	2	0.7
95.2	275	275	0	0.0
96.4	260	274	14	5.4
97.6	181	177	-4	-2.2
98.8	122	121	-1	-0.8
Min	122	121	-15	-4.3
Max	567	567	25	6.9
Mean	441	447	7	1.4
Median	454	464	7	1.6

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	25.6
1.1<=X<10.0		65.9
X>=5.0		4.9
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		15.0
X>=5.0		10.0
X>=10.0		0.0
-10.0<X<=-1.1		35.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	567	567	0	0.0
2.4	567	567	0	0.0
3.6	567	567	0	0.0
4.8	567	567	0	0.0
6.0	567	567	0	0.0
7.2	567	567	0	0.0
8.4	567	567	0	0.0
9.6	567	567	0	0.0
10.8	567	567	0	0.0
12.0	567	567	0	0.0
13.3	567	567	0	0.0
14.5	567	567	0	0.0
15.7	567	567	0	0.0
16.9	567	567	0	0.0
18.1	567	567	0	0.0
19.3	567	567	0	0.0
20.5	566	567	1	0.2
21.7	566	567	1	0.2
22.9	566	567	1	0.2
24.1	566	567	1	0.2
25.3	563	567	4	0.7
26.5	558	567	9	1.6
27.7	557	567	10	1.8
28.9	556	567	11	2.0
30.1	546	567	21	3.8
31.3	534	565	31	5.8
32.5	530	561	31	5.8
33.7	525	557	32	6.1
34.9	524	556	32	6.1
36.1	509	546	37	7.3
37.3	506	536	30	5.9
38.6	504	534	30	6.0
39.8	501	530	29	5.8
41.0	500	525	25	5.0
42.2	496	524	28	5.6
43.4	492	510	18	3.7
44.6	490	506	16	3.3
45.8	487	506	19	3.9
47.0	476	504	28	5.9
48.2	473	501	28	5.9
49.4	471	500	29	6.2
50.6	469	492	23	4.9
51.8	462	490	28	6.1
53.0	455	476	21	4.6
54.2	448	475	27	6.0
55.4	442	470	28	6.3
56.6	426	470	44	10.3
57.8	419	462	43	10.3
59.0	410	455	45	11.0
60.2	409	449	40	9.8
61.4	404	442	38	9.4
62.7	404	435	31	7.7
63.9	404	426	22	5.4
65.1	402	422	20	5.0
66.3	400	411	11	2.8
67.5	400	410	10	2.5
68.7	399	406	7	1.8
69.9	398	405	7	1.8
71.1	389	404	15	3.9
72.3	382	404	22	5.8
73.5	382	404	22	5.8
74.7	381	400	19	5.0
75.9	367	400	33	9.0
77.1	364	381	17	4.7
78.3	362	377	15	4.1
79.5	359	373	14	3.9
80.7	358	371	13	3.6
81.9	351	360	9	2.6
83.1	347	357	10	2.9
84.3	342	346	4	1.2
85.5	317	340	23	7.3
86.7	309	337	28	9.1
88.0	304	325	21	6.9
89.2	302	316	14	4.6
90.4	297	309	12	4.0
91.6	297	304	7	2.4
92.8	290	290	0	0.0
94.0	268	289	21	7.8
95.2	267	267	0	0.0
96.4	246	245	-1	-0.4
97.6	244	241	-3	-1.2
98.8	212	211	-1	-0.5
Min	212	211	-3	-1.2
Max	567	567	45	11.0
Mean	451	467	15	3.6
Median	470	496	15	3.9

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	30.5
1.1<=X<10.0		64.6
X>=5.0		39.0
X>=10.0		3.7
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**3.7**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	20.0
1.1<=X<10.0		75.0
X>=5.0		25.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	567	567	0	0.0
2.4	567	567	0	0.0
3.6	567	567	0	0.0
4.8	567	567	0	0.0
6.0	567	567	0	0.0
7.2	567	567	0	0.0
8.4	567	567	0	0.0
9.6	567	567	0	0.0
10.8	567	567	0	0.0
12.0	567	567	0	0.0
13.3	567	567	0	0.0
14.5	567	567	0	0.0
15.7	567	567	0	0.0
16.9	567	567	0	0.0
18.1	567	567	0	0.0
19.3	567	567	0	0.0
20.5	567	567	0	0.0
21.7	566	567	1	0.2
22.9	565	567	2	0.4
24.1	561	567	6	1.1
25.3	558	567	9	1.6
26.5	557	567	10	1.8
27.7	555	567	12	2.2
28.9	553	567	14	2.5
30.1	553	567	14	2.5
31.3	552	567	15	2.7
32.5	551	567	16	2.9
33.7	547	567	20	3.7
34.9	545	567	22	4.0
36.1	542	567	25	4.6
37.3	538	567	29	5.4
38.6	537	567	30	5.6
39.8	534	567	33	6.2
41.0	531	567	36	6.8
42.2	527	567	40	7.6
43.4	525	567	42	8.0
44.6	522	567	45	8.6
45.8	518	567	49	9.5
47.0	516	567	51	9.9
48.2	510	565	55	10.8
49.4	509	545	36	7.1
50.6	503	543	40	8.0
51.8	501	538	37	7.4
53.0	498	537	39	7.8
54.2	497	531	34	6.8
55.4	488	525	37	7.6
56.6	481	522	41	8.5
57.8	480	520	40	8.3
59.0	479	518	39	8.1
60.2	475	516	41	8.6
61.4	462	510	48	10.4
62.7	458	509	51	11.1
63.9	442	498	56	12.7
65.1	439	497	58	13.2
66.3	437	481	44	10.1
67.5	432	479	47	10.9
68.7	412	478	66	16.0
69.9	408	475	67	16.4
71.1	404	462	58	14.4
72.3	395	455	60	15.2
73.5	392	439	47	12.0
74.7	389	438	49	12.6
75.9	382	436	54	14.1
77.1	380	432	52	13.7
78.3	379	408	29	7.7
79.5	376	398	22	5.9
80.7	373	391	18	4.8
81.9	355	390	35	9.9
83.1	347	385	38	11.0
84.3	346	379	33	9.5
85.5	345	379	34	9.9
86.7	325	370	45	13.8
88.0	323	349	26	8.0
89.2	313	343	30	9.6
90.4	312	322	10	3.2
91.6	307	311	4	1.3
92.8	282	300	18	6.4
94.0	279	282	3	1.1
95.2	268	280	12	4.5
96.4	261	268	7	2.7
97.6	249	250	1	0.4
98.8	209	208	-1	-0.5
Min	209	208	-1	-0.5
Max	567	567	67	16.4
Mean	469	495	25	5.8
Median	506	544	28	6.1

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	25.6
1.1<=X<10.0		53.7
X>=5.0		53.7
X>=10.0		20.7
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**20.7**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	10.0
1.1<=X<10.0		70.0
X>=5.0		60.0
X>=10.0		20.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**20.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	567	619	52	9.2
2.4	567	619	52	9.2
3.6	567	619	52	9.2
4.8	567	618	51	9.0
6.0	567	617	50	8.8
7.2	567	617	50	8.8
8.4	567	617	50	8.8
9.6	567	617	50	8.8
10.8	567	617	50	8.8
12.0	567	617	50	8.8
13.3	567	616	49	8.6
14.5	567	616	49	8.6
15.7	567	615	48	8.5
16.9	567	614	47	8.3
18.1	567	613	46	8.1
19.3	567	613	46	8.1
20.5	567	612	45	7.9
21.7	567	611	44	7.8
22.9	567	611	44	7.8
24.1	567	607	40	7.1
25.3	567	606	39	6.9
26.5	567	603	36	6.3
27.7	567	601	34	6.0
28.9	567	597	30	5.3
30.1	567	596	29	5.1
31.3	566	594	28	4.9
32.5	564	593	29	5.1
33.7	561	592	31	5.5
34.9	558	592	34	6.1
36.1	557	591	34	6.1
37.3	557	591	34	6.1
38.6	557	590	33	5.9
39.8	556	587	31	5.6
41.0	555	583	28	5.0
42.2	555	579	24	4.3
43.4	553	578	25	4.5
44.6	552	578	26	4.7
45.8	552	569	17	3.1
47.0	551	567	16	2.9
48.2	547	567	20	3.7
49.4	541	567	26	4.8
50.6	530	567	37	7.0
51.8	529	567	38	7.2
53.0	527	567	40	7.6
54.2	522	567	45	8.6
55.4	516	567	51	9.9
56.6	509	567	58	11.4
57.8	496	567	71	14.3
59.0	493	567	74	15.0
60.2	493	567	74	15.0
61.4	484	567	83	17.1
62.7	473	567	94	19.9
63.9	464	567	103	22.2
65.1	459	567	108	23.5
66.3	447	567	120	26.8
67.5	439	567	128	29.2
68.7	437	566	129	29.5
69.9	436	540	104	23.9
71.1	433	530	97	22.4
72.3	431	529	98	22.7
73.5	430	527	97	22.6
74.7	416	522	106	25.5
75.9	410	509	99	24.1
77.1	397	484	87	21.9
78.3	397	457	60	15.1
79.5	394	439	45	11.4
80.7	390	436	46	11.8
81.9	378	433	55	14.6
83.1	377	430	53	14.1
84.3	371	428	57	15.4
85.5	369	410	41	11.1
86.7	363	409	46	12.7
88.0	350	398	48	13.7
89.2	348	390	42	12.1
90.4	342	389	47	13.7
91.6	330	382	52	15.8
92.8	325	370	45	13.8
94.0	309	348	39	12.6
95.2	305	308	3	1.0
96.4	278	294	16	5.8
97.6	248	249	1	0.4
98.8	214	213	-1	-0.5
Min	214	213	-1	-0.5
Max	567	619	129	29.5
Mean	487	538	51	11.0
Median	536	567	46	8.8

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	3.7
1.1<=X<10.0		57.3
X>=5.0		86.6
X>=10.0		39.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**39.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	15.0
1.1<=X<10.0		5.0
X>=5.0		85.0
X>=10.0		80.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**80.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	667	762	95	14.2
2.4	667	762	95	14.2
3.6	667	762	95	14.2
4.8	667	762	95	14.2
6.0	667	762	95	14.2
7.2	667	754	87	13.0
8.4	667	730	63	9.4
9.6	666	708	42	6.3
10.8	666	708	42	6.3
12.0	665	692	27	4.1
13.3	665	692	27	4.1
14.5	665	692	27	4.1
15.7	665	692	27	4.1
16.9	664	692	28	4.2
18.1	663	692	29	4.4
19.3	663	692	29	4.4
20.5	663	691	28	4.2
21.7	661	691	30	4.5
22.9	661	691	30	4.5
24.1	661	691	30	4.5
25.3	661	691	30	4.5
26.5	661	691	30	4.5
27.7	661	691	30	4.5
28.9	659	691	32	4.9
30.1	658	691	33	5.0
31.3	656	691	35	5.3
32.5	654	690	36	5.5
33.7	654	689	35	5.4
34.9	653	686	33	5.1
36.1	652	679	27	4.1
37.3	651	679	28	4.3
38.6	651	677	26	4.0
39.8	645	676	31	4.8
41.0	644	676	32	5.0
42.2	643	674	31	4.8
43.4	640	674	34	5.3
44.6	639	673	34	5.3
45.8	638	672	34	5.3
47.0	638	672	34	5.3
48.2	636	672	36	5.7
49.4	629	671	42	6.7
50.6	625	669	44	7.0
51.8	623	666	43	6.9
53.0	623	665	42	6.7
54.2	620	661	41	6.6
55.4	616	654	38	6.2
56.6	614	646	32	5.2
57.8	611	645	34	5.6
59.0	599	645	46	7.7
60.2	598	643	45	7.5
61.4	598	638	40	6.7
62.7	591	636	45	7.6
63.9	590	628	38	6.4
65.1	585	628	43	7.4
66.3	584	628	44	7.5
67.5	583	628	45	7.7
68.7	581	628	47	8.1
69.9	580	628	48	8.3
71.1	576	628	52	9.0
72.3	572	628	56	9.8
73.5	567	628	61	10.8
74.7	564	584	20	3.5
75.9	562	581	19	3.4
77.1	561	576	15	2.7
78.3	559	560	1	0.2
79.5	549	559	10	1.8
80.7	528	547	19	3.6
81.9	525	528	3	0.6
83.1	521	519	-2	-0.4
84.3	516	517	1	0.2
85.5	505	505	0	0.0
86.7	475	482	7	1.5
88.0	472	472	0	0.0
89.2	468	469	1	0.2
90.4	456	459	3	0.7
91.6	435	435	0	0.0
92.8	425	427	2	0.5
94.0	373	397	24	6.4
95.2	367	367	0	0.0
96.4	366	365	-1	-0.3
97.6	337	352	15	4.5
98.8	250	251	1	0.4
Min	250	251	-2	-0.4
Max	667	762	95	14.2
Mean	594	627	33	5.3
Median	627	670	32	5.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	15.9
1.1<=X<10.0		75.6
X>=5.0		51.2
X>=10.0		8.5
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**8.5**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	65.0
1.1<=X<10.0		35.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	792	903	111	14.0
2.4	792	903	111	14.0
3.6	792	903	111	14.0
4.8	792	903	111	14.0
6.0	792	903	111	14.0
7.2	792	862	70	8.8
8.4	792	822	30	3.8
9.6	792	818	26	3.3
10.8	792	817	25	3.2
12.0	792	814	22	2.8
13.3	792	796	4	0.5
14.5	792	795	3	0.4
15.7	792	795	3	0.4
16.9	792	795	3	0.4
18.1	792	795	3	0.4
19.3	792	795	3	0.4
20.5	792	795	3	0.4
21.7	792	795	3	0.4
22.9	792	795	3	0.4
24.1	792	795	3	0.4
25.3	792	795	3	0.4
26.5	792	795	3	0.4
27.7	792	795	3	0.4
28.9	792	795	3	0.4
30.1	792	795	3	0.4
31.3	792	795	3	0.4
32.5	792	795	3	0.4
33.7	792	795	3	0.4
34.9	792	795	3	0.4
36.1	792	795	3	0.4
37.3	792	795	3	0.4
38.6	792	795	3	0.4
39.8	792	795	3	0.4
41.0	792	795	3	0.4
42.2	792	795	3	0.4
43.4	792	795	3	0.4
44.6	792	795	3	0.4
45.8	792	795	3	0.4
47.0	792	795	3	0.4
48.2	792	795	3	0.4
49.4	792	795	3	0.4
50.6	792	795	3	0.4
51.8	792	795	3	0.4
53.0	792	795	3	0.4
54.2	792	795	3	0.4
55.4	792	795	3	0.4
56.6	792	795	3	0.4
57.8	792	795	3	0.4
59.0	792	795	3	0.4
60.2	792	795	3	0.4
61.4	792	795	3	0.4
62.7	790	795	5	0.6
63.9	761	795	34	4.5
65.1	760	795	35	4.6
66.3	754	795	41	5.4
67.5	746	795	49	6.6
68.7	739	795	56	7.6
69.9	738	778	40	5.4
71.1	731	777	46	6.3
72.3	725	770	45	6.2
73.5	711	749	38	5.3
74.7	677	746	69	10.2
75.9	670	660	-10	-1.5
77.1	657	656	-1	-0.2
78.3	648	653	5	0.8
79.5	636	648	12	1.9
80.7	633	634	1	0.2
81.9	620	633	13	2.1
83.1	613	620	7	1.1
84.3	589	593	4	0.7
85.5	583	587	4	0.7
86.7	581	571	-10	-1.7
88.0	515	529	14	2.7
89.2	506	506	0	0.0
90.4	496	493	-3	-0.6
91.6	481	483	2	0.4
92.8	472	474	2	0.4
94.0	469	469	0	0.0
95.2	438	462	24	5.5
96.4	434	433	-1	-0.2
97.6	359	374	15	4.2
98.8	240	241	1	0.4
Min	240	241	-10	-1.7
Max	792	903	111	14.0
Mean	722	738	17	2.3
Median	792	795	3	0.4

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	65.9
1.1<=X<10.0		24.4
X>=5.0		18.3
X>=10.0		7.3
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**7.3**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		30.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	967	967	0	0.0
2.4	967	967	0	0.0
3.6	967	967	0	0.0
4.8	967	967	0	0.0
6.0	967	967	0	0.0
7.2	967	967	0	0.0
8.4	967	967	0	0.0
9.6	967	967	0	0.0
10.8	967	967	0	0.0
12.0	967	967	0	0.0
13.3	967	967	0	0.0
14.5	967	967	0	0.0
15.7	967	967	0	0.0
16.9	967	967	0	0.0
18.1	967	967	0	0.0
19.3	967	967	0	0.0
20.5	967	967	0	0.0
21.7	967	967	0	0.0
22.9	967	967	0	0.0
24.1	967	967	0	0.0
25.3	967	967	0	0.0
26.5	967	967	0	0.0
27.7	967	967	0	0.0
28.9	967	967	0	0.0
30.1	967	967	0	0.0
31.3	967	967	0	0.0
32.5	967	967	0	0.0
33.7	967	967	0	0.0
34.9	967	967	0	0.0
36.1	967	967	0	0.0
37.3	967	967	0	0.0
38.6	967	967	0	0.0
39.8	967	967	0	0.0
41.0	967	967	0	0.0
42.2	967	967	0	0.0
43.4	967	967	0	0.0
44.6	967	967	0	0.0
45.8	967	967	0	0.0
47.0	967	967	0	0.0
48.2	967	967	0	0.0
49.4	967	967	0	0.0
50.6	967	967	0	0.0
51.8	967	967	0	0.0
53.0	967	967	0	0.0
54.2	967	967	0	0.0
55.4	967	967	0	0.0
56.6	945	967	22	2.3
57.8	940	967	27	2.9
59.0	932	967	35	3.8
60.2	901	967	66	7.3
61.4	889	946	57	6.4
62.7	880	914	34	3.9
63.9	844	898	54	6.4
65.1	832	898	66	7.9
66.3	823	894	71	8.6
67.5	811	870	59	7.3
68.7	798	862	64	8.0
69.9	779	845	66	8.5
71.1	777	840	63	8.1
72.3	775	838	63	8.1
73.5	762	798	36	4.7
74.7	753	779	26	3.5
75.9	746	775	29	3.9
77.1	721	720	-1	-0.1
78.3	720	702	-18	-2.5
79.5	704	697	-7	-1.0
80.7	695	695	0	0.0
81.9	646	645	-1	-0.2
83.1	603	615	12	2.0
84.3	587	587	0	0.0
85.5	575	567	-8	-1.4
86.7	563	566	3	0.5
88.0	549	564	15	2.7
89.2	543	563	20	3.7
90.4	542	563	21	3.9
91.6	533	537	4	0.8
92.8	525	530	5	1.0
94.0	515	517	2	0.4
95.2	505	508	3	0.6
96.4	487	486	-1	-0.2
97.6	395	410	15	3.8
98.8	249	249	0	0.0
Min	249	249	-18	-2.5
Max	967	967	71	8.6
Mean	845	856	11	1.4
Median	967	967	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	70.7
1.1<=X<10.0		26.8
X>=5.0		12.2
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		30.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	967	967	0	0.0
2.4	967	967	0	0.0
3.6	967	967	0	0.0
4.8	967	967	0	0.0
6.0	967	967	0	0.0
7.2	967	967	0	0.0
8.4	967	967	0	0.0
9.6	967	967	0	0.0
10.8	967	967	0	0.0
12.0	967	967	0	0.0
13.3	967	967	0	0.0
14.5	967	967	0	0.0
15.7	967	967	0	0.0
16.9	967	967	0	0.0
18.1	967	967	0	0.0
19.3	967	967	0	0.0
20.5	967	967	0	0.0
21.7	967	967	0	0.0
22.9	967	967	0	0.0
24.1	967	967	0	0.0
25.3	967	967	0	0.0
26.5	967	967	0	0.0
27.7	967	967	0	0.0
28.9	967	967	0	0.0
30.1	967	967	0	0.0
31.3	967	967	0	0.0
32.5	967	967	0	0.0
33.7	967	967	0	0.0
34.9	967	967	0	0.0
36.1	967	967	0	0.0
37.3	967	967	0	0.0
38.6	967	967	0	0.0
39.8	967	967	0	0.0
41.0	967	967	0	0.0
42.2	967	967	0	0.0
43.4	967	967	0	0.0
44.6	967	967	0	0.0
45.8	967	967	0	0.0
47.0	967	967	0	0.0
48.2	967	966	-1	-0.1
49.4	965	965	0	0.0
50.6	964	963	-1	-0.1
51.8	961	962	1	0.1
53.0	937	937	0	0.0
54.2	931	933	2	0.2
55.4	930	930	0	0.0
56.6	898	930	32	3.6
57.8	873	928	55	6.3
59.0	863	906	43	5.0
60.2	827	898	71	8.6
61.4	822	864	42	5.1
62.7	811	828	17	2.1
63.9	807	811	4	0.5
65.1	796	801	5	0.6
66.3	762	791	29	3.8
67.5	735	780	45	6.1
68.7	726	766	40	5.5
69.9	719	757	38	5.3
71.1	717	748	31	4.3
72.3	705	739	34	4.8
73.5	662	735	73	11.0
74.7	652	726	74	11.3
75.9	652	697	45	6.9
77.1	651	683	32	4.9
78.3	632	648	16	2.5
79.5	628	627	-1	-0.2
80.7	595	594	-1	-0.2
81.9	592	592	0	0.0
83.1	588	587	-1	-0.2
84.3	580	579	-1	-0.2
85.5	557	569	12	2.2
86.7	538	561	23	4.3
88.0	536	538	2	0.4
89.2	524	521	-3	-0.6
90.4	500	488	-12	-2.4
91.6	485	487	2	0.4
92.8	484	484	0	0.0
94.0	468	474	6	1.3
95.2	429	436	7	1.6
96.4	401	417	16	4.0
97.6	383	407	24	6.3
98.8	228	229	1	0.4
Min	228	229	-12	-2.4
Max	967	967	74	11.3
Mean	819	829	10	1.4
Median	965	964	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	70.7
1.1<=X<10.0		25.6
X>=5.0		13.4
X>=10.0		2.4
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		45.0
X>=5.0		10.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	942	942	0	0.0
2.4	942	942	0	0.0
3.6	942	942	0	0.0
4.8	942	942	0	0.0
6.0	942	942	0	0.0
7.2	942	942	0	0.0
8.4	942	942	0	0.0
9.6	942	942	0	0.0
10.8	942	942	0	0.0
12.0	942	942	0	0.0
13.3	942	942	0	0.0
14.5	942	942	0	0.0
15.7	942	942	0	0.0
16.9	942	942	0	0.0
18.1	942	942	0	0.0
19.3	942	942	0	0.0
20.5	942	917	-25	-2.7
21.7	907	907	0	0.0
22.9	883	882	-1	-0.1
24.1	878	877	-1	-0.1
25.3	873	873	0	0.0
26.5	859	859	0	0.0
27.7	847	847	0	0.0
28.9	841	841	0	0.0
30.1	812	812	0	0.0
31.3	796	796	0	0.0
32.5	795	795	0	0.0
33.7	794	794	0	0.0
34.9	790	789	-1	-0.1
36.1	786	786	0	0.0
37.3	782	782	0	0.0
38.6	776	776	0	0.0
39.8	774	774	0	0.0
41.0	766	767	1	0.1
42.2	766	766	0	0.0
43.4	765	766	1	0.1
44.6	763	761	-2	-0.3
45.8	756	756	0	0.0
47.0	755	755	0	0.0
48.2	752	752	0	0.0
49.4	738	724	-14	-1.9
50.6	726	719	-7	-1.0
51.8	724	705	-19	-2.6
53.0	688	704	16	2.3
54.2	680	700	20	2.9
55.4	680	688	8	1.2
56.6	665	684	19	2.9
57.8	649	680	31	4.8
59.0	640	679	39	6.1
60.2	602	667	65	10.8
61.4	594	640	46	7.7
62.7	588	631	43	7.3
63.9	586	614	28	4.8
65.1	578	582	4	0.7
66.3	554	558	4	0.7
67.5	553	556	3	0.5
68.7	549	554	5	0.9
69.9	541	546	5	0.9
71.1	508	546	38	7.5
72.3	501	537	36	7.2
73.5	495	529	34	6.9
74.7	495	518	23	4.6
75.9	485	507	22	4.5
77.1	483	488	5	1.0
78.3	474	474	0	0.0
79.5	474	473	-1	-0.2
80.7	466	466	0	0.0
81.9	456	465	9	2.0
83.1	453	464	11	2.4
84.3	442	453	11	2.5
85.5	427	443	16	3.7
86.7	426	427	1	0.2
88.0	421	426	5	1.2
89.2	403	406	3	0.7
90.4	400	404	4	1.0
91.6	393	402	9	2.3
92.8	381	395	14	3.7
94.0	341	324	-17	-5.0
95.2	328	300	-28	-8.5
96.4	300	300	0	0.0
97.6	300	297	-3	-1.0
98.8	195	196	1	0.5
Min	195	196	-28	-8.5
Max	942	942	65	10.8
Mean	682	687	6	1.0
Median	732	722	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	67.1
1.1<=X<10.0		25.6
X>=5.0		8.5
X>=10.0		1.2
-10.0<X<=-1.1		6.1
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		40.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		10.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	792	792	0	0.0
2.4	792	792	0	0.0
3.6	792	792	0	0.0
4.8	792	792	0	0.0
6.0	792	792	0	0.0
7.2	792	792	0	0.0
8.4	792	792	0	0.0
9.6	792	792	0	0.0
10.8	792	792	0	0.0
12.0	792	792	0	0.0
13.3	792	792	0	0.0
14.5	792	792	0	0.0
15.7	792	792	0	0.0
16.9	792	792	0	0.0
18.1	792	792	0	0.0
19.3	792	792	0	0.0
20.5	792	792	0	0.0
21.7	792	792	0	0.0
22.9	792	792	0	0.0
24.1	792	792	0	0.0
25.3	792	792	0	0.0
26.5	792	792	0	0.0
27.7	790	792	2	0.3
28.9	790	790	0	0.0
30.1	788	790	2	0.3
31.3	786	787	1	0.1
32.5	777	786	9	1.2
33.7	773	777	4	0.5
34.9	769	773	4	0.5
36.1	768	769	1	0.1
37.3	766	765	-1	-0.1
38.6	765	765	0	0.0
39.8	759	759	0	0.0
41.0	757	759	2	0.3
42.2	734	735	1	0.1
43.4	726	726	0	0.0
44.6	721	721	0	0.0
45.8	714	712	-2	-0.3
47.0	713	710	-3	-0.4
48.2	709	706	-3	-0.4
49.4	691	692	1	0.1
50.6	688	687	-1	-0.1
51.8	674	685	11	1.6
53.0	645	674	29	4.5
54.2	640	663	23	3.6
55.4	629	640	11	1.7
56.6	622	634	12	1.9
57.8	599	633	34	5.7
59.0	592	621	29	4.9
60.2	570	612	42	7.4
61.4	567	572	5	0.9
62.7	565	568	3	0.5
63.9	550	568	18	3.3
65.1	516	536	20	3.9
66.3	497	501	4	0.8
67.5	492	492	0	0.0
68.7	487	492	5	1.0
69.9	454	491	37	8.1
71.1	453	470	17	3.8
72.3	451	460	9	2.0
73.5	446	450	4	0.9
74.7	432	445	13	3.0
75.9	419	444	25	6.0
77.1	415	432	17	4.1
78.3	413	423	10	2.4
79.5	411	407	-4	-1.0
80.7	398	404	6	1.5
81.9	397	400	3	0.8
83.1	389	397	8	2.1
84.3	373	374	1	0.3
85.5	369	368	-1	-0.3
86.7	357	357	0	0.0
88.0	352	354	2	0.6
89.2	350	339	-11	-3.1
90.4	338	322	-16	-4.7
91.6	301	300	-1	-0.3
92.8	300	300	0	0.0
94.0	294	283	-11	-3.7
95.2	286	282	-4	-1.4
96.4	282	251	-31	-11.0
97.6	248	244	-4	-1.6
98.8	118	118	0	0.0
Min	118	118	-31	-11.0
Max	792	792	42	8.1
Mean	611	615	4	0.6
Median	690	690	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	68.3
1.1<=X<10.0		24.4
X>=5.0		4.9
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		1.2
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	45.0
1.1<=X<10.0		25.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		5.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-5.0**

Folsom Reservoir End of Month Storage - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	752	752	0	0.0
2.4	752	752	0	0.0
3.6	752	752	0	0.0
4.8	752	752	0	0.0
6.0	752	752	0	0.0
7.2	752	752	0	0.0
8.4	752	752	0	0.0
9.6	752	752	0	0.0
10.8	752	752	0	0.0
12.0	752	752	0	0.0
13.3	737	737	0	0.0
14.5	736	729	-7	-1.0
15.7	726	729	3	0.4
16.9	723	726	3	0.4
18.1	716	719	3	0.4
19.3	714	714	0	0.0
20.5	707	707	0	0.0
21.7	686	695	9	1.3
22.9	671	686	15	2.2
24.1	665	664	-1	-0.2
25.3	645	645	0	0.0
26.5	645	645	0	0.0
27.7	644	644	0	0.0
28.9	640	640	0	0.0
30.1	639	639	0	0.0
31.3	624	624	0	0.0
32.5	623	623	0	0.0
33.7	622	622	0	0.0
34.9	606	618	12	2.0
36.1	599	606	7	1.2
37.3	597	597	0	0.0
38.6	596	596	0	0.0
39.8	595	596	1	0.2
41.0	595	595	0	0.0
42.2	593	593	0	0.0
43.4	592	592	0	0.0
44.6	589	589	0	0.0
45.8	588	587	-1	-0.2
47.0	587	586	-1	-0.2
48.2	586	580	-6	-1.0
49.4	586	579	-7	-1.2
50.6	579	576	-3	-0.5
51.8	576	573	-3	-0.5
53.0	573	556	-17	-3.0
54.2	556	554	-2	-0.4
55.4	549	553	4	0.7
56.6	544	550	6	1.1
57.8	543	545	2	0.4
59.0	543	543	0	0.0
60.2	540	534	-6	-1.1
61.4	504	513	9	1.8
62.7	496	500	4	0.8
63.9	490	495	5	1.0
65.1	463	488	25	5.4
66.3	450	476	26	5.8
67.5	441	463	22	5.0
68.7	435	461	26	6.0
69.9	421	459	38	9.0
71.1	420	441	21	5.0
72.3	418	433	15	3.6
73.5	411	423	12	2.9
74.7	411	419	8	1.9
75.9	411	417	6	1.5
77.1	403	411	8	2.0
78.3	397	403	6	1.5
79.5	393	395	2	0.5
80.7	389	390	1	0.3
81.9	388	388	0	0.0
83.1	382	372	-10	-2.6
84.3	366	366	0	0.0
85.5	338	340	2	0.6
86.7	338	337	-1	-0.3
88.0	333	334	1	0.3
89.2	330	331	1	0.3
90.4	319	300	-19	-6.0
91.6	301	300	-1	-0.3
92.8	300	269	-31	-10.3
94.0	283	267	-16	-5.7
95.2	267	264	-3	-1.1
96.4	244	240	-4	-1.6
97.6	208	205	-3	-1.4
98.8	116	116	0	0.0
Min	116	116	-31	-10.3
Max	752	752	38	9.0
Mean	540	542	2	0.3
Median	583	578	0	0.0

Entire 82-Year Simulation Period

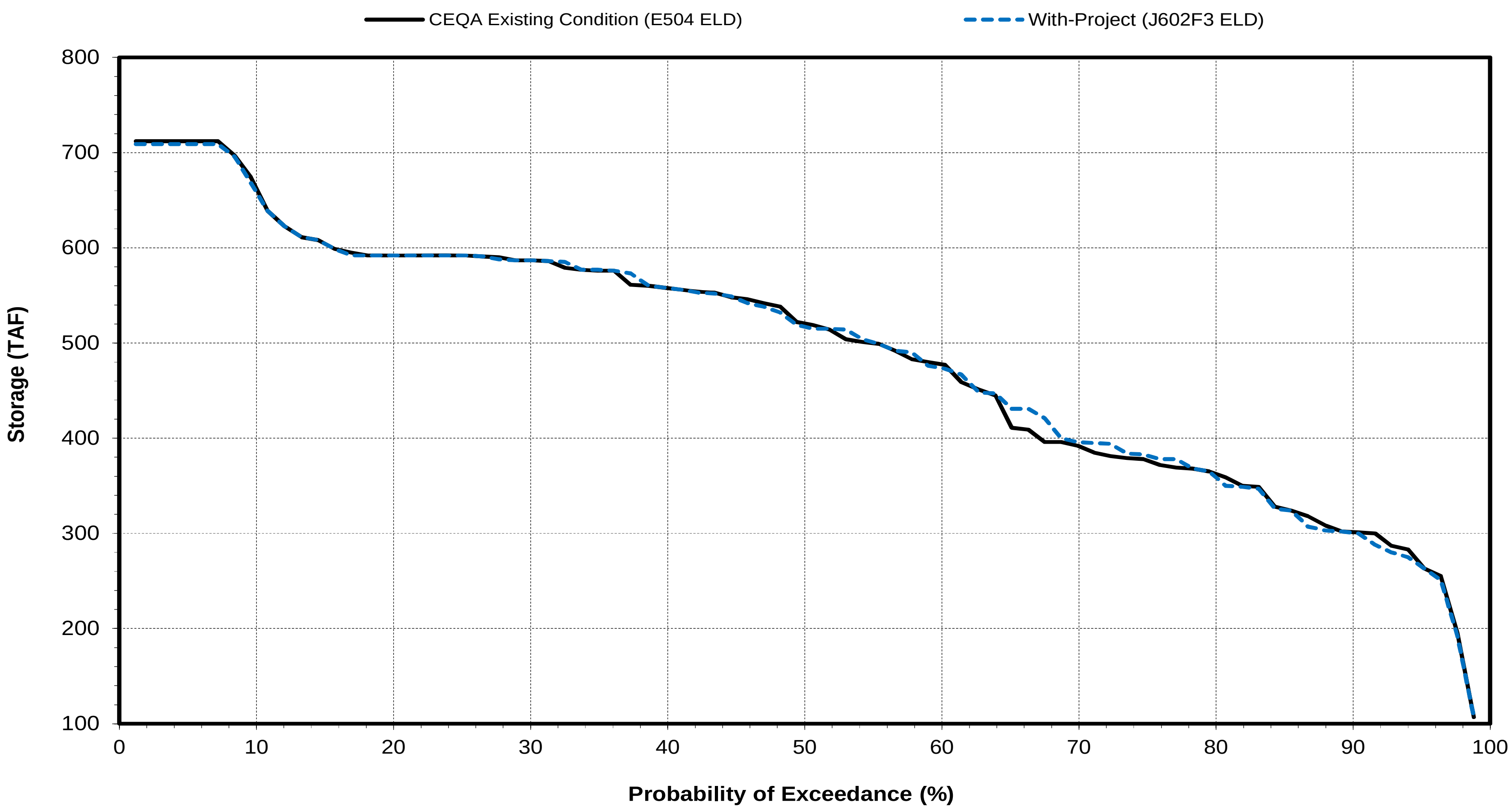
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	65.9
1.1<=X<10.0		22.0
X>=5.0		7.3
X>=10.0		0.0
-10.0<X<=-1.1		11.0
X<=-5.0		3.7
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		15.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-5.0**

Folsom Reservoir End of Month Storage

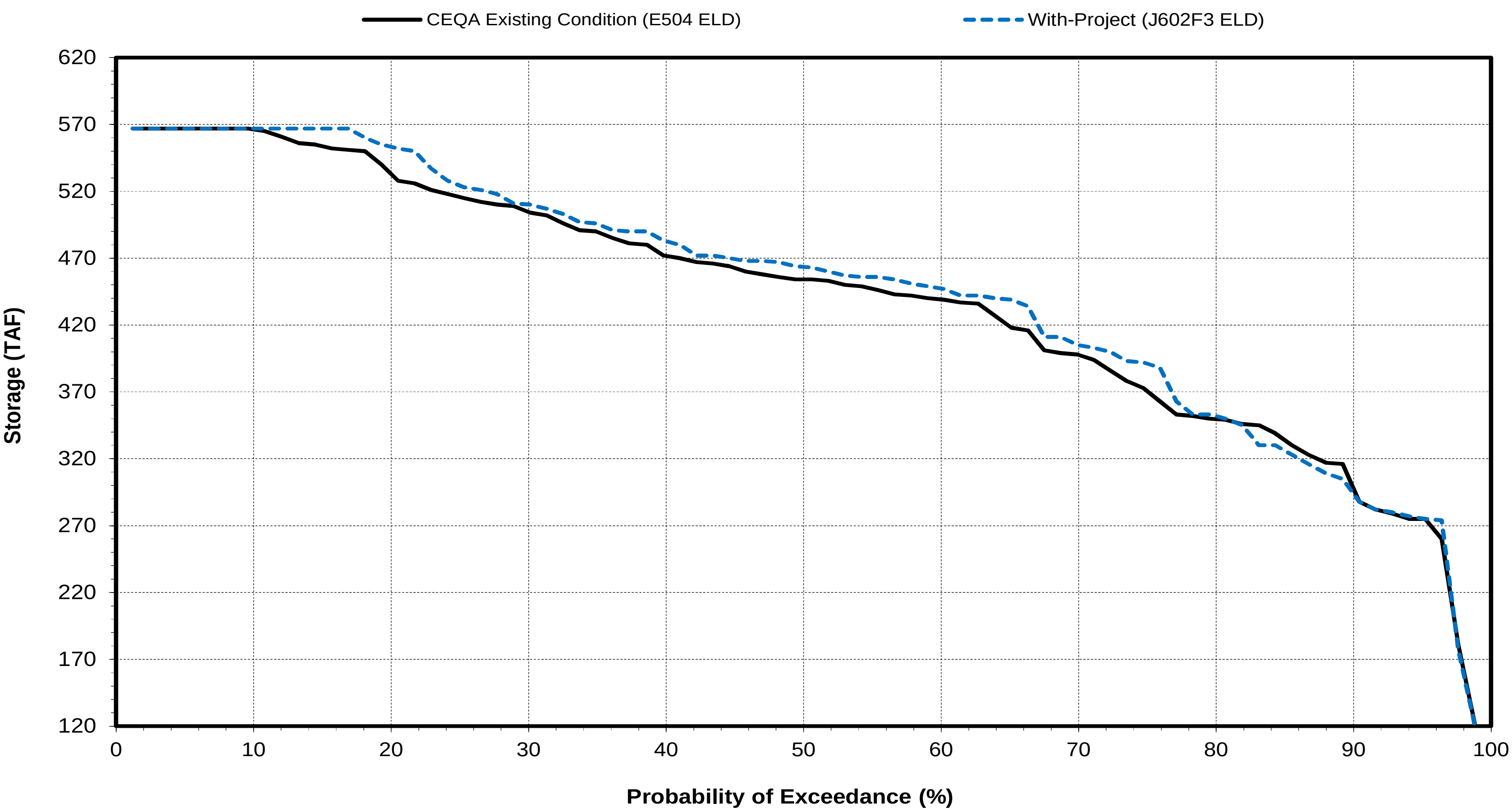
October



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Folsom Reservoir End of Month Storage

November

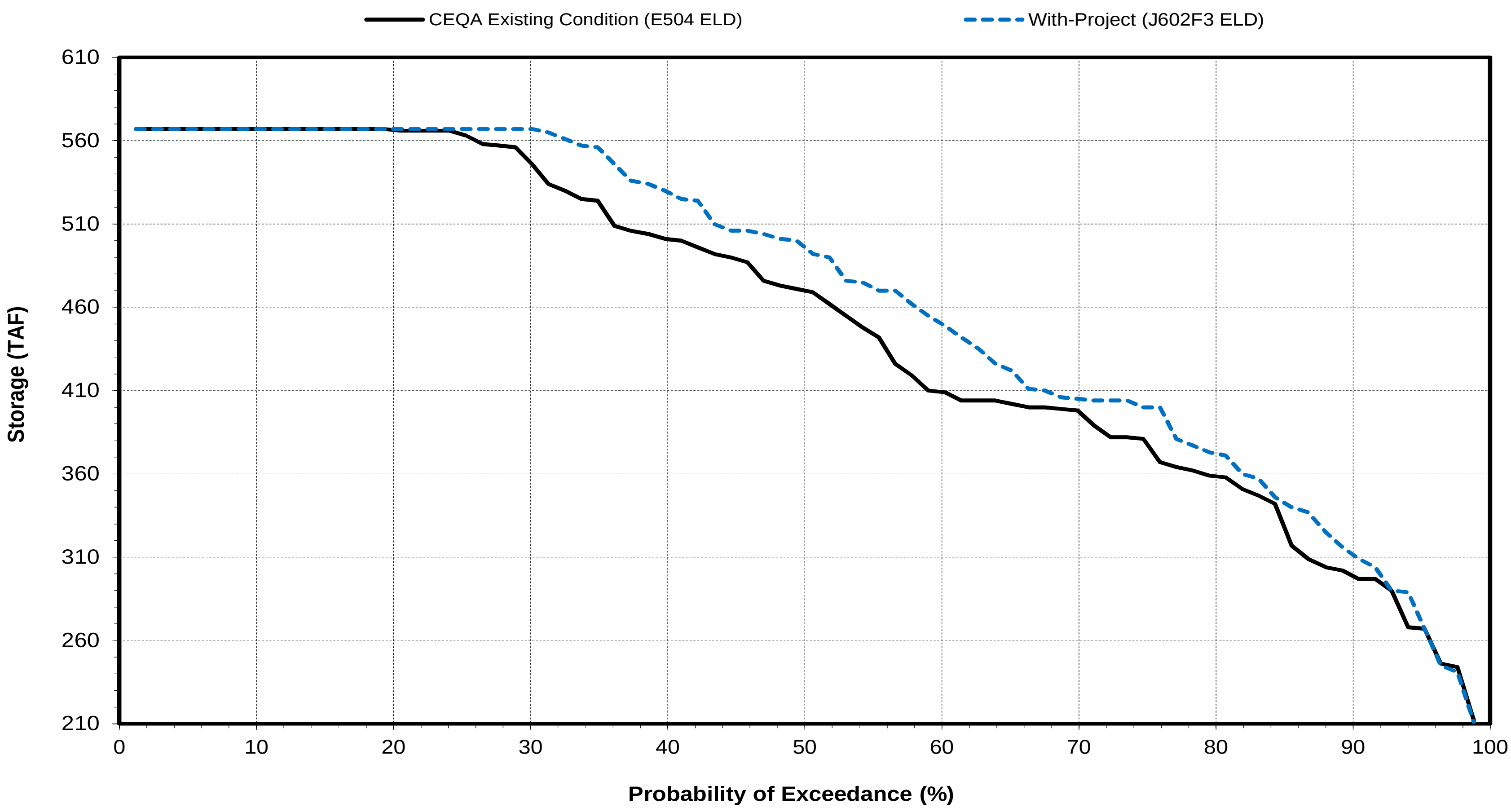


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

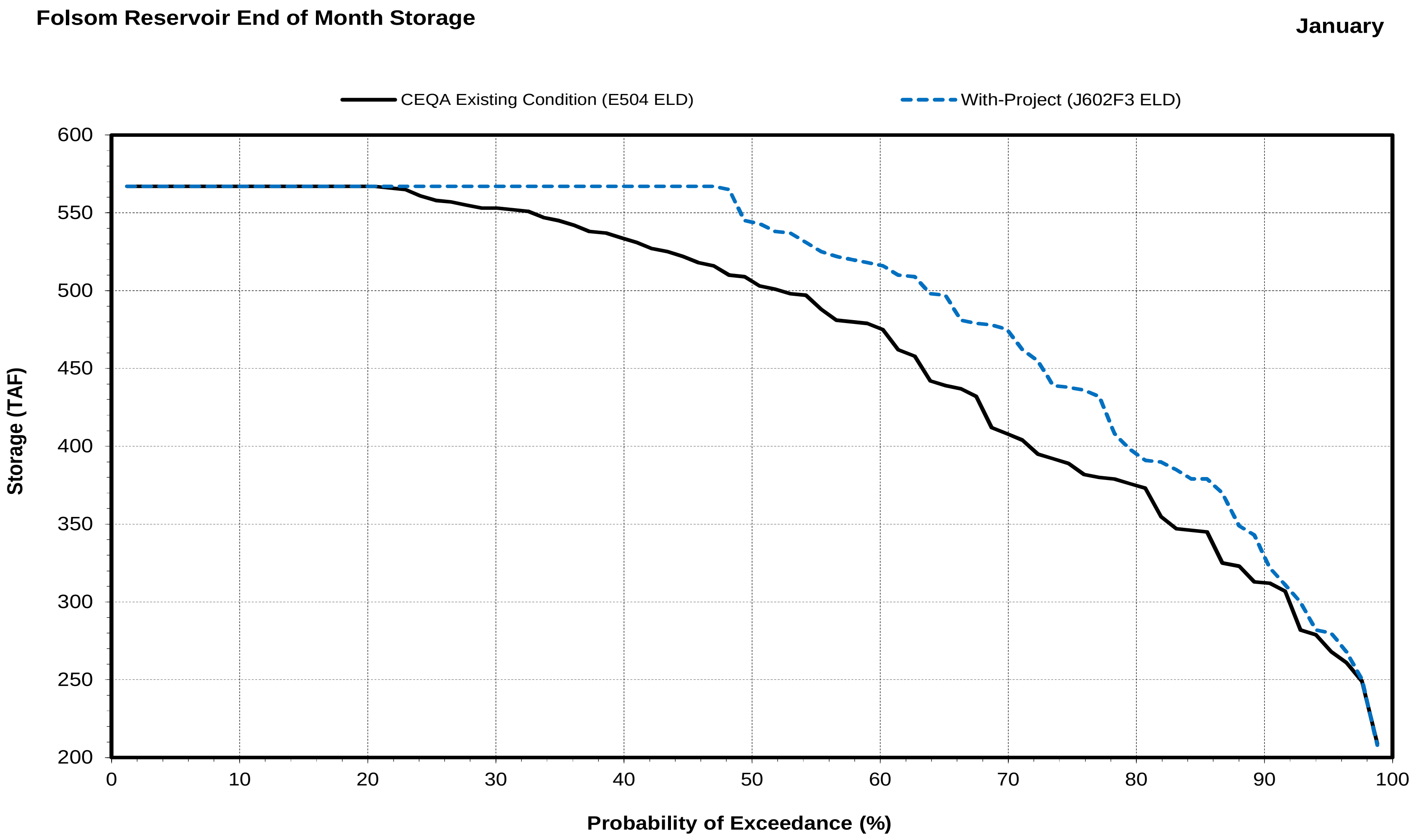
Folsom Reservoir End of Month Storage

December



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

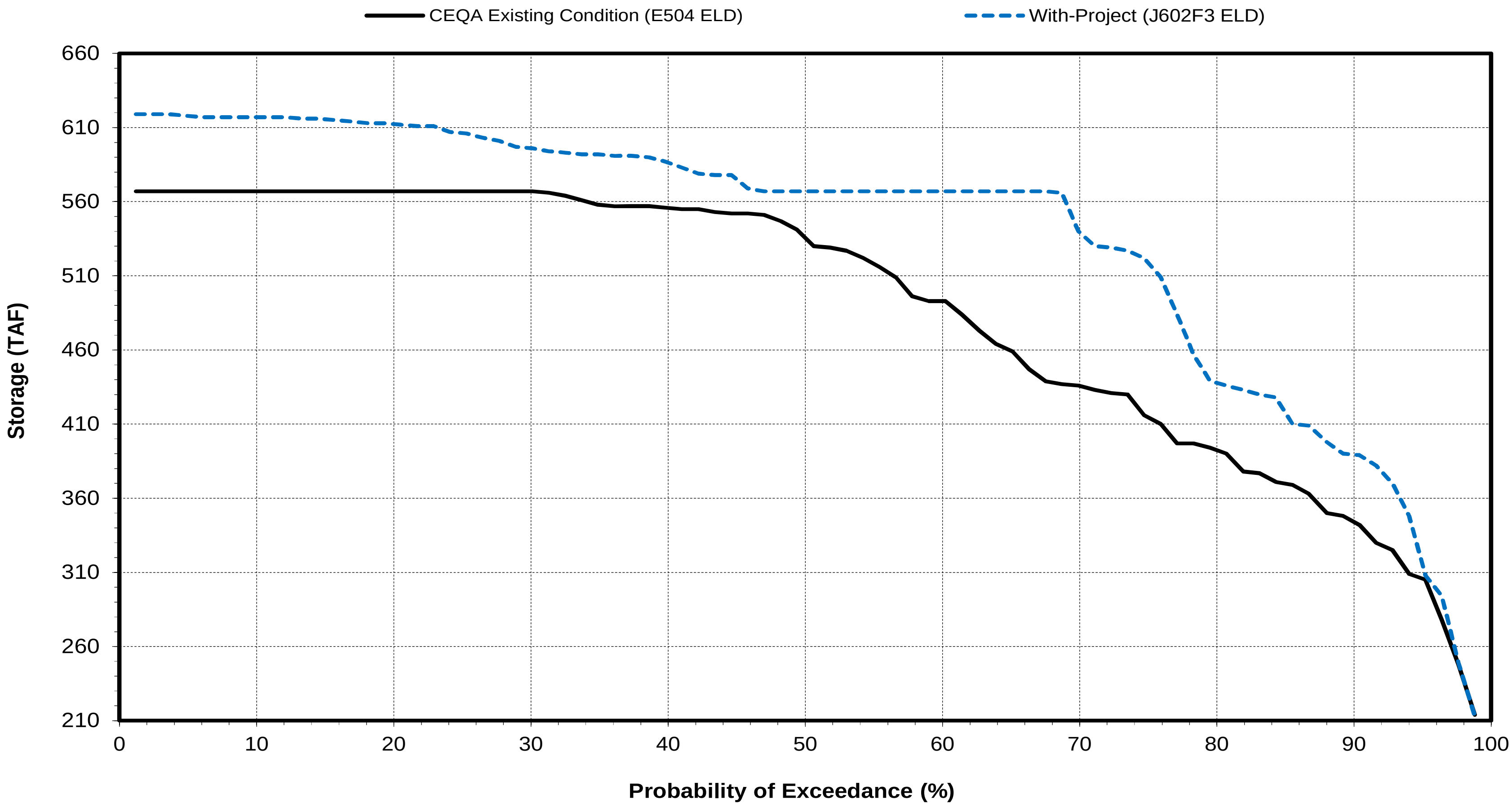


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Folsom Reservoir End of Month Storage

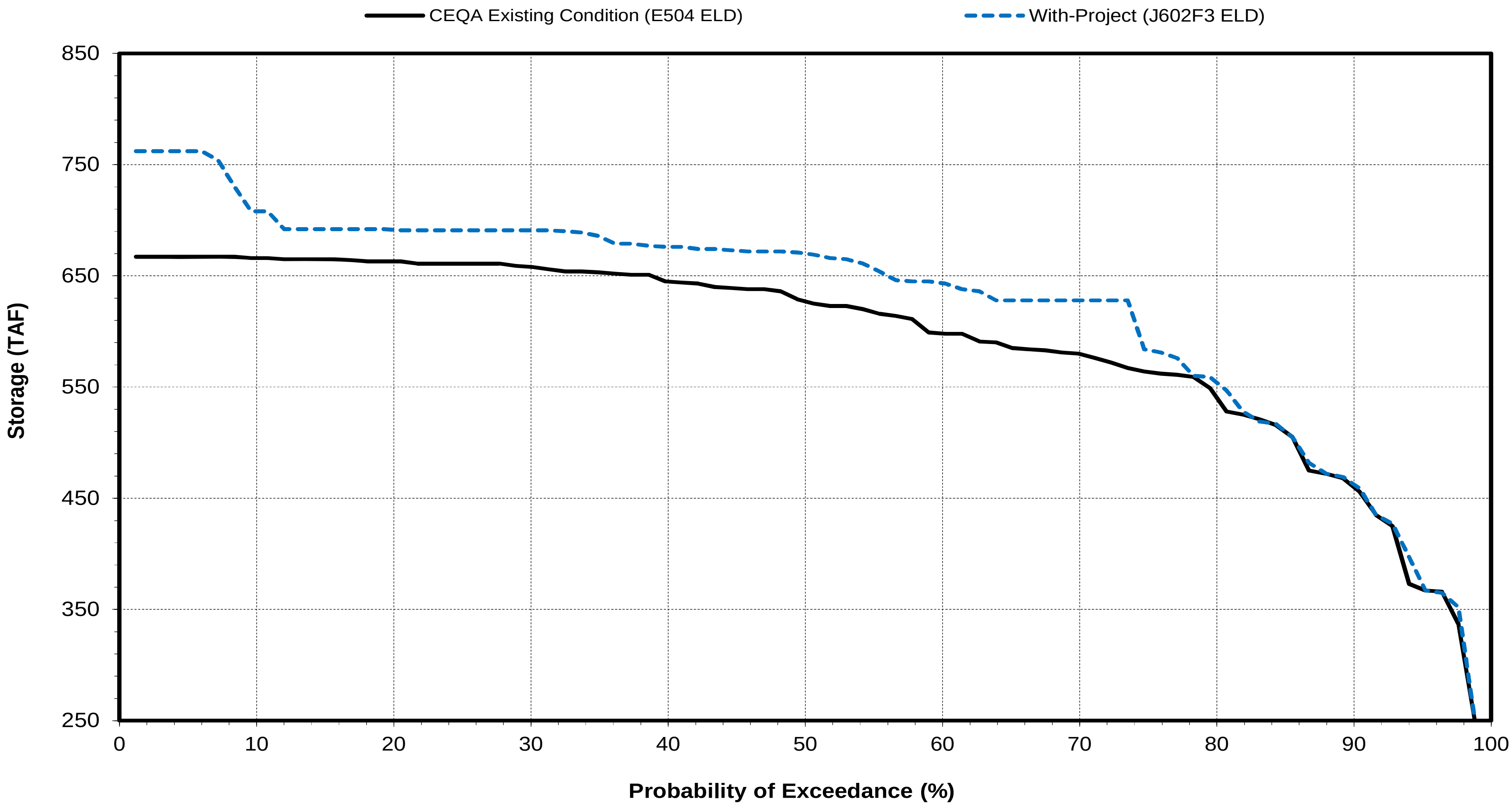
February



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Folsom Reservoir End of Month Storage

March

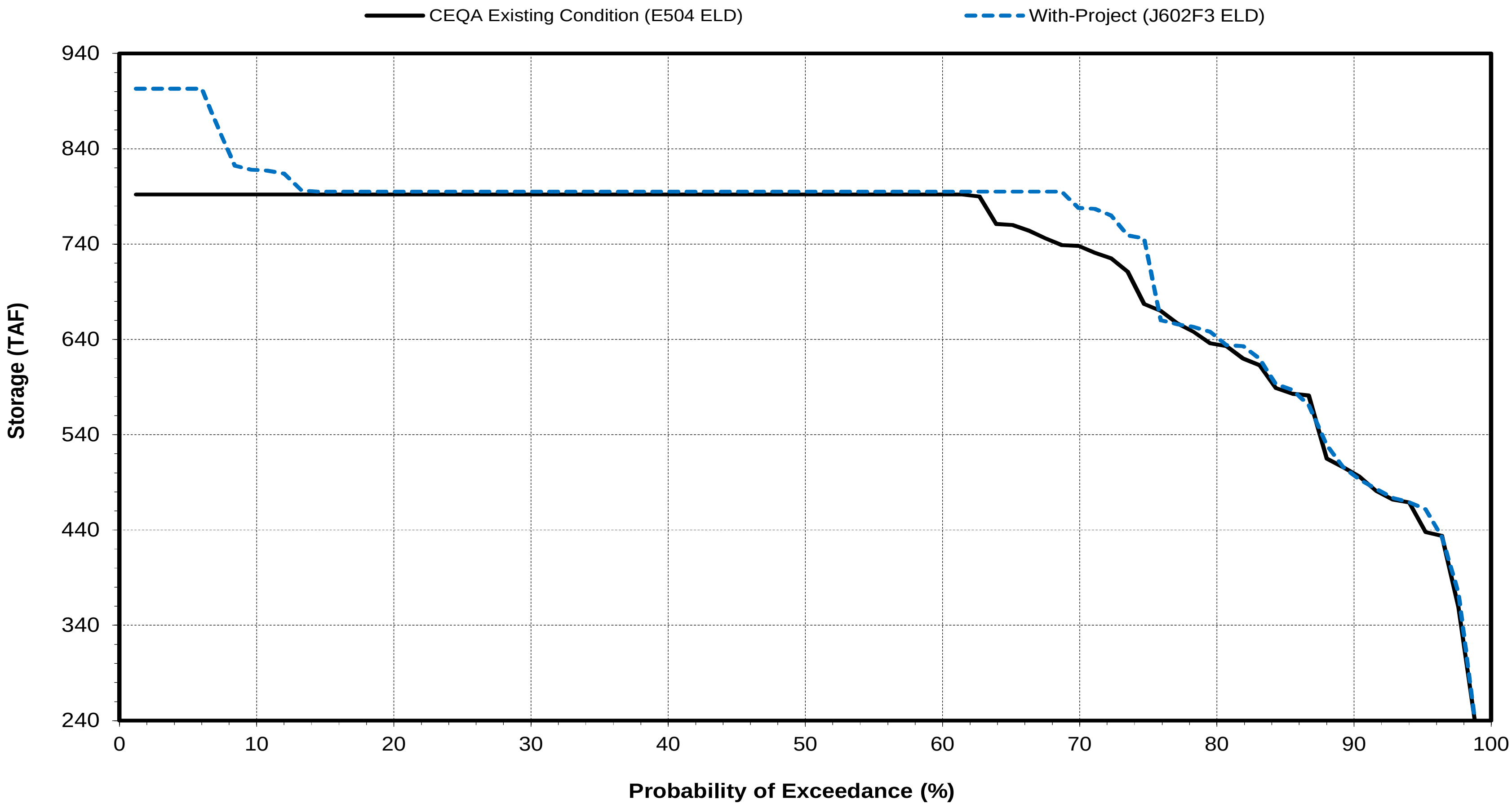


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Folsom Reservoir End of Month Storage

April

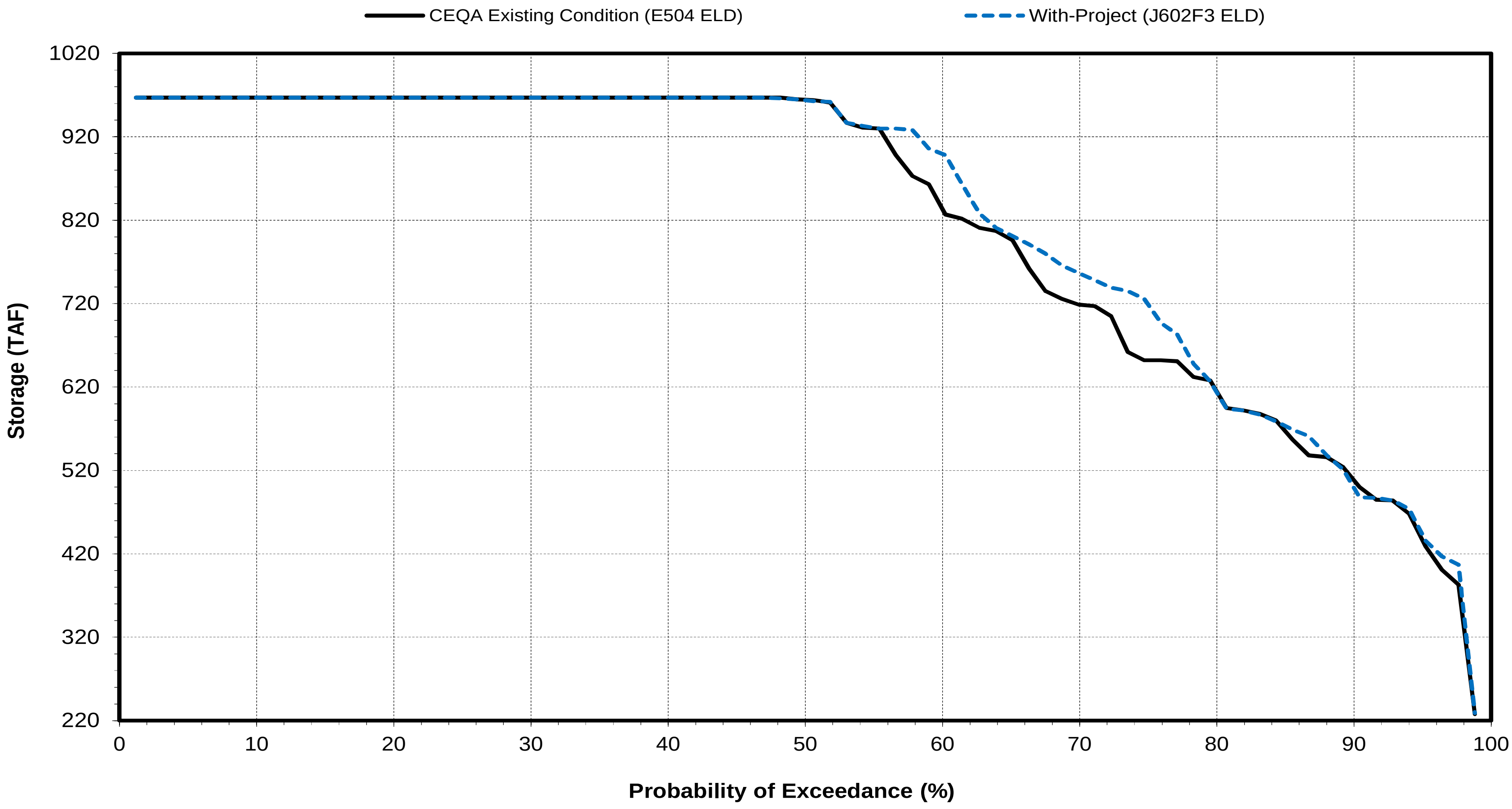


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Folsom Reservoir End of Month Storage

June

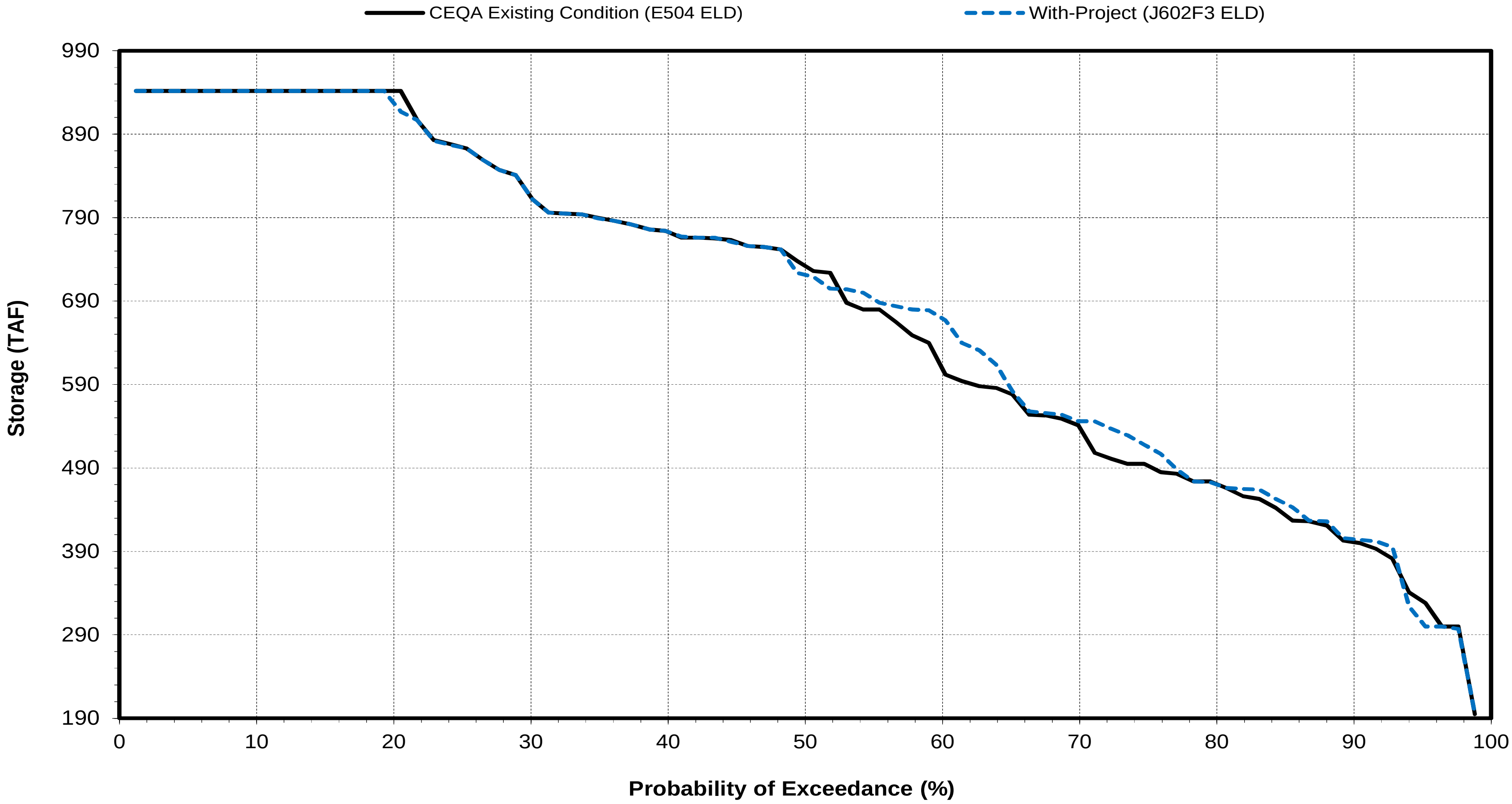


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

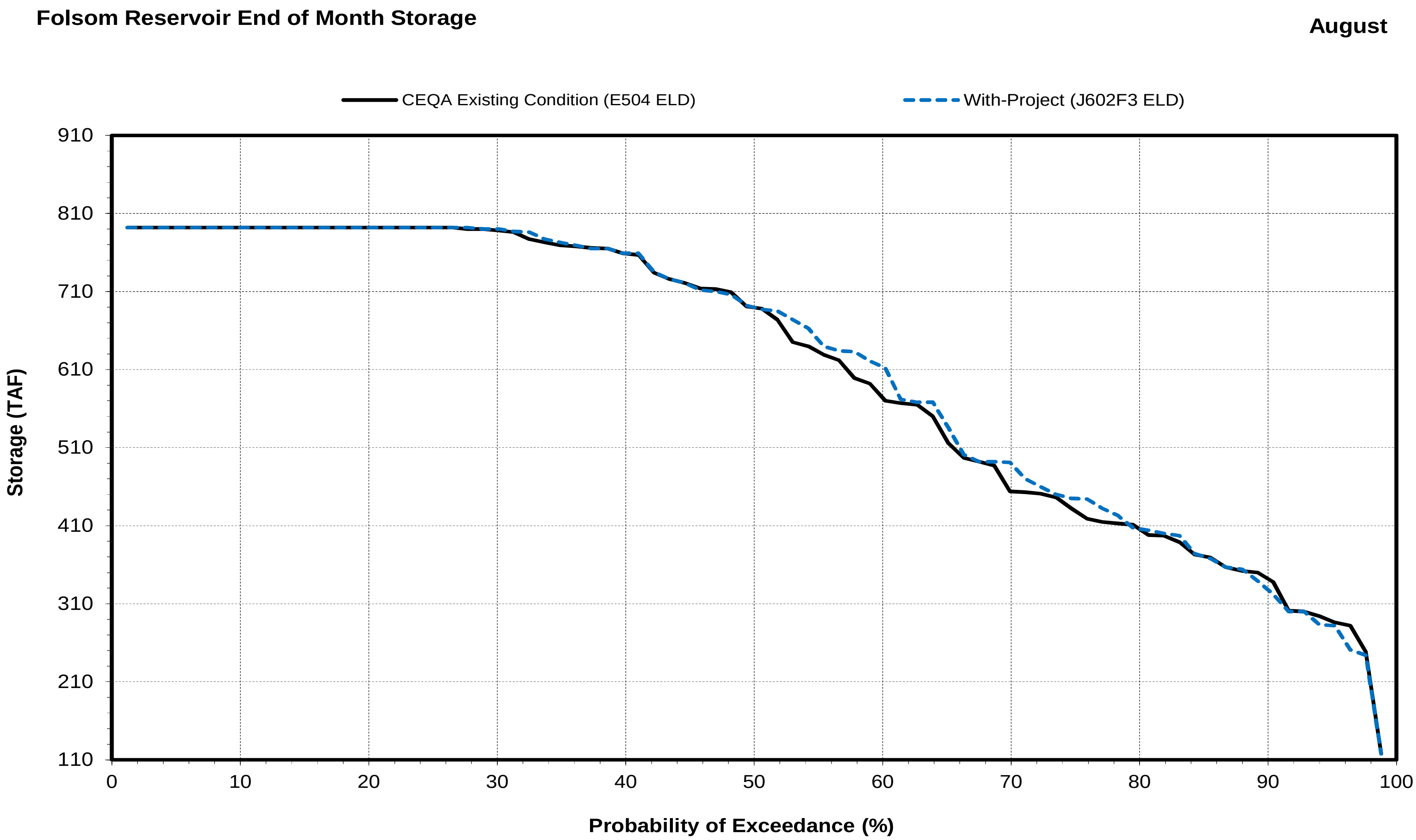
Folsom Reservoir End of Month Storage

July



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Long-term and Water Year Type Average Lower American River Flow at Watt Avenue Under CEQA Existing Condition (E504 ELD) and With-Project (J602F ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	1,967	2,872	3,303	4,386	5,131	3,665	3,162	3,394	3,418	3,513	2,236	2,411
With-Project (J602F3 ELD)	1,990	2,771	3,161	4,224	4,668	3,961	3,432	3,488	3,436	3,580	2,260	2,447
Difference	23	-101	-142	-162	-463	296	270	94	18	67	24	36
Percent Difference[3]	1.2	-3.5	-4.3	-3.7	-9.0	8.1	8.5	2.8	0.5	1.9	1.1	1.5
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	2,081	3,703	5,865	8,624	9,084	5,968	5,120	5,928	5,724	3,733	3,163	3,720
With-Project (J602F3 ELD)	2,123	3,517	5,467	8,277	8,186	7,061	5,639	5,976	5,722	3,733	3,163	3,737
Difference	42	-186	-398	-347	-898	1,093	519	48	-2	0	0	17
Percent Difference[3]	2.0	-5.0	-6.8	-4.0	-9.9	18.3	10.1	0.8	0.0	0.0	0.0	0.5
Above Normal												
CEQA Existing Condition (E504 ELD)	2,045	3,492	2,976	4,998	6,208	5,220	3,370	3,622	3,160	4,276	2,173	3,581
With-Project (J602F3 ELD)	2,067	3,222	2,881	4,657	5,808	5,470	3,861	3,849	3,180	4,286	2,205	3,630
Difference	22	-270	-95	-341	-400	250	491	227	20	10	32	49
Percent Difference[3]	1.1	-7.7	-3.2	-6.8	-6.4	4.8	14.6	6.3	0.6	0.2	1.5	1.4
Below Normal												
CEQA Existing Condition (E504 ELD)	1,934	2,369	2,470	2,307	4,203	2,433	3,025	2,792	2,636	4,532	1,739	1,742
With-Project (J602F3 ELD)	1,944	2,353	2,466	2,307	3,676	2,462	3,207	2,895	2,704	4,532	1,760	1,791
Difference	10	-16	-4	0	-527	29	182	103	68	0	21	49
Percent Difference[3]	0.5	-0.7	-0.2	0.0	-12.5	1.2	6.0	3.7	2.6	0.0	1.2	2.8
Dry												
CEQA Existing Condition (E504 ELD)	1,926	2,292	1,675	1,595	2,175	2,067	1,803	1,642	2,240	3,150	1,961	1,319
With-Project (J602F3 ELD)	1,970	2,297	1,679	1,586	2,037	1,666	1,816	1,759	2,249	3,361	1,975	1,379
Difference	44	5	4	-9	-138	-401	13	117	9	211	14	60
Percent Difference[3]	2.3	0.2	0.2	-0.6	-6.3	-19.4	0.7	7.1	0.4	6.7	0.7	4.5
Critical												
CEQA Existing Condition (E504 ELD)	1,744	1,908	1,495	1,205	1,008	956	909	1,010	1,357	1,631	1,284	824
With-Project (J602F3 ELD)	1,706	1,898	1,479	1,201	1,012	928	909	1,021	1,373	1,761	1,369	833
Difference	-38	-10	-16	-4	4	-28	0	11	16	130	85	9
Percent Difference[3]	-2.2	-0.5	-1.1	-0.3	0.4	-2.9	0.0	1.1	1.2	8.0	6.6	1.1

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

Lower American River Flow at Watt Avenue - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	4387	4387	0	0.0
2.4	4283	4038	-245	-5.7
3.6	4128	4005	-123	-3.0
4.8	3954	3917	-37	-0.9
6.0	3916	3894	-22	-0.6
7.2	3885	3873	-12	-0.3
8.4	3845	3836	-9	-0.2
9.6	3836	3676	-160	-4.2
10.8	3595	3635	40	1.1
12.0	3564	3424	-140	-3.9
13.3	3423	3366	-57	-1.7
14.5	3317	3272	-45	-1.4
15.7	3121	3144	23	0.7
16.9	3112	3121	9	0.3
18.1	2919	3012	93	3.2
19.3	2824	2973	149	5.3
20.5	2798	2827	29	1.0
21.7	2779	2826	47	1.7
22.9	2768	2799	31	1.1
24.1	2721	2770	49	1.8
25.3	2639	2747	108	4.1
26.5	2388	2721	333	13.9
27.7	2290	2637	347	15.2
28.9	2278	2403	125	5.5
30.1	2193	2383	190	8.7
31.3	2182	2372	190	8.7
32.5	2144	2339	195	9.1
33.7	2110	2198	88	4.2
34.9	2006	2193	187	9.3
36.1	1971	2162	191	9.7
37.3	1937	2021	84	4.3
38.6	1904	1934	30	1.6
39.8	1854	1904	50	2.7
41.0	1791	1796	5	0.3
42.2	1780	1795	15	0.8
43.4	1768	1791	23	1.3
44.6	1767	1769	2	0.1
45.8	1761	1767	6	0.3
47.0	1719	1760	41	2.4
48.2	1685	1720	35	2.1
49.4	1652	1682	30	1.8
50.6	1647	1681	34	2.1
51.8	1573	1637	64	4.1
53.0	1554	1575	21	1.4
54.2	1455	1554	99	6.8
55.4	1444	1467	23	1.6
56.6	1425	1461	36	2.5
57.8	1417	1455	38	2.7
59.0	1416	1421	5	0.4
60.2	1413	1416	3	0.2
61.4	1407	1407	0	0.0
62.7	1407	1406	-1	-0.1
63.9	1400	1399	-1	-0.1
65.1	1390	1397	7	0.5
66.3	1389	1390	1	0.1
67.5	1386	1389	3	0.2
68.7	1374	1386	12	0.9
69.9	1372	1374	2	0.1
71.1	1371	1372	1	0.1
72.3	1361	1371	10	0.7
73.5	1359	1360	1	0.1
74.7	1357	1357	0	0.0
75.9	1355	1355	0	0.0
77.1	1350	1349	-1	-0.1
78.3	1348	1347	-1	-0.1
79.5	1345	1344	-1	-0.1
80.7	1341	1337	-4	-0.3
81.9	1337	1336	-1	-0.1
83.1	1324	1324	0	0.0
84.3	1121	1137	16	1.4
85.5	1114	1112	-2	-0.2
86.7	1088	1097	9	0.8
88.0	1064	1053	-11	-1.0
89.2	1029	1032	3	0.3
90.4	1023	900	-123	-12.0
91.6	907	704	-203	-22.4
92.8	778	687	-91	-11.7
94.0	687	685	-2	-0.3
95.2	685	676	-9	-1.3
96.4	500	500	0	0.0
97.6	500	500	0	0.0
98.8	500	500	0	0.0
Min	500	500	-245	-22.4
Max	4387	4387	347	15.2
Mean	1967	1990	22	0.9
Median	1650	1682	5	0.3

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	50.0
1.1<=X<10.0		35.4
X>=5.0		12.2
X>=10.0		2.4
-10.0<X<=-1.1		8.5
X<=-5.0		4.9
X<=-10.0		3.7
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		15.0
X<=-10.0		15.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-15.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	17135	13962	-3173	-18.5
2.4	16292	12986	-3306	-20.3
3.6	8024	7941	-83	-1.0
4.8	7039	6944	-95	-1.3
6.0	5677	4916	-761	-13.4
7.2	5119	4877	-242	-4.7
8.4	4916	4869	-47	-1.0
9.6	4869	4686	-183	-3.8
10.8	4688	4552	-136	-2.9
12.0	4405	4409	4	0.1
13.3	4218	4156	-62	-1.5
14.5	4204	4145	-59	-1.4
15.7	4144	4028	-116	-2.8
16.9	3744	3751	7	0.2
18.1	3719	3719	0	0.0
19.3	3708	3704	-4	-0.1
20.5	3700	3649	-51	-1.4
21.7	3548	3545	-3	-0.1
22.9	3512	3497	-15	-0.4
24.1	3338	3314	-24	-0.7
25.3	3298	3298	0	0.0
26.5	3239	3258	19	0.6
27.7	3232	3232	0	0.0
28.9	3191	3194	3	0.1
30.1	3183	3190	7	0.2
31.3	3175	3183	8	0.3
32.5	3150	3159	9	0.3
33.7	3129	3078	-51	-1.6
34.9	3078	3036	-42	-1.4
36.1	3040	3027	-13	-0.4
37.3	3025	2976	-49	-1.6
38.6	2956	2928	-28	-0.9
39.8	2899	2880	-19	-0.7
41.0	2880	2866	-14	-0.5
42.2	2870	2860	-10	-0.3
43.4	2860	2855	-5	-0.2
44.6	2778	2778	0	0.0
45.8	2528	2528	0	0.0
47.0	2412	2367	-45	-1.9
48.2	2274	2274	0	0.0
49.4	2239	2239	0	0.0
50.6	2195	2203	8	0.4
51.8	2111	2111	0	0.0
53.0	2013	2019	6	0.3
54.2	1894	1894	0	0.0
55.4	1857	1867	10	0.5
56.6	1835	1859	24	1.3
57.8	1829	1857	28	1.5
59.0	1822	1844	22	1.2
60.2	1808	1835	27	1.5
61.4	1802	1827	25	1.4
62.7	1789	1820	31	1.7
63.9	1780	1802	22	1.2
65.1	1766	1780	14	0.8
66.3	1658	1765	107	6.5
67.5	1628	1733	105	6.4
68.7	1617	1730	113	7.0
69.9	1612	1685	73	4.5
71.1	1610	1662	52	3.2
72.3	1608	1623	15	0.9
73.5	1585	1611	26	1.6
74.7	1583	1610	27	1.7
75.9	1576	1545	-31	-2.0
77.1	1552	1542	-10	-0.6
78.3	1542	1477	-65	-4.2
79.5	1458	1477	19	1.3
80.7	1440	1452	12	0.8
81.9	1313	1311	-2	-0.2
83.1	1178	1194	16	1.4
84.3	1155	1164	9	0.8
85.5	1125	1123	-2	-0.2
86.7	1087	1075	-12	-1.1
88.0	1006	941	-65	-6.5
89.2	948	777	-171	-18.0
90.4	861	761	-100	-11.6
91.6	777	751	-26	-3.3
92.8	752	726	-26	-3.5
94.0	726	688	-38	-5.2
95.2	684	684	0	0.0
96.4	500	500	0	0.0
97.6	500	500	0	0.0
98.8	500	500	0	0.0
Min	500	500	-3306	-20.3
Max	17135	13962	113	7.0
Mean	2872	2771	-102	-1.1
Median	2217	2221	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	51.2
1.1<=X<10.0		19.5
X>=5.0		3.7
X>=10.0		0.0
-10.0<X<=-1.1		23.2
X<=-5.0		8.5
X<=-10.0		6.1
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-6.1**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	45.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		35.0
X<=-5.0		20.0
X<=-10.0		10.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-10.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	20640	17110	-3530	-17.1
2.4	18108	15358	-2750	-15.2
3.6	16102	14803	-1299	-8.1
4.8	15475	14341	-1134	-7.3
6.0	14348	13422	-926	-6.5
7.2	13866	11392	-2474	-17.8
8.4	9017	9049	32	0.4
9.6	8841	8842	1	0.0
10.8	7138	7230	92	1.3
12.0	6659	6659	0	0.0
13.3	5475	5475	0	0.0
14.5	4890	4975	85	1.7
15.7	4779	4890	111	2.3
16.9	3987	3937	-50	-1.3
18.1	3870	3870	0	0.0
19.3	3477	3643	166	4.8
20.5	3292	3299	7	0.2
21.7	3154	3175	21	0.7
22.9	3050	3050	0	0.0
24.1	2703	2872	169	6.3
25.3	2437	2437	0	0.0
26.5	2068	2067	-1	0.0
27.7	2014	2014	0	0.0
28.9	2008	2008	0	0.0
30.1	1992	1987	-5	-0.3
31.3	1984	1984	0	0.0
32.5	1981	1981	0	0.0
33.7	1968	1968	0	0.0
34.9	1959	1959	0	0.0
36.1	1946	1946	0	0.0
37.3	1938	1938	0	0.0
38.6	1932	1932	0	0.0
39.8	1932	1932	0	0.0
41.0	1925	1925	0	0.0
42.2	1917	1919	2	0.1
43.4	1910	1917	7	0.4
44.6	1907	1910	3	0.2
45.8	1905	1908	3	0.2
47.0	1904	1905	1	0.1
48.2	1904	1904	0	0.0
49.4	1902	1904	2	0.1
50.6	1897	1902	5	0.3
51.8	1893	1898	5	0.3
53.0	1888	1893	5	0.3
54.2	1888	1888	0	0.0
55.4	1886	1887	1	0.1
56.6	1886	1886	0	0.0
57.8	1884	1886	2	0.1
59.0	1877	1883	6	0.3
60.2	1875	1883	8	0.4
61.4	1874	1877	3	0.2
62.7	1866	1875	9	0.5
63.9	1866	1874	8	0.4
65.1	1861	1867	6	0.3
66.3	1861	1866	5	0.3
67.5	1802	1861	59	3.3
68.7	1788	1861	73	4.1
69.9	1680	1785	105	6.3
71.1	1676	1689	13	0.8
72.3	1673	1677	4	0.2
73.5	1672	1676	4	0.2
74.7	1641	1641	0	0.0
75.9	1632	1626	-6	-0.4
77.1	1627	1553	-74	-4.5
78.3	1562	1541	-21	-1.3
79.5	1502	1494	-8	-0.5
80.7	1471	1494	23	1.6
81.9	1444	1452	8	0.6
83.1	1343	1341	-2	-0.1
84.3	1224	1222	-2	-0.2
85.5	1193	1210	17	1.4
86.7	1154	1163	9	0.8
88.0	1123	1082	-41	-3.7
89.2	1093	992	-101	-9.2
90.4	1000	842	-158	-15.8
91.6	842	807	-35	-4.2
92.8	832	804	-28	-3.4
94.0	807	753	-54	-6.7
95.2	753	731	-22	-2.9
96.4	728	728	0	0.0
97.6	500	500	0	0.0
98.8	500	500	0	0.0
Min	500	500	-3530	-17.8
Max	20640	17110	169	6.3
Mean	3303	3161	-142	-1.0
Median	1900	1903	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	68.3
1.1<=X<10.0		12.2
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		14.6
X<=-5.0		11.0
X<=-10.0		4.9
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-4.9**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	45.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		40.0
X<=-5.0		15.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-5.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	29318	26209	-3109	-10.6
2.4	21047	17946	-3101	-14.7
3.6	18380	15857	-2523	-13.7
4.8	15498	15637	139	0.9
6.0	14645	14195	-450	-3.1
7.2	12903	12834	-69	-0.5
8.4	11676	11454	-222	-1.9
9.6	11552	10602	-950	-8.2
10.8	10638	10360	-278	-2.6
12.0	9889	10266	377	3.8
13.3	9188	9187	-1	0.0
14.5	9091	9091	0	0.0
15.7	9030	9030	0	0.0
16.9	8083	8431	348	4.3
18.1	7365	7365	0	0.0
19.3	6975	6787	-188	-2.7
20.5	6526	6593	67	1.0
21.7	6403	6526	123	1.9
22.9	5954	5954	0	0.0
24.1	5912	5598	-314	-5.3
25.3	5123	5122	-1	0.0
26.5	5030	5030	0	0.0
27.7	4915	4915	0	0.0
28.9	4646	4642	-4	-0.1
30.1	4610	4448	-162	-3.5
31.3	4448	4115	-333	-7.5
32.5	4228	3909	-319	-7.5
33.7	4049	3534	-515	-12.7
34.9	3745	3438	-307	-8.2
36.1	3668	3331	-337	-9.2
37.3	3535	3125	-410	-11.6
38.6	3324	3123	-201	-6.0
39.8	3191	2852	-339	-10.6
41.0	2852	2762	-90	-3.2
42.2	2722	2722	0	0.0
43.4	2710	2537	-173	-6.4
44.6	2437	2433	-4	-0.2
45.8	2356	2353	-3	-0.1
47.0	2156	2154	-2	-0.1
48.2	1839	1813	-26	-1.4
49.4	1714	1714	0	0.0
50.6	1673	1673	0	0.0
51.8	1669	1669	0	0.0
53.0	1665	1665	0	0.0
54.2	1663	1663	0	0.0
55.4	1654	1654	0	0.0
56.6	1649	1649	0	0.0
57.8	1647	1647	0	0.0
59.0	1641	1641	0	0.0
60.2	1641	1641	0	0.0
61.4	1636	1636	0	0.0
62.7	1631	1631	0	0.0
63.9	1626	1626	0	0.0
65.1	1621	1621	0	0.0
66.3	1620	1620	0	0.0
67.5	1618	1618	0	0.0
68.7	1618	1618	0	0.0
69.9	1617	1617	0	0.0
71.1	1610	1614	4	0.2
72.3	1608	1610	2	0.1
73.5	1607	1608	1	0.1
74.7	1584	1607	23	1.5
75.9	1583	1584	1	0.1
77.1	1582	1583	1	0.1
78.3	1546	1582	36	2.3
79.5	1539	1559	20	1.3
80.7	1434	1529	95	6.6
81.9	1429	1434	5	0.3
83.1	1428	1428	0	0.0
84.3	1385	1385	0	0.0
85.5	1222	1254	32	2.6
86.7	1212	1220	8	0.7
88.0	1156	1172	16	1.4
89.2	982	974	-8	-0.8
90.4	950	958	8	0.8
91.6	925	915	-10	-1.1
92.8	880	783	-97	-11.0
94.0	795	718	-77	-9.7
95.2	718	718	0	0.0
96.4	718	718	0	0.0
97.6	250	250	0	0.0
98.8	250	250	0	0.0
Min	250	250	-3109	-14.7
Max	29318	26209	377	6.6
Mean	4386	4224	-162	-1.8
Median	1694	1694	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	59.8
1.1<=X<10.0		11.0
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		20.7
X<=-5.0		19.5
X<=-10.0		8.5
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-8.5**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		25.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		10.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-5.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	33726	29618	-4108	-12.2
2.4	15671	13791	-1880	-12.0
3.6	14198	13062	-1136	-8.0
4.8	13410	12579	-831	-6.2
6.0	13142	12282	-860	-6.5
7.2	13132	12268	-864	-6.6
8.4	12298	12113	-185	-1.5
9.6	12289	11408	-881	-7.2
10.8	11908	11162	-746	-6.3
12.0	11812	10908	-904	-7.7
13.3	11616	10360	-1256	-10.8
14.5	10171	9677	-494	-4.9
15.7	9875	9175	-700	-7.1
16.9	9786	9137	-649	-6.6
18.1	9715	9020	-695	-7.2
19.3	9392	8869	-523	-5.6
20.5	8439	8505	66	0.8
21.7	8227	7723	-504	-6.1
22.9	8159	7546	-613	-7.5
24.1	7960	7096	-864	-10.9
25.3	7677	6573	-1104	-14.4
26.5	7024	6503	-521	-7.4
27.7	6682	6034	-648	-9.7
28.9	6145	5907	-238	-3.9
30.1	6064	5876	-188	-3.1
31.3	6056	5871	-185	-3.1
32.5	5972	5421	-551	-9.2
33.7	5874	5355	-519	-8.8
34.9	5505	5080	-425	-7.7
36.1	5446	4740	-706	-13.0
37.3	5383	4640	-743	-13.8
38.6	5267	4635	-632	-12.0
39.8	4625	3962	-663	-14.3
41.0	4511	3765	-746	-16.5
42.2	4328	3607	-721	-16.7
43.4	4205	3338	-867	-20.6
44.6	4093	3243	-850	-20.8
45.8	3962	3215	-747	-18.9
47.0	3776	3185	-591	-15.7
48.2	3602	3169	-433	-12.0
49.4	3244	3014	-230	-7.1
50.6	3112	2828	-284	-9.1
51.8	3094	2718	-376	-12.2
53.0	3014	2536	-478	-15.9
54.2	2965	2192	-773	-26.1
55.4	2828	2146	-682	-24.1
56.6	2717	2015	-702	-25.8
57.8	2333	1854	-479	-20.5
59.0	2248	1821	-427	-19.0
60.2	2231	1694	-537	-24.1
61.4	2033	1665	-368	-18.1
62.7	1989	1656	-333	-16.7
63.9	1854	1653	-201	-10.8
65.1	1821	1633	-188	-10.3
66.3	1656	1613	-43	-2.6
67.5	1653	1608	-45	-2.7
68.7	1633	1605	-28	-1.7
69.9	1625	1568	-57	-3.5
71.1	1613	1452	-161	-10.0
72.3	1452	1404	-48	-3.3
73.5	1404	1400	-4	-0.3
74.7	1400	1388	-12	-0.9
75.9	1388	1377	-11	-0.8
77.1	1377	1375	-2	-0.1
78.3	1375	1345	-30	-2.2
79.5	1356	1337	-19	-1.4
80.7	1345	1334	-11	-0.8
81.9	1334	1331	-3	-0.2
83.1	1331	1329	-2	-0.2
84.3	1329	1287	-42	-3.2
85.5	1318	1198	-120	-9.1
86.7	1280	1198	-82	-6.4
88.0	1198	1181	-17	-1.4
89.2	1198	1162	-36	-3.0
90.4	1177	1155	-22	-1.9
91.6	1162	1057	-105	-9.0
92.8	1021	973	-48	-4.7
94.0	960	826	-134	-14.0
95.2	826	697	-129	-15.6
96.4	250	250	0	0.0
97.6	250	250	0	0.0
98.8	250	250	0	0.0
Min	250	250	-4108	-26.1
Max	33726	29618	66	0.8
Mean	5131	4668	-463	-8.8
Median	3178	2921	-426	-7.5

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	13.4
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		48.8
X<=-5.0		65.9
X<=-10.0		37.8
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-37.8**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	40.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		50.0
X<=-5.0		25.0
X<=-10.0		10.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-10.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	17806	18115	309	1.7
2.4	16477	16550	73	0.4
3.6	12686	13808	1122	8.8
4.8	11988	13095	1107	9.2
6.0	11010	12151	1141	10.4
7.2	10931	10964	33	0.3
8.4	10674	10710	36	0.3
9.6	9285	10550	1265	13.6
10.8	8410	9993	1583	18.8
12.0	7248	7788	540	7.5
13.3	6699	7561	862	12.9
14.5	6137	7502	1365	22.2
15.7	6126	6910	784	12.8
16.9	6065	6693	628	10.4
18.1	5951	6495	544	9.1
19.3	5743	6280	537	9.4
20.5	5676	6148	472	8.3
21.7	4720	5842	1122	23.8
22.9	4567	5706	1139	24.9
24.1	4417	5022	605	13.7
25.3	4349	5008	659	15.2
26.5	4337	4843	506	11.7
27.7	4286	4811	525	12.2
28.9	4001	4681	680	17.0
30.1	3939	4358	419	10.6
31.3	3933	4232	299	7.6
32.5	3812	4147	335	8.8
33.7	3743	4131	388	10.4
34.9	3706	3858	152	4.1
36.1	3553	3727	174	4.9
37.3	3509	3690	181	5.2
38.6	3330	3678	348	10.5
39.8	3308	3591	283	8.6
41.0	3274	3584	310	9.5
42.2	3208	3508	300	9.4
43.4	3063	3491	428	14.0
44.6	3017	3217	200	6.6
45.8	3009	3114	105	3.5
47.0	2941	3114	173	5.9
48.2	2400	2970	570	23.8
49.4	2328	2813	485	20.8
50.6	2282	2750	468	20.5
51.8	2218	2551	333	15.0
53.0	2164	2449	285	13.2
54.2	2153	2433	280	13.0
55.4	2040	2430	390	19.1
56.6	1992	2160	168	8.4
57.8	1964	2094	130	6.6
59.0	1821	1821	0	0.0
60.2	1700	1813	113	6.6
61.4	1696	1712	16	0.9
62.7	1663	1700	37	2.2
63.9	1646	1689	43	2.6
65.1	1639	1658	19	1.2
66.3	1628	1643	15	0.9
67.5	1617	1628	11	0.7
68.7	1613	1615	2	0.1
69.9	1604	1613	9	0.6
71.1	1602	1610	8	0.5
72.3	1570	1423	-147	-9.4
73.5	1569	1371	-198	-12.6
74.7	1423	1339	-84	-5.9
75.9	1371	1308	-63	-4.6
77.1	1339	1297	-42	-3.1
78.3	1182	1182	0	0.0
79.5	1079	1079	0	0.0
80.7	1028	1000	-28	-2.7
81.9	1000	984	-16	-1.6
83.1	907	907	0	0.0
84.3	884	883	-1	-0.1
85.5	830	813	-17	-2.0
86.7	813	758	-55	-6.8
88.0	789	752	-37	-4.7
89.2	758	748	-10	-1.3
90.4	752	743	-9	-1.2
91.6	748	729	-19	-2.5
92.8	743	717	-26	-3.5
94.0	729	707	-22	-3.0
95.2	717	669	-48	-6.7
96.4	708	666	-42	-5.9
97.6	669	662	-7	-1.0
98.8	250	250	0	0.0
Min	250	250	-198	-12.6
Max	17806	18115	1583	24.9
Mean	3665	3961	296	5.8
Median	2305	2782	171	5.6

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	19.5
1.1<=X<10.0		29.3
X>=5.0		51.2
X>=10.0		30.5
-10.0<X<=-1.1		19.5
X<=-5.0		7.3
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**29.3**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	30.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		70.0
X<=-5.0		15.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	14168	15106	938	6.6
2.4	10312	9612	-700	-6.8
3.6	8479	8889	410	4.8
4.8	7895	8844	949	12.0
6.0	7730	8178	448	5.8
7.2	7667	7610	-57	-0.7
8.4	6569	7442	873	13.3
9.6	6484	6986	502	7.7
10.8	6419	6957	538	8.4
12.0	6210	6947	737	11.9
13.3	6062	6947	885	14.6
14.5	5908	6523	615	10.4
15.7	5797	6488	691	11.9
16.9	5738	5891	153	2.7
18.1	5318	5795	477	9.0
19.3	4912	5755	843	17.2
20.5	4885	5200	315	6.4
21.7	4808	5190	382	7.9
22.9	4553	5143	590	13.0
24.1	4551	4733	182	4.0
25.3	4529	4658	129	2.8
26.5	4311	4575	264	6.1
27.7	4236	4468	232	5.5
28.9	4151	4269	118	2.8
30.1	4093	4225	132	3.2
31.3	3825	4205	380	9.9
32.5	3759	4189	430	11.4
33.7	3685	4065	380	10.3
34.9	3586	4023	437	12.2
36.1	3490	4019	529	15.2
37.3	3336	3996	660	19.8
38.6	3319	3904	585	17.6
39.8	3079	3740	661	21.5
41.0	2753	3698	945	34.3
42.2	2711	3536	825	30.4
43.4	2703	3435	732	27.1
44.6	2669	3230	561	21.0
45.8	2662	3117	455	17.1
47.0	2446	3078	632	25.8
48.2	2429	3043	614	25.3
49.4	2402	2948	546	22.7
50.6	2289	2877	588	25.7
51.8	2260	2823	563	24.9
53.0	2233	2788	555	24.9
54.2	2201	2766	565	25.7
55.4	2053	2652	599	29.2
56.6	2046	2115	69	3.4
57.8	2022	1964	-58	-2.9
59.0	1942	1942	0	0.0
60.2	1792	1821	29	1.6
61.4	1753	1778	25	1.4
62.7	1723	1724	1	0.1
63.9	1589	1589	0	0.0
65.1	1573	1578	5	0.3
66.3	1565	1566	1	0.1
67.5	1559	1560	1	0.1
68.7	1554	1554	0	0.0
69.9	1551	1545	-6	-0.4
71.1	1551	1533	-18	-1.2
72.3	1548	1520	-28	-1.8
73.5	1545	1466	-79	-5.1
74.7	1538	1290	-248	-16.1
75.9	1283	1275	-8	-0.6
77.1	1275	1241	-34	-2.7
78.3	1241	1225	-16	-1.3
79.5	1217	1160	-57	-4.7
80.7	1151	1079	-72	-6.3
81.9	1079	1020	-59	-5.5
83.1	1020	977	-43	-4.2
84.3	977	922	-55	-5.6
85.5	922	849	-73	-7.9
86.7	782	783	1	0.1
88.0	781	781	0	0.0
89.2	760	760	0	0.0
90.4	658	660	2	0.3
91.6	646	646	0	0.0
92.8	627	627	0	0.0
94.0	616	616	0	0.0
95.2	606	606	0	0.0
96.4	605	605	0	0.0
97.6	250	250	0	0.0
98.8	250	250	0	0.0
Min	250	250	-700	-16.1
Max	14168	15106	949	34.3
Mean	3162	3432	270	7.0
Median	2346	2913	143	3.3

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	25.6
1.1<=X<10.0		23.2
X>=5.0		46.3
X>=10.0		34.1
-10.0<X<=-1.1		15.9
X<=-5.0		8.5
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**32.9**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		40.0
X<=-5.0		20.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	11257	11301	44	0.4
2.4	11067	11112	45	0.4
3.6	10169	10217	48	0.5
4.8	9687	9742	55	0.6
6.0	9269	9324	55	0.6
7.2	9153	9198	45	0.5
8.4	8956	8996	40	0.4
9.6	8868	8913	45	0.5
10.8	8104	8154	50	0.6
12.0	8017	8057	40	0.5
13.3	6812	6849	37	0.5
14.5	6650	6683	33	0.5
15.7	6419	6464	45	0.7
16.9	6143	6197	54	0.9
18.1	5096	5141	45	0.9
19.3	4898	4889	-9	-0.2
20.5	4844	4819	-25	-0.5
21.7	4774	4732	-42	-0.9
22.9	4685	4652	-33	-0.7
24.1	4534	4573	39	0.9
25.3	4411	4455	44	1.0
26.5	4268	4317	49	1.1
27.7	4255	4298	43	1.0
28.9	4027	4072	45	1.1
30.1	4024	4072	48	1.2
31.3	3850	3890	40	1.0
32.5	3748	3796	48	1.3
33.7	3737	3782	45	1.2
34.9	3600	3648	48	1.3
36.1	3540	3584	44	1.2
37.3	3451	3476	25	0.7
38.6	3378	3469	91	2.7
39.8	3368	3427	59	1.8
41.0	3363	3413	50	1.5
42.2	3326	3409	83	2.5
43.4	3287	3396	109	3.3
44.6	3219	3320	101	3.1
45.8	3166	3268	102	3.2
47.0	2881	3044	163	5.7
48.2	2876	2961	85	3.0
49.4	2724	2928	204	7.5
50.6	2590	2803	213	8.2
51.8	2491	2761	270	10.8
53.0	2284	2685	401	17.6
54.2	2186	2635	449	20.5
55.4	2140	2529	389	18.2
56.6	2130	2330	200	9.4
57.8	1989	2320	331	16.6
59.0	1564	2254	690	44.1
60.2	1553	2231	678	43.7
61.4	1553	2139	586	37.7
62.7	1551	2032	481	31.0
63.9	1551	1784	233	15.0
65.1	1550	1562	12	0.8
66.3	1549	1553	4	0.3
67.5	1544	1553	9	0.6
68.7	1534	1551	17	1.1
69.9	1525	1549	24	1.6
71.1	1519	1544	25	1.6
72.3	1491	1537	46	3.1
73.5	1464	1486	22	1.5
74.7	1339	1352	13	1.0
75.9	1309	1334	25	1.9
77.1	1282	1309	27	2.1
78.3	1260	1287	27	2.1
79.5	1254	1260	6	0.5
80.7	1227	1254	27	2.2
81.9	1157	1227	70	6.1
83.1	1032	1157	125	12.1
84.3	983	1032	49	5.0
85.5	980	987	7	0.7
86.7	953	980	27	2.8
88.0	840	844	4	0.5
89.2	764	764	0	0.0
90.4	739	739	0	0.0
91.6	627	661	34	5.4
92.8	621	627	6	1.0
94.0	609	609	0	0.0
95.2	606	606	0	0.0
96.4	604	604	0	0.0
97.6	250	250	0	0.0
98.8	250	250	0	0.0
Min	250	250	-42	-0.9
Max	11257	11301	690	44.1
Mean	3394	3488	93	4.6
Median	2657	2866	45	1.1

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	47.6
1.1<=X<10.0		39.0
X>=5.0		22.0
X>=10.0		13.4
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**13.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		40.0
X>=5.0		20.0
X>=10.0		5.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**5.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	14076	14076	0	0.0
2.4	10859	10859	0	0.0
3.6	10190	10190	0	0.0
4.8	10143	10142	-1	0.0
6.0	10058	10057	-1	0.0
7.2	9020	9020	0	0.0
8.4	8522	8522	0	0.0
9.6	7395	7395	0	0.0
10.8	6962	6961	-1	0.0
12.0	6302	6302	0	0.0
13.3	6036	6035	-1	0.0
14.5	6005	6007	2	0.0
15.7	5760	5760	0	0.0
16.9	5563	5563	0	0.0
18.1	5074	5073	-1	0.0
19.3	5054	5053	-1	0.0
20.5	4791	4791	0	0.0
21.7	4726	4726	0	0.0
22.9	4637	4636	-1	0.0
24.1	4579	4579	0	0.0
25.3	4539	4538	-1	0.0
26.5	4084	4147	63	1.5
27.7	4050	4050	0	0.0
28.9	3947	3946	-1	0.0
30.1	3910	3910	0	0.0
31.3	3885	3883	-2	-0.1
32.5	3745	3867	122	3.3
33.7	3358	3744	386	11.5
34.9	3253	3358	105	3.2
36.1	3000	3223	223	7.4
37.3	2975	3000	25	0.8
38.6	2955	2974	19	0.6
39.8	2950	2974	24	0.8
41.0	2918	2954	36	1.2
42.2	2900	2949	49	1.7
43.4	2890	2889	-1	0.0
44.6	2815	2815	0	0.0
45.8	2754	2804	50	1.8
47.0	2727	2754	27	1.0
48.2	2726	2730	4	0.1
49.4	2659	2659	0	0.0
50.6	2605	2608	3	0.1
51.8	2593	2603	10	0.4
53.0	2572	2593	21	0.8
54.2	2524	2523	-1	0.0
55.4	2424	2421	-3	-0.1
56.6	2411	2411	0	0.0
57.8	2405	2409	4	0.2
59.0	2214	2336	122	5.5
60.2	1983	2179	196	9.9
61.4	1953	1952	-1	-0.1
62.7	1947	1948	1	0.1
63.9	1883	1886	3	0.2
65.1	1802	1834	32	1.8
66.3	1723	1723	0	0.0
67.5	1721	1713	-8	-0.5
68.7	1708	1649	-59	-3.5
69.9	1696	1638	-58	-3.4
71.1	1649	1618	-31	-1.9
72.3	1638	1592	-46	-2.8
73.5	1593	1521	-72	-4.5
74.7	1520	1517	-3	-0.2
75.9	1517	1516	-1	-0.1
77.1	1516	1502	-14	-0.9
78.3	1506	1499	-7	-0.5
79.5	1503	1497	-6	-0.4
80.7	1502	1495	-7	-0.5
81.9	1495	1491	-4	-0.3
83.1	1487	1486	-1	-0.1
84.3	1444	1486	42	2.9
85.5	1320	1369	49	3.7
86.7	1290	1321	31	2.4
88.0	1218	1313	95	7.8
89.2	1184	1184	0	0.0
90.4	1139	1139	0	0.0
91.6	1035	1047	12	1.2
92.8	954	1037	83	8.7
94.0	719	719	0	0.0
95.2	636	636	0	0.0
96.4	597	597	0	0.0
97.6	576	576	0	0.0
98.8	250	250	0	0.0
Min	250	250	-72	-4.5
Max	14076	14076	386	11.5
Mean	3418	3436	18	0.7
Median	2632	2634	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	73.2
1.1<=X<10.0		19.5
X>=5.0		7.3
X>=10.0		1.2
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		30.0
X>=5.0		10.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	5566	5566	0	0.0
2.4	5038	5165	127	2.5
3.6	4760	4760	0	0.0
4.8	4759	4759	0	0.0
6.0	4756	4756	0	0.0
7.2	4755	4755	0	0.0
8.4	4754	4754	0	0.0
9.6	4753	4753	0	0.0
10.8	4752	4752	0	0.0
12.0	4751	4751	0	0.0
13.3	4751	4751	0	0.0
14.5	4750	4751	1	0.0
15.7	4749	4750	1	0.0
16.9	4747	4747	0	0.0
18.1	4747	4747	0	0.0
19.3	4745	4745	0	0.0
20.5	4743	4743	0	0.0
21.7	4742	4740	-2	0.0
22.9	4742	4740	-2	0.0
24.1	4738	4738	0	0.0
25.3	4737	4737	0	0.0
26.5	4736	4735	-1	0.0
27.7	4728	4728	0	0.0
28.9	4727	4727	0	0.0
30.1	4724	4724	0	0.0
31.3	4713	4722	9	0.2
32.5	4708	4713	5	0.1
33.7	4545	4545	0	0.0
34.9	4480	4479	-1	0.0
36.1	4457	4456	-1	0.0
37.3	4426	4424	-2	0.0
38.6	4399	4400	1	0.0
39.8	4284	4355	71	1.7
41.0	4022	4283	261	6.5
42.2	3881	4100	219	5.6
43.4	3858	4022	164	4.3
44.6	3834	3878	44	1.1
45.8	3813	3861	48	1.3
47.0	3806	3838	32	0.8
48.2	3713	3813	100	2.7
49.4	3643	3806	163	4.5
50.6	3593	3680	87	2.4
51.8	3535	3643	108	3.1
53.0	3527	3585	58	1.6
54.2	3481	3541	60	1.7
55.4	3167	3535	368	11.6
56.6	3157	3482	325	10.3
57.8	3152	3400	248	7.9
59.0	3111	3166	55	1.8
60.2	3065	3160	95	3.1
61.4	3060	3084	24	0.8
62.7	3051	3060	9	0.3
63.9	3021	3051	30	1.0
65.1	3004	3034	30	1.0
66.3	2962	2964	2	0.1
67.5	2948	2948	0	0.0
68.7	2831	2939	108	3.8
69.9	2815	2917	102	3.6
71.1	2808	2854	46	1.6
72.3	2777	2811	34	1.2
73.5	2699	2808	109	4.0
74.7	2688	2777	89	3.3
75.9	2686	2765	79	2.9
77.1	2588	2699	111	4.3
78.3	2547	2688	141	5.5
79.5	2481	2547	66	2.7
80.7	2415	2481	66	2.7
81.9	2407	2438	31	1.3
83.1	2404	2414	10	0.4
84.3	2255	2407	152	6.7
85.5	2149	2333	184	8.6
86.7	2081	2148	67	3.2
88.0	1892	2001	109	5.8
89.2	1833	1933	100	5.5
90.4	1807	1818	11	0.6
91.6	1784	1784	0	0.0
92.8	1657	1680	23	1.4
94.0	1426	1641	215	15.1
95.2	1277	1420	143	11.2
96.4	807	1259	452	56.0
97.6	547	871	324	59.2
98.8	250	250	0	0.0
Min	250	250	-2	0.0
Max	5566	5566	452	59.2
Mean	3513	3580	67	3.5
Median	3618	3743	30	1.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	51.2
1.1<=X<10.0		41.5
X>=5.0		17.1
X>=10.0		7.3
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**7.3**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	20.0
1.1<=X<10.0		60.0
X>=5.0		45.0
X>=10.0		20.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**20.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	4682	4682	0	0.0
2.4	4458	4458	0	0.0
3.6	4252	4252	0	0.0
4.8	4195	4138	-57	-1.4
6.0	4138	4095	-43	-1.0
7.2	4095	4060	-35	-0.9
8.4	4060	4031	-29	-0.7
9.6	4031	4029	-2	0.0
10.8	4029	4024	-5	-0.1
12.0	4024	3996	-28	-0.7
13.3	3996	3993	-3	-0.1
14.5	3993	3988	-5	-0.1
15.7	3988	3980	-8	-0.2
16.9	3980	3905	-75	-1.9
18.1	3905	3845	-60	-1.5
19.3	3845	3669	-176	-4.6
20.5	3669	3516	-153	-4.2
21.7	3572	3388	-184	-5.2
22.9	3516	3292	-224	-6.4
24.1	3107	3084	-23	-0.7
25.3	3021	3029	8	0.3
26.5	2912	2898	-14	-0.5
27.7	2687	2849	162	6.0
28.9	2627	2748	121	4.6
30.1	2493	2684	191	7.7
31.3	2466	2619	153	6.2
32.5	2443	2509	66	2.7
33.7	2427	2467	40	1.6
34.9	2411	2456	45	1.9
36.1	2392	2447	55	2.3
37.3	2359	2427	68	2.9
38.6	2301	2416	115	5.0
39.8	2245	2412	167	7.4
41.0	2208	2361	153	6.9
42.2	2205	2301	96	4.4
43.4	2185	2221	36	1.6
44.6	2164	2214	50	2.3
45.8	2148	2189	41	1.9
47.0	2076	2148	72	3.5
48.2	2004	2141	137	6.8
49.4	1948	2073	125	6.4
50.6	1928	2032	104	5.4
51.8	1876	1950	74	3.9
53.0	1849	1948	99	5.4
54.2	1762	1929	167	9.5
55.4	1699	1865	166	9.8
56.6	1657	1848	191	11.5
57.8	1655	1833	178	10.8
59.0	1645	1689	44	2.7
60.2	1593	1644	51	3.2
61.4	1553	1599	46	3.0
62.7	1514	1590	76	5.0
63.9	1513	1521	8	0.5
65.1	1508	1514	6	0.4
66.3	1504	1508	4	0.3
67.5	1500	1503	3	0.2
68.7	1500	1500	0	0.0
69.9	1499	1500	1	0.1
71.1	1497	1499	2	0.1
72.3	1497	1497	0	0.0
73.5	1495	1495	0	0.0
74.7	1494	1494	0	0.0
75.9	1494	1494	0	0.0
77.1	1491	1491	0	0.0
78.3	1486	1486	0	0.0
79.5	1484	1484	0	0.0
80.7	1393	1393	0	0.0
81.9	1312	1315	3	0.2
83.1	1275	1240	-35	-2.7
84.3	1221	1231	10	0.8
85.5	1214	1208	-6	-0.5
86.7	1177	1177	0	0.0
88.0	1118	1113	-5	-0.4
89.2	926	926	0	0.0
90.4	721	722	1	0.1
91.6	596	596	0	0.0
92.8	593	582	-11	-1.9
94.0	583	581	-2	-0.3
95.2	572	572	0	0.0
96.4	570	570	0	0.0
97.6	570	569	-1	-0.2
98.8	569	568	-1	-0.2
Min	569	568	-224	-6.4
Max	4682	4682	191	11.5
Mean	2236	2260	24	1.5
Median	1938	2053	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	52.4
1.1<=X<10.0		34.1
X>=5.0		18.3
X>=10.0		2.4
-10.0<X<=-1.1		11.0
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Lower American River Flow at Watt Avenue - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	4846	4846	0	0.0
2.4	4821	4821	0	0.0
3.6	4815	4817	2	0.0
4.8	4813	4815	2	0.0
6.0	4803	4811	8	0.2
7.2	4796	4803	7	0.1
8.4	4796	4796	0	0.0
9.6	4794	4796	2	0.0
10.8	4788	4794	6	0.1
12.0	4786	4788	2	0.0
13.3	4653	4786	133	2.9
14.5	4646	4653	7	0.2
15.7	4546	4646	100	2.2
16.9	4484	4582	98	2.2
18.1	4381	4546	165	3.8
19.3	4312	4312	0	0.0
20.5	4136	4150	14	0.3
21.7	4081	4081	0	0.0
22.9	4058	4058	0	0.0
24.1	3999	3999	0	0.0
25.3	3697	3696	-1	0.0
26.5	3472	3445	-27	-0.8
27.7	3360	3361	1	0.0
28.9	3114	3113	-1	0.0
30.1	3066	3066	0	0.0
31.3	2990	2968	-22	-0.7
32.5	2910	2916	6	0.2
33.7	2893	2892	-1	0.0
34.9	2681	2681	0	0.0
36.1	2627	2629	2	0.1
37.3	2528	2603	75	3.0
38.6	2464	2564	100	4.1
39.8	2428	2546	118	4.9
41.0	2422	2528	106	4.4
42.2	2404	2464	60	2.5
43.4	2350	2422	72	3.1
44.6	2266	2407	141	6.2
45.8	2256	2350	94	4.2
47.0	2177	2324	147	6.8
48.2	2163	2164	1	0.0
49.4	2132	2162	30	1.4
50.6	2088	2153	65	3.1
51.8	2056	2088	32	1.6
53.0	2026	2086	60	3.0
54.2	2011	2056	45	2.2
55.4	1929	2011	82	4.3
56.6	1862	1862	0	0.0
57.8	1848	1848	0	0.0
59.0	1754	1749	-5	-0.3
60.2	1700	1700	0	0.0
61.4	1637	1652	15	0.9
62.7	1591	1629	38	2.4
63.9	1492	1591	99	6.6
65.1	1423	1472	49	3.4
66.3	1387	1415	28	2.0
67.5	1370	1388	18	1.3
68.7	1355	1371	16	1.2
69.9	1354	1365	11	0.8
71.1	1350	1355	5	0.4
72.3	1350	1350	0	0.0
73.5	1345	1350	5	0.4
74.7	1345	1343	-2	-0.1
75.9	1335	1335	0	0.0
77.1	1331	1334	3	0.2
78.3	1243	1273	30	2.4
79.5	1031	1243	212	20.6
80.7	929	1050	121	13.0
81.9	863	1031	168	19.5
83.1	841	868	27	3.2
84.3	821	841	20	2.4
85.5	790	830	40	5.1
86.7	717	821	104	14.5
88.0	641	790	149	23.2
89.2	637	641	4	0.6
90.4	634	637	3	0.5
91.6	630	634	4	0.6
92.8	629	630	1	0.2
94.0	629	629	0	0.0
95.2	628	628	0	0.0
96.4	628	628	0	0.0
97.6	375	375	0	0.0
98.8	375	375	0	0.0
Min	375	375	-27	-0.8
Max	4846	4846	212	23.2
Mean	2411	2447	35	2.3
Median	2110	2158	6	0.4

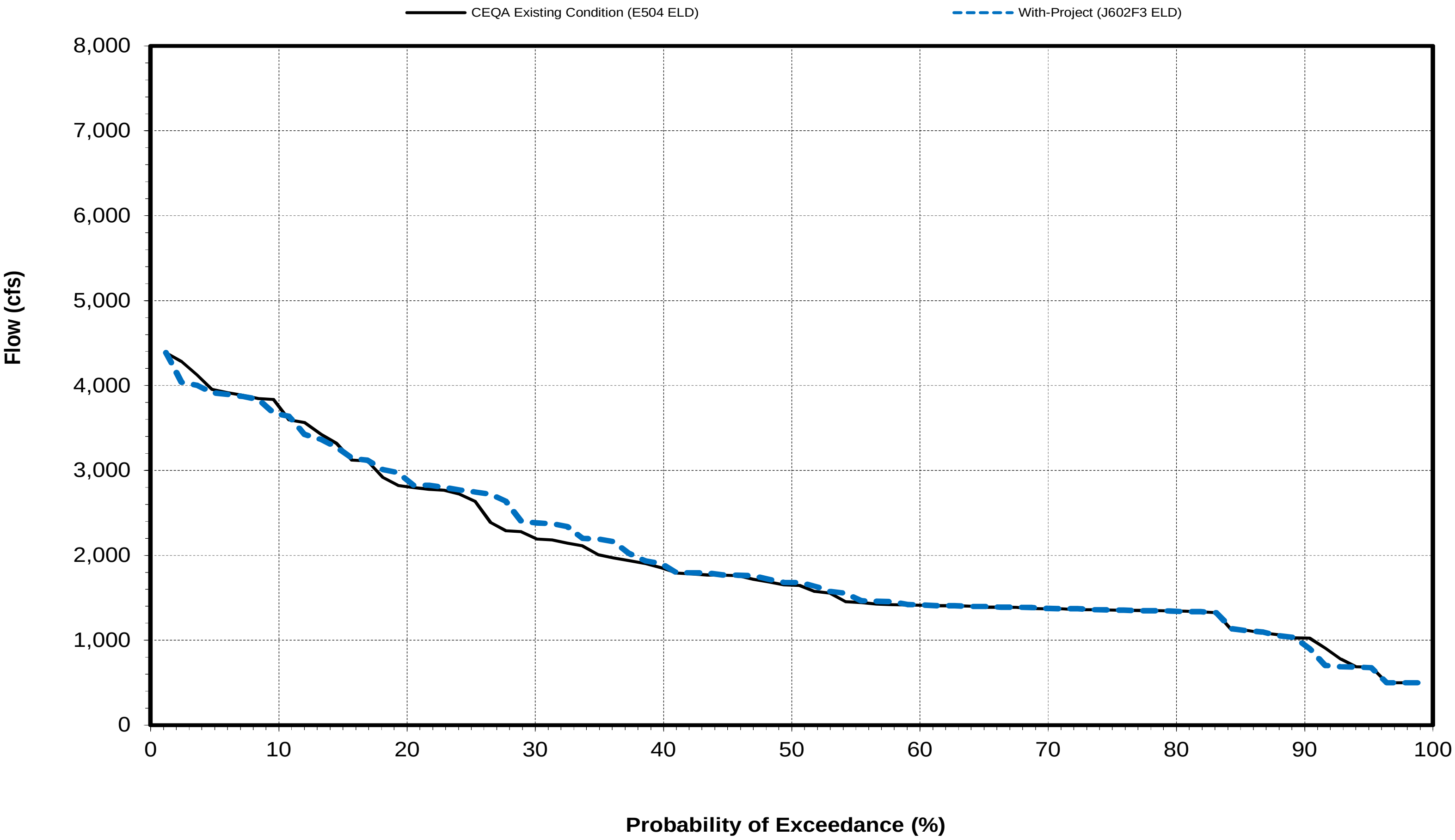
Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	58.5
1.1<=X<10.0		35.4
X>=5.0		11.0
X>=10.0		6.1
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**6.1**

Low Flow Conditions (Upper 25% of Distribution)

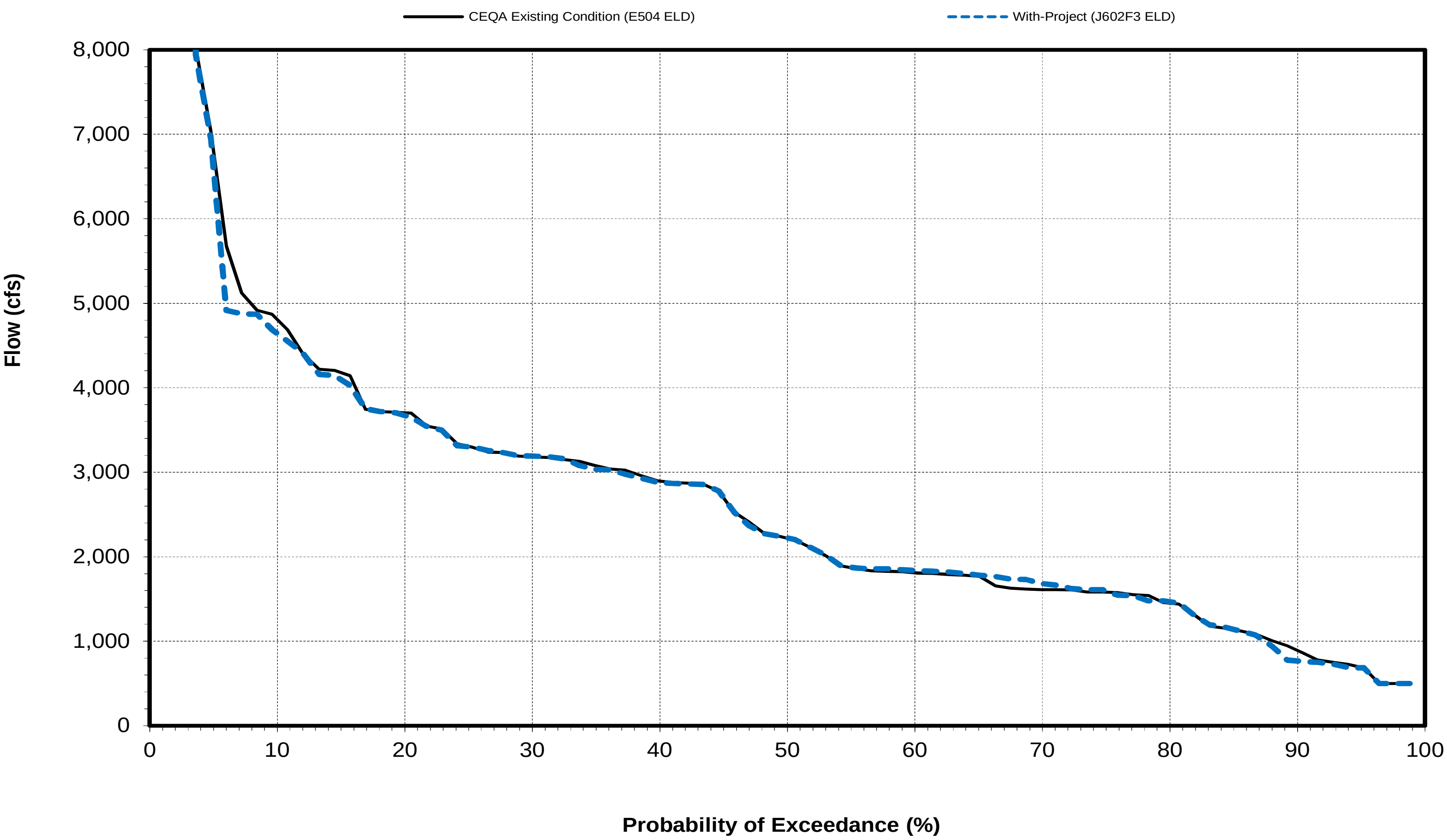
(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		20.0
X>=5.0		30.0
X>=10.0		25.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**25.0**

Lower American River Flow at Watt Avenue **October**



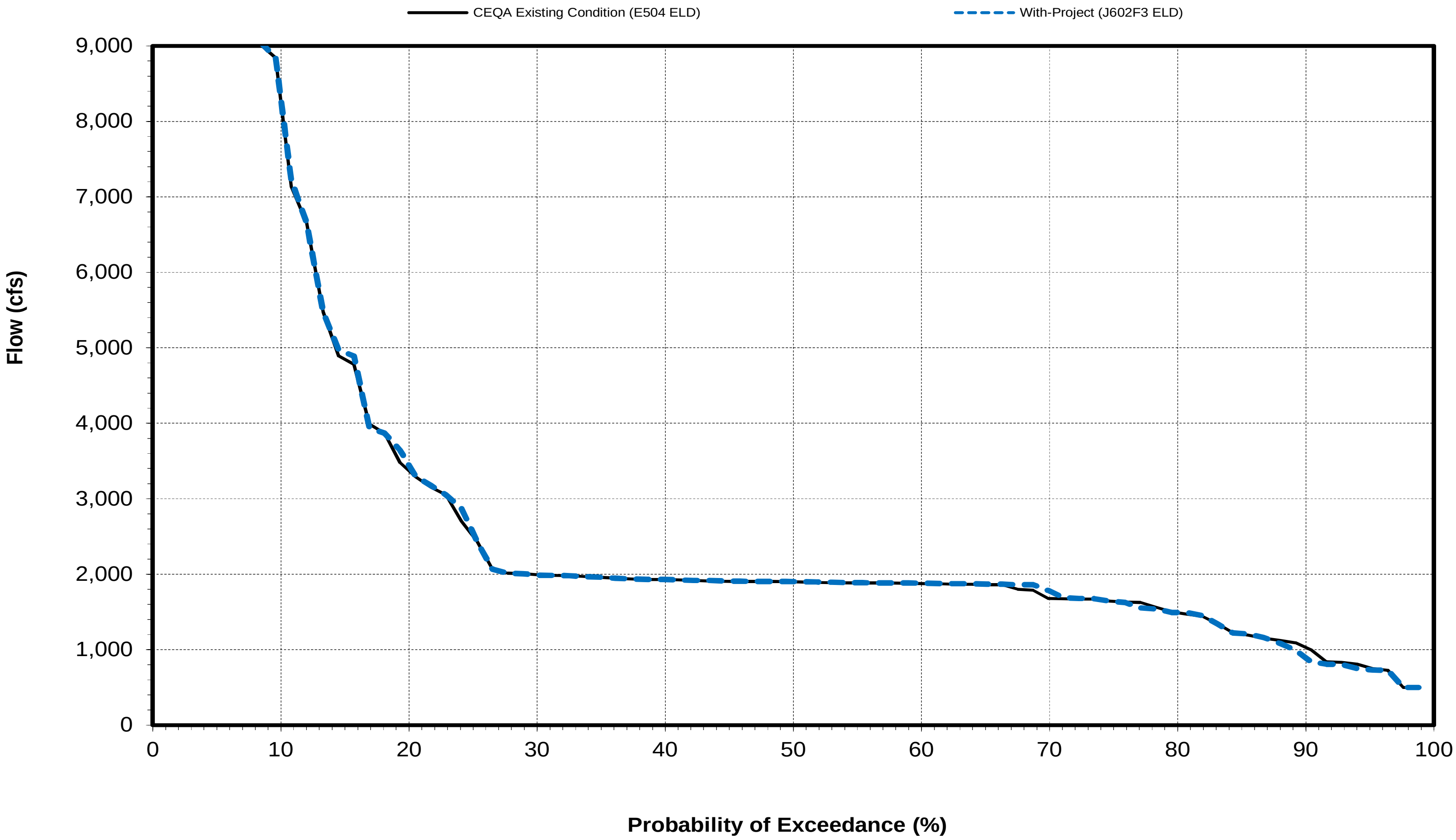
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Lower American River Flow at Watt Avenue **November**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

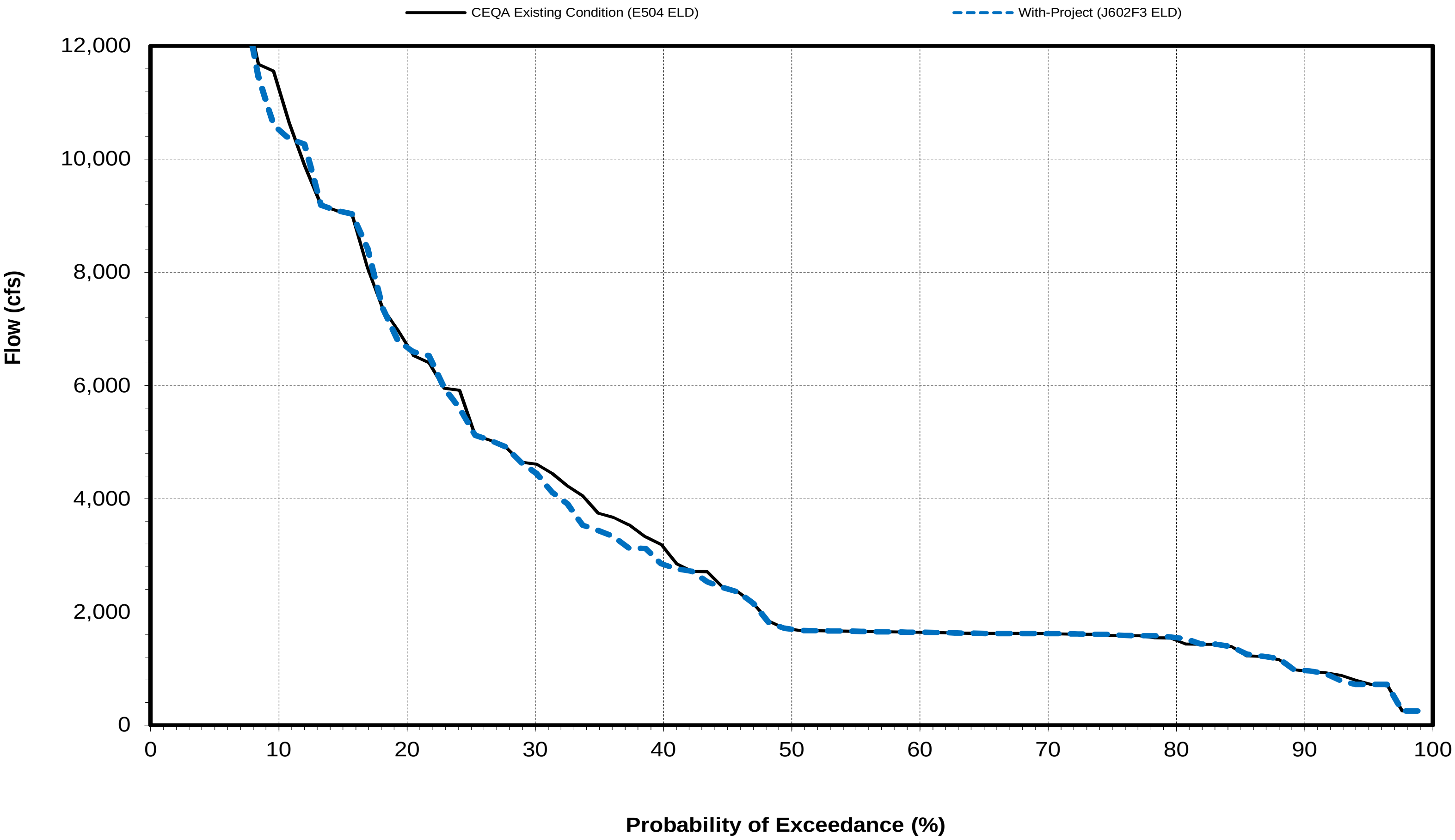
Lower American River Flow at Watt Avenue **December**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Lower American River Flow at Watt Avenue **January**

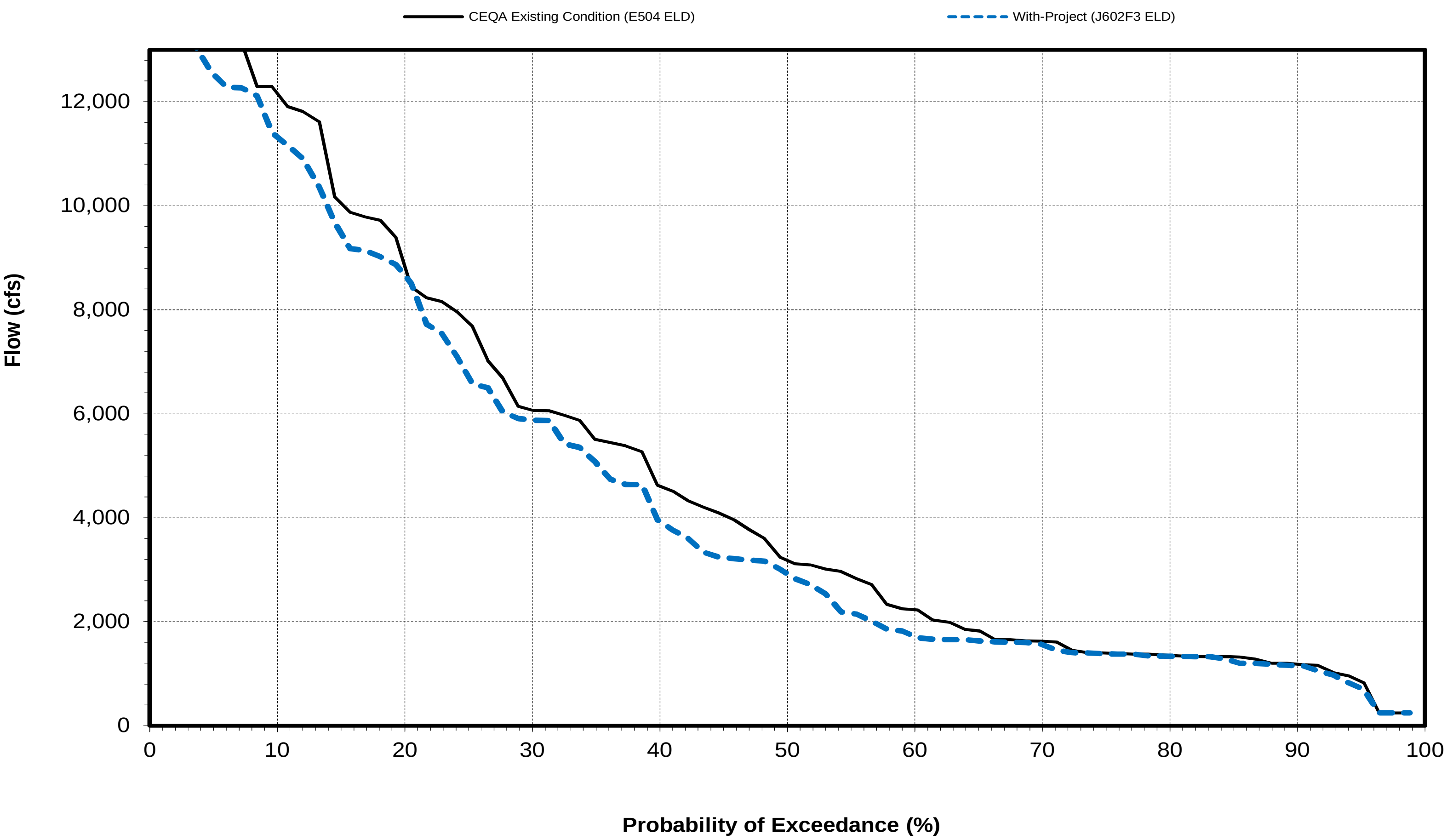


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Lower American River Flow at Watt Avenue

February

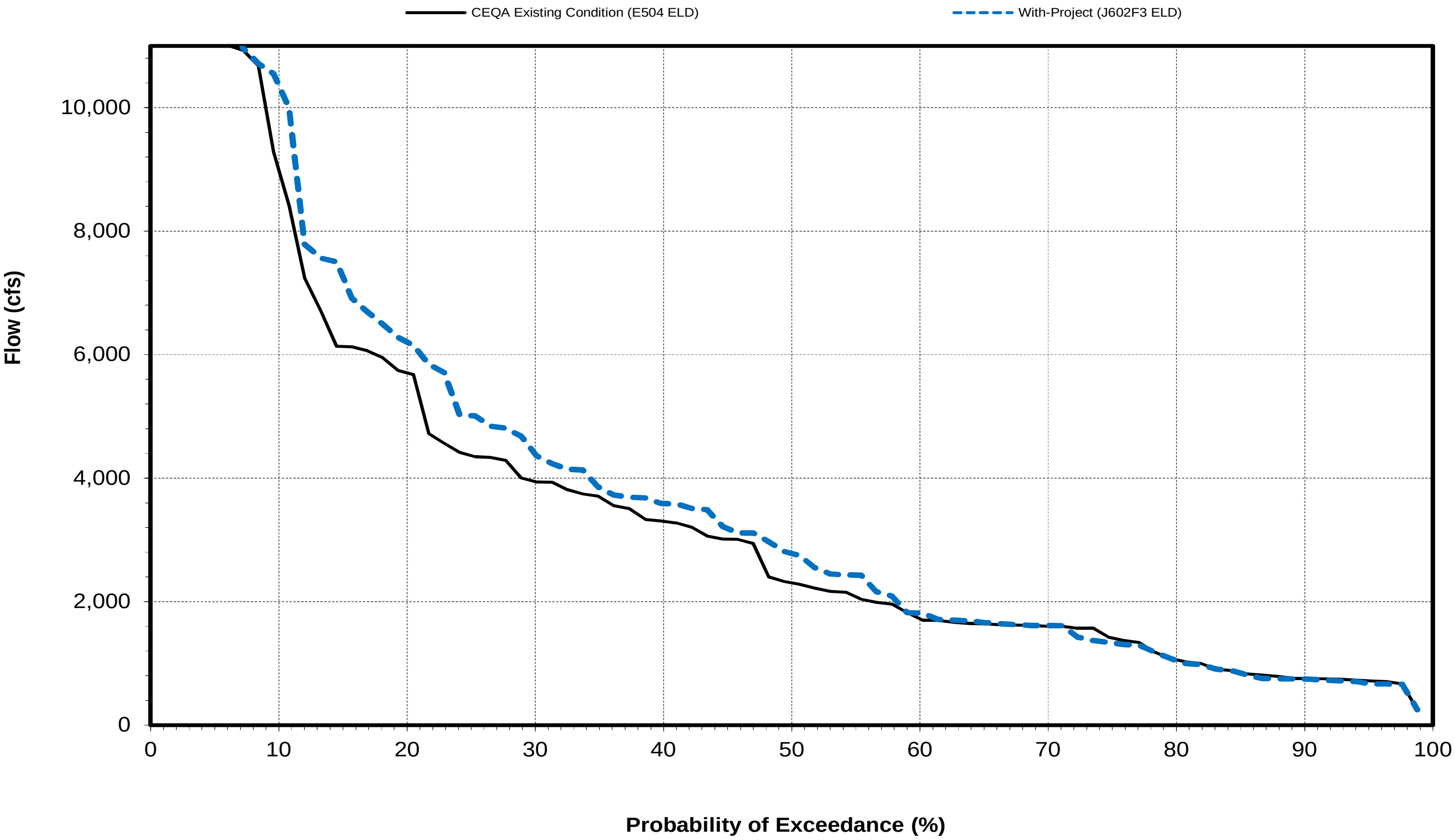


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Lower American River Flow at Watt Avenue

March

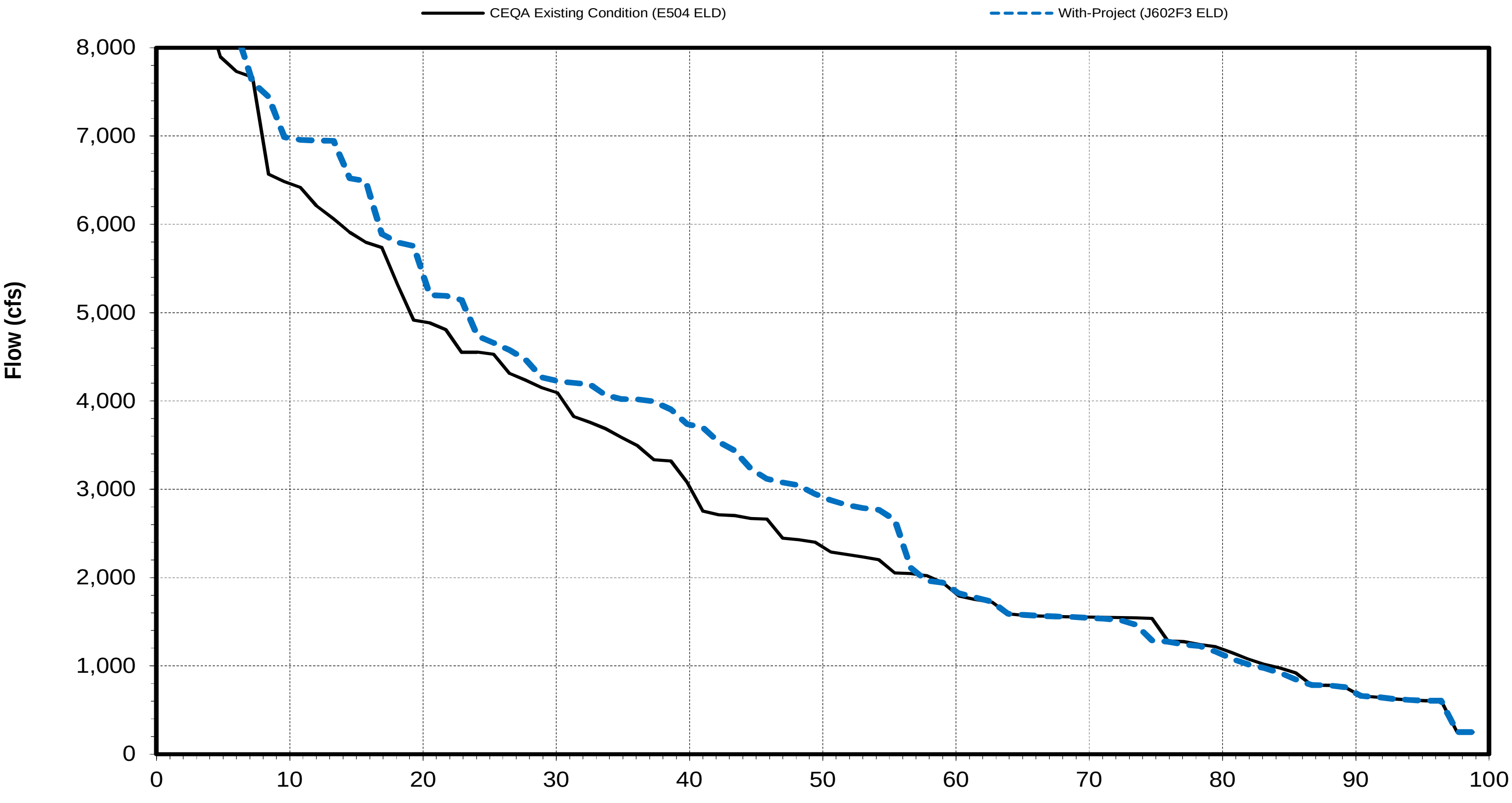


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Lower American River Flow at Watt Avenue

April

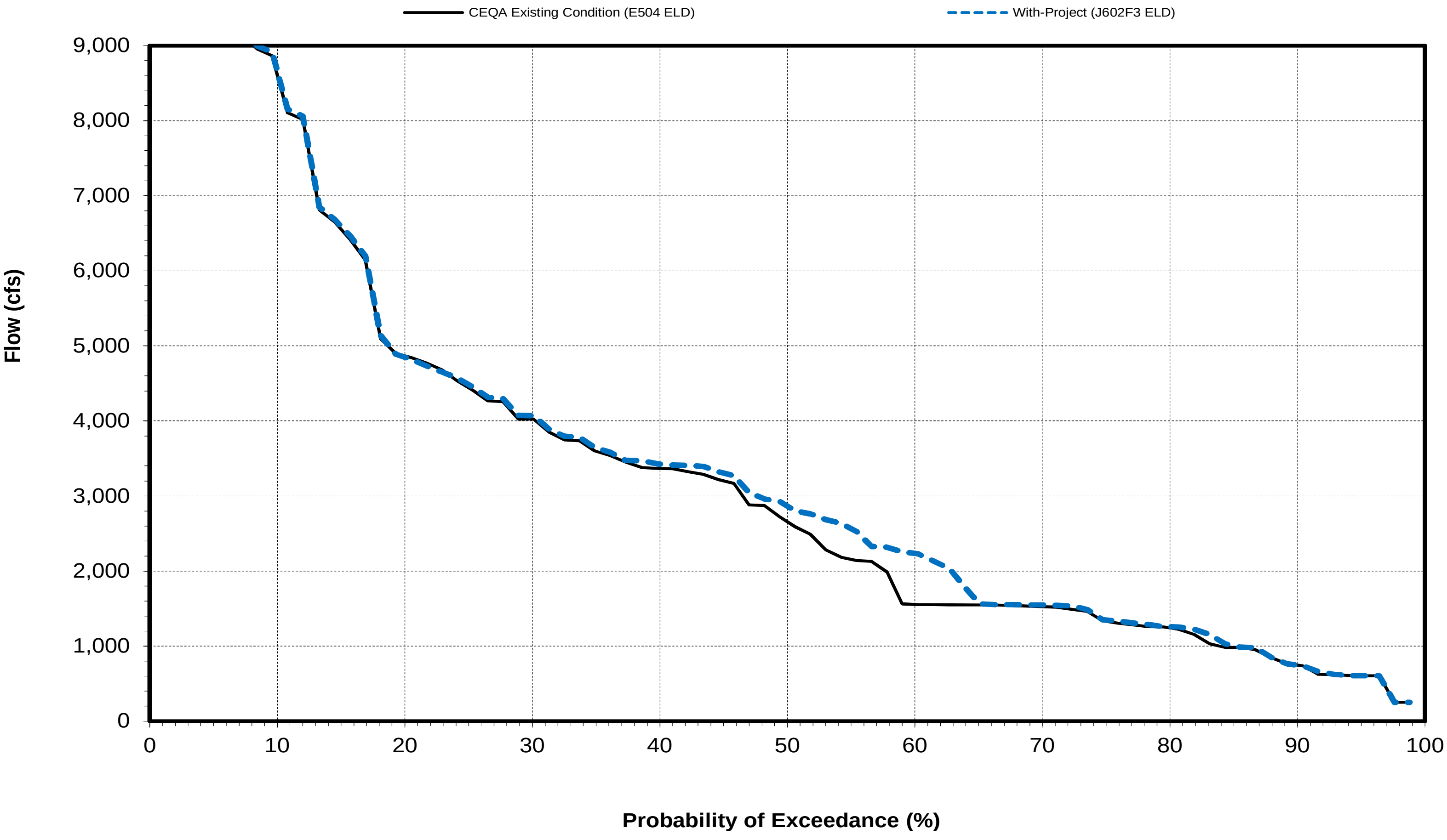


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Lower American River Flow at Watt Avenue

May

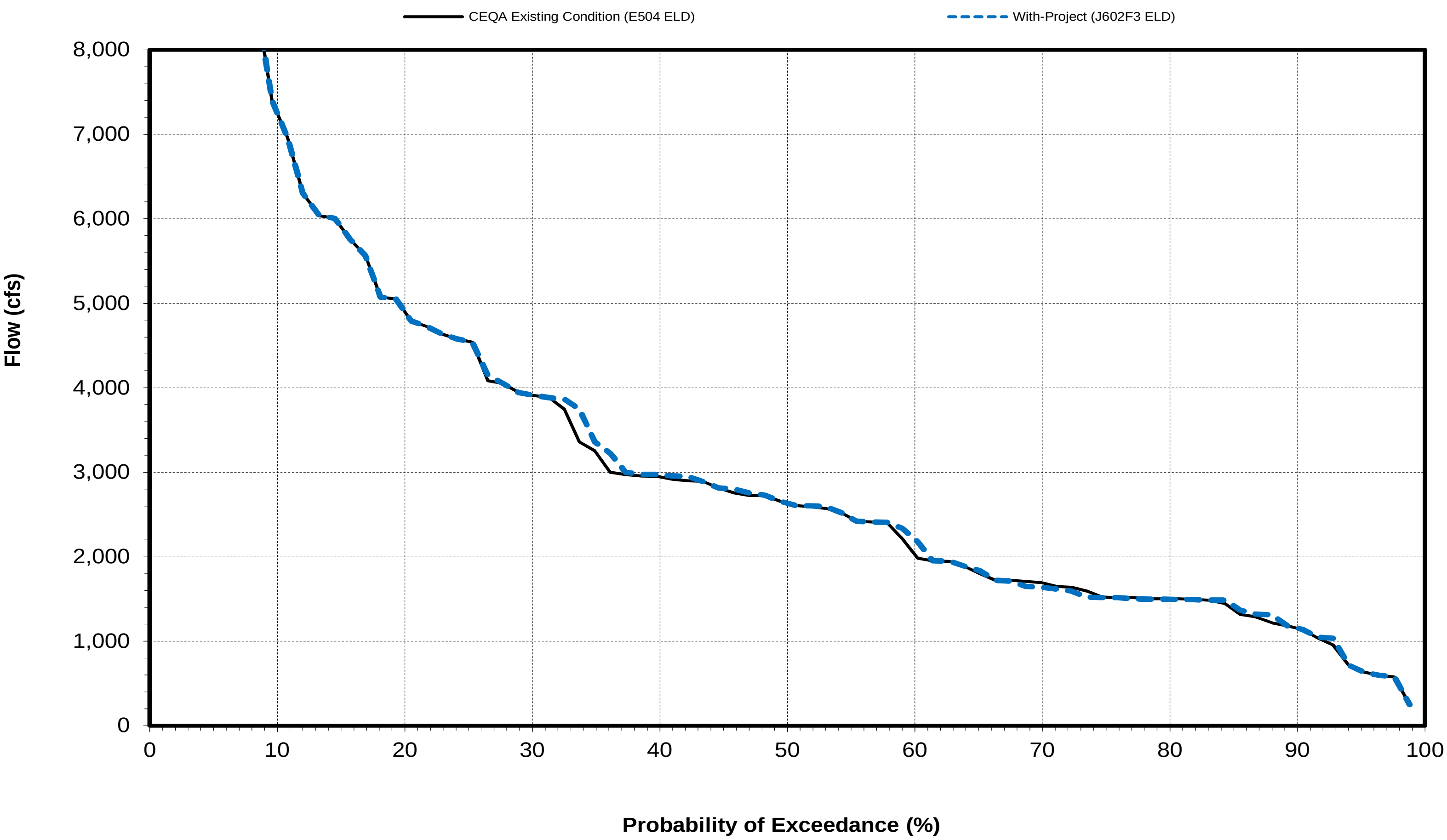


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Lower American River Flow at Watt Avenue

June

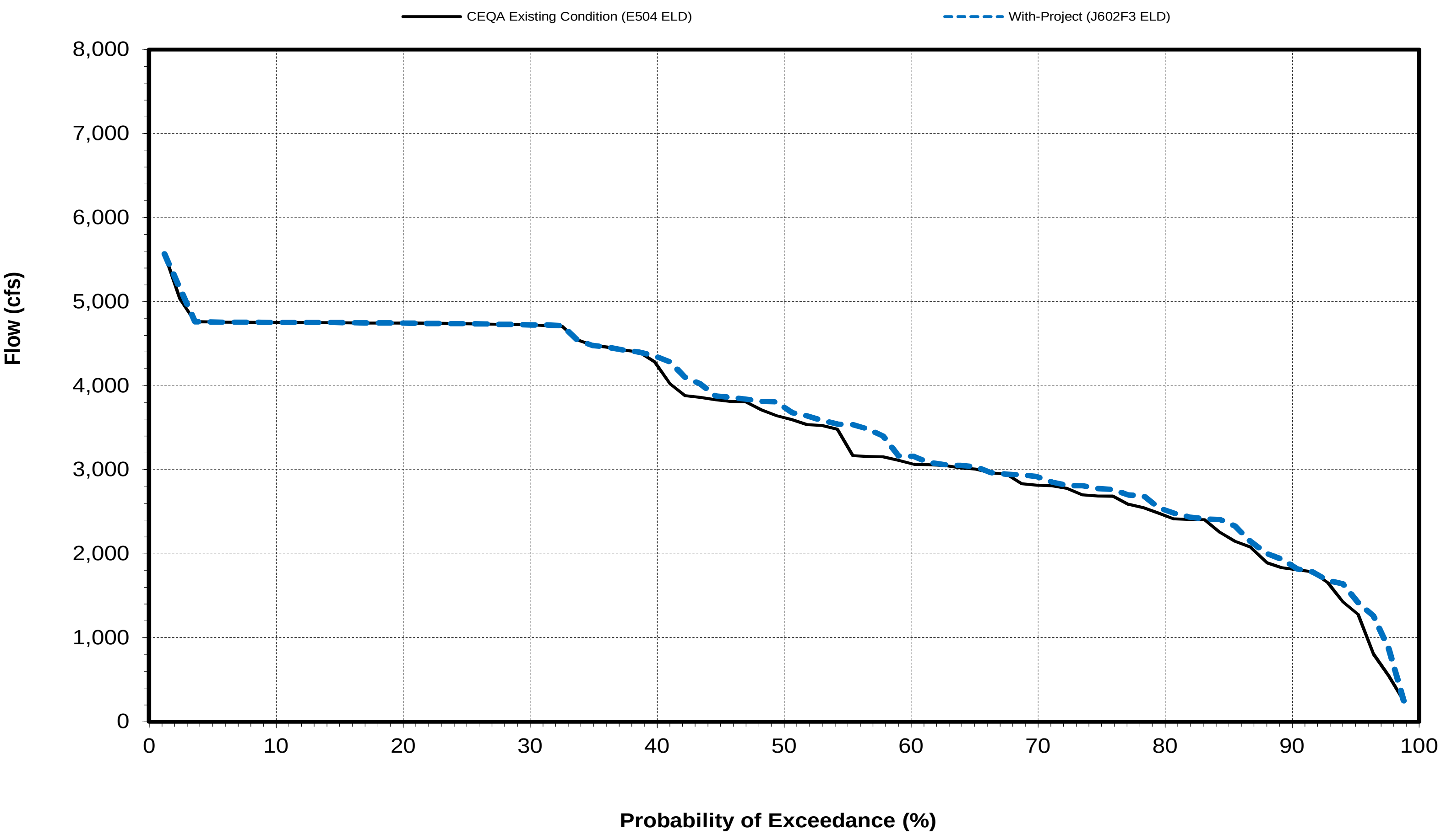


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

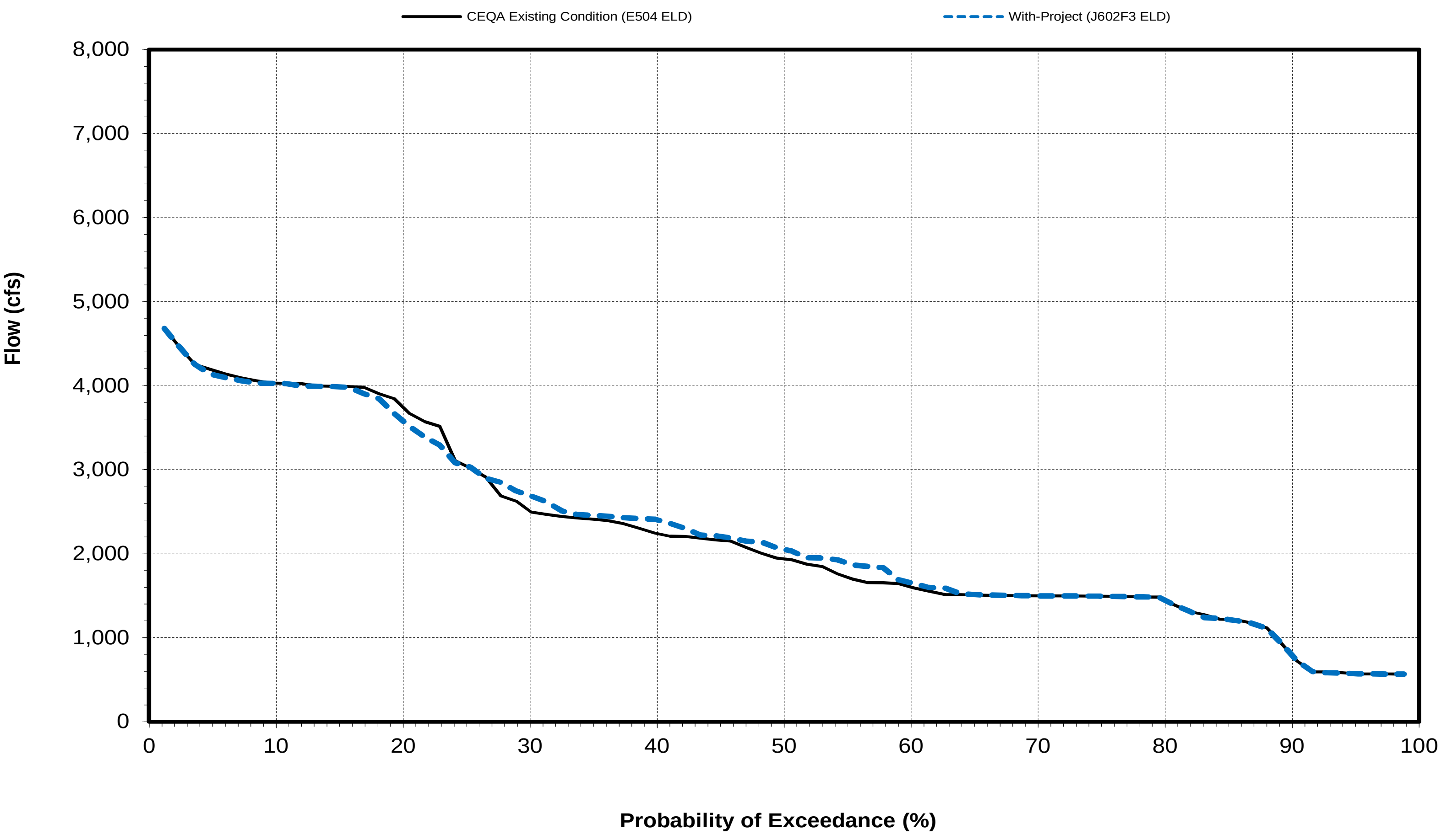
Lower American River Flow at Watt Avenue

July



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

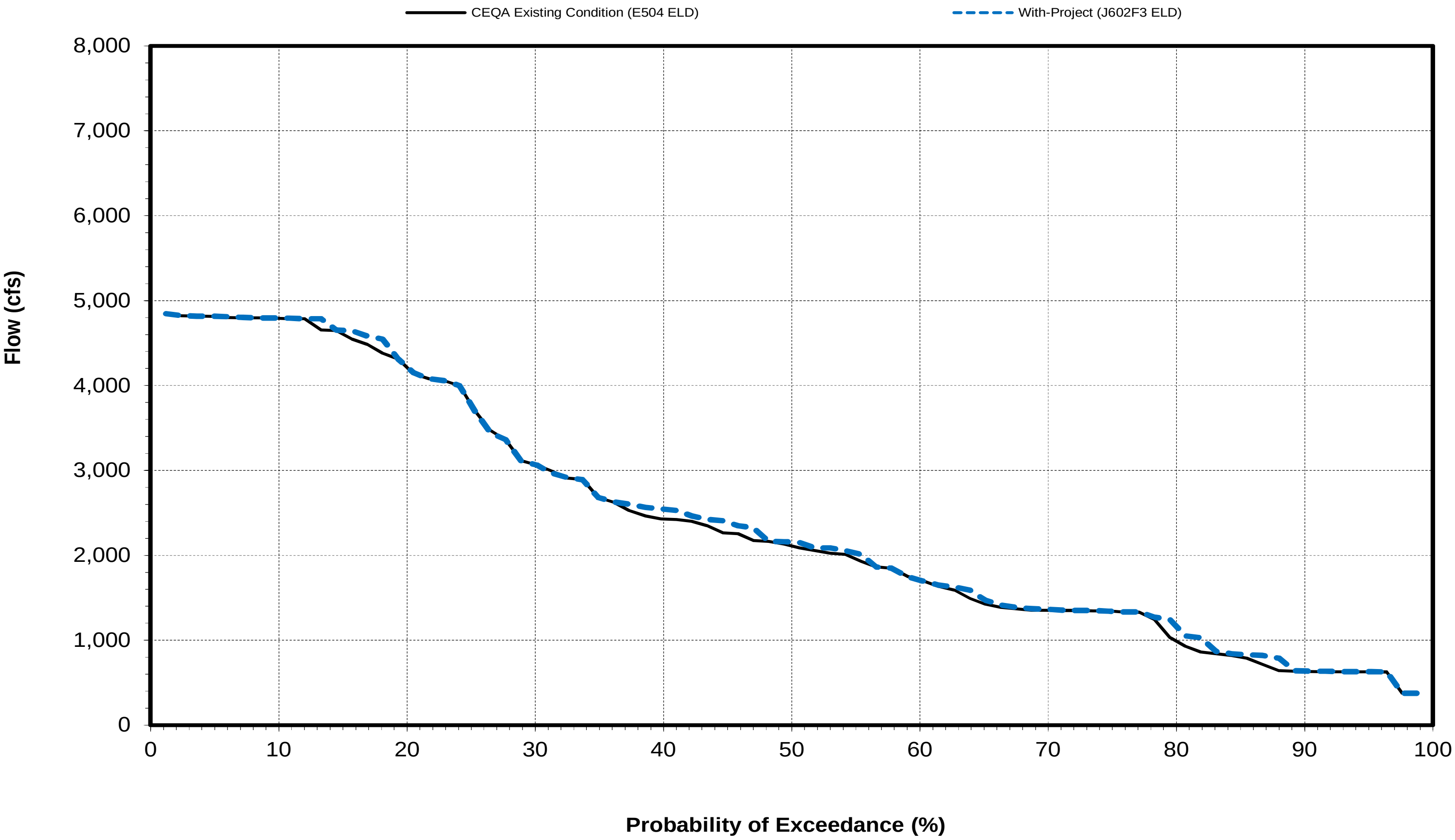
Lower American River Flow at Watt Avenue **August**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Lower American River Flow at Watt Avenue

September



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Long-term and Water Year Type Average Lower American River Flow at the Mouth Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

Analysis Period	Monthly Mean Flow (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	1,967	2,872	3,303	4,386	5,131	3,665	3,162	3,394	3,418	3,513	2,236	2,411
With-Project (J602F3 ELD)	1,990	2,771	3,161	4,224	4,668	3,961	3,432	3,488	3,436	3,580	2,260	2,447
Difference	23	-101	-142	-162	-463	296	270	94	18	67	24	36
Percent Difference[3]	1.2	-3.5	-4.3	-3.7	-9.0	8.1	8.5	2.8	0.5	1.9	1.1	1.5
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	2,081	3,703	5,865	8,624	9,084	5,968	5,120	5,928	5,724	3,733	3,163	3,720
With-Project (J602F3 ELD)	2,123	3,517	5,467	8,277	8,186	7,061	5,639	5,976	5,722	3,733	3,163	3,737
Difference	42	-186	-398	-347	-898	1,093	519	48	-2	0	0	17
Percent Difference[3]	2.0	-5.0	-6.8	-4.0	-9.9	18.3	10.1	0.8	0.0	0.0	0.0	0.5
Above Normal												
CEQA Existing Condition (E504 ELD)	2,045	3,492	2,976	4,998	6,208	5,220	3,370	3,622	3,160	4,276	2,173	3,581
With-Project (J602F3 ELD)	2,067	3,222	2,881	4,657	5,808	5,470	3,861	3,849	3,180	4,286	2,205	3,630
Difference	22	-270	-95	-341	-400	250	491	227	20	10	32	49
Percent Difference[3]	1.1	-7.7	-3.2	-6.8	-6.4	4.8	14.6	6.3	0.6	0.2	1.5	1.4
Below Normal												
CEQA Existing Condition (E504 ELD)	1,934	2,369	2,470	2,307	4,203	2,433	3,025	2,792	2,636	4,532	1,739	1,742
With-Project (J602F3 ELD)	1,944	2,353	2,466	2,307	3,676	2,462	3,207	2,895	2,704	4,532	1,760	1,791
Difference	10	-16	-4	0	-527	29	182	103	68	0	21	49
Percent Difference[3]	0.5	-0.7	-0.2	0.0	-12.5	1.2	6.0	3.7	2.6	0.0	1.2	2.8
Dry												
CEQA Existing Condition (E504 ELD)	1,926	2,292	1,675	1,595	2,175	2,067	1,803	1,642	2,240	3,150	1,961	1,319
With-Project (J602F3 ELD)	1,970	2,297	1,679	1,586	2,037	1,666	1,816	1,759	2,249	3,361	1,975	1,379
Difference	44	5	4	-9	-138	-401	13	117	9	211	14	60
Percent Difference[3]	2.3	0.2	0.2	-0.6	-6.3	-19.4	0.7	7.1	0.4	6.7	0.7	4.5
Critical												
CEQA Existing Condition (E504 ELD)	1,744	1,908	1,495	1,205	1,008	956	909	1,010	1,357	1,631	1,284	824
With-Project (J602F3 ELD)	1,706	1,898	1,479	1,201	1,012	928	909	1,021	1,373	1,761	1,369	833
Difference	-38	-10	-16	-4	4	-28	0	11	16	130	85	9
Percent Difference[3]	-2.2	-0.5	-1.1	-0.3	0.4	-2.9	0.0	1.1	1.2	8.0	6.6	1.1

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

Lower American River Flow at the Mouth - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	4387	4387	0	0.0
2.4	4283	4038	-245	-5.7
3.6	4128	4005	-123	-3.0
4.8	3954	3917	-37	-0.9
6.0	3916	3894	-22	-0.6
7.2	3885	3873	-12	-0.3
8.4	3845	3836	-9	-0.2
9.6	3836	3676	-160	-4.2
10.8	3595	3635	40	1.1
12.0	3564	3424	-140	-3.9
13.3	3423	3366	-57	-1.7
14.5	3317	3272	-45	-1.4
15.7	3121	3144	23	0.7
16.9	3112	3121	9	0.3
18.1	2919	3012	93	3.2
19.3	2824	2973	149	5.3
20.5	2798	2827	29	1.0
21.7	2779	2826	47	1.7
22.9	2768	2799	31	1.1
24.1	2721	2770	49	1.8
25.3	2639	2747	108	4.1
26.5	2388	2721	333	13.9
27.7	2290	2637	347	15.2
28.9	2278	2403	125	5.5
30.1	2193	2383	190	8.7
31.3	2182	2372	190	8.7
32.5	2144	2339	195	9.1
33.7	2110	2198	88	4.2
34.9	2006	2193	187	9.3
36.1	1971	2162	191	9.7
37.3	1937	2021	84	4.3
38.6	1904	1934	30	1.6
39.8	1854	1904	50	2.7
41.0	1791	1796	5	0.3
42.2	1780	1795	15	0.8
43.4	1768	1791	23	1.3
44.6	1767	1769	2	0.1
45.8	1761	1767	6	0.3
47.0	1719	1760	41	2.4
48.2	1685	1720	35	2.1
49.4	1652	1682	30	1.8
50.6	1647	1681	34	2.1
51.8	1573	1637	64	4.1
53.0	1554	1575	21	1.4
54.2	1455	1554	99	6.8
55.4	1444	1467	23	1.6
56.6	1425	1461	36	2.5
57.8	1417	1455	38	2.7
59.0	1416	1421	5	0.4
60.2	1413	1416	3	0.2
61.4	1407	1407	0	0.0
62.7	1407	1406	-1	-0.1
63.9	1400	1399	-1	-0.1
65.1	1390	1397	7	0.5
66.3	1389	1390	1	0.1
67.5	1386	1389	3	0.2
68.7	1374	1386	12	0.9
69.9	1372	1374	2	0.1
71.1	1371	1372	1	0.1
72.3	1361	1371	10	0.7
73.5	1359	1360	1	0.1
74.7	1357	1357	0	0.0
75.9	1355	1355	0	0.0
77.1	1350	1349	-1	-0.1
78.3	1348	1347	-1	-0.1
79.5	1345	1344	-1	-0.1
80.7	1341	1337	-4	-0.3
81.9	1337	1336	-1	-0.1
83.1	1324	1324	0	0.0
84.3	1121	1137	16	1.4
85.5	1114	1112	-2	-0.2
86.7	1088	1097	9	0.8
88.0	1064	1053	-11	-1.0
89.2	1029	1032	3	0.3
90.4	1023	900	-123	-12.0
91.6	907	704	-203	-22.4
92.8	778	687	-91	-11.7
94.0	687	685	-2	-0.3
95.2	685	676	-9	-1.3
96.4	500	500	0	0.0
97.6	500	500	0	0.0
98.8	500	500	0	0.0
Min	500	500	-245	-22.4
Max	4387	4387	347	15.2
Mean	1967	1990	22	0.9
Median	1650	1682	5	0.3

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	50.0
1.1<=X<10.0		35.4
X>=5.0		12.2
X>=10.0		2.4
-10.0<X<=-1.1		8.5
X<=-5.0		4.9
X<=-10.0		3.7
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		15.0
X<=-10.0		15.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-15.0**

Lower American River Flow at the Mouth - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	17135	13962	-3173	-18.5
2.4	16292	12986	-3306	-20.3
3.6	8024	7941	-83	-1.0
4.8	7039	6944	-95	-1.3
6.0	5677	4916	-761	-13.4
7.2	5119	4877	-242	-4.7
8.4	4916	4869	-47	-1.0
9.6	4869	4686	-183	-3.8
10.8	4688	4552	-136	-2.9
12.0	4405	4409	4	0.1
13.3	4218	4156	-62	-1.5
14.5	4204	4145	-59	-1.4
15.7	4144	4028	-116	-2.8
16.9	3744	3751	7	0.2
18.1	3719	3719	0	0.0
19.3	3708	3704	-4	-0.1
20.5	3700	3649	-51	-1.4
21.7	3548	3545	-3	-0.1
22.9	3512	3497	-15	-0.4
24.1	3338	3314	-24	-0.7
25.3	3298	3298	0	0.0
26.5	3239	3258	19	0.6
27.7	3232	3232	0	0.0
28.9	3191	3194	3	0.1
30.1	3183	3190	7	0.2
31.3	3175	3183	8	0.3
32.5	3150	3159	9	0.3
33.7	3129	3078	-51	-1.6
34.9	3078	3036	-42	-1.4
36.1	3040	3027	-13	-0.4
37.3	3025	2976	-49	-1.6
38.6	2956	2928	-28	-0.9
39.8	2899	2880	-19	-0.7
41.0	2880	2866	-14	-0.5
42.2	2870	2860	-10	-0.3
43.4	2860	2855	-5	-0.2
44.6	2778	2778	0	0.0
45.8	2528	2528	0	0.0
47.0	2412	2367	-45	-1.9
48.2	2274	2274	0	0.0
49.4	2239	2239	0	0.0
50.6	2195	2203	8	0.4
51.8	2111	2111	0	0.0
53.0	2013	2019	6	0.3
54.2	1894	1894	0	0.0
55.4	1857	1867	10	0.5
56.6	1835	1859	24	1.3
57.8	1829	1857	28	1.5
59.0	1822	1844	22	1.2
60.2	1808	1835	27	1.5
61.4	1802	1827	25	1.4
62.7	1789	1820	31	1.7
63.9	1780	1802	22	1.2
65.1	1766	1780	14	0.8
66.3	1658	1765	107	6.5
67.5	1628	1733	105	6.4
68.7	1617	1730	113	7.0
69.9	1612	1685	73	4.5
71.1	1610	1662	52	3.2
72.3	1608	1623	15	0.9
73.5	1585	1611	26	1.6
74.7	1583	1610	27	1.7
75.9	1576	1545	-31	-2.0
77.1	1552	1542	-10	-0.6
78.3	1542	1477	-65	-4.2
79.5	1458	1477	19	1.3
80.7	1440	1452	12	0.8
81.9	1313	1311	-2	-0.2
83.1	1178	1194	16	1.4
84.3	1155	1164	9	0.8
85.5	1125	1123	-2	-0.2
86.7	1087	1075	-12	-1.1
88.0	1006	941	-65	-6.5
89.2	948	777	-171	-18.0
90.4	861	761	-100	-11.6
91.6	777	751	-26	-3.3
92.8	752	726	-26	-3.5
94.0	726	688	-38	-5.2
95.2	684	684	0	0.0
96.4	500	500	0	0.0
97.6	500	500	0	0.0
98.8	500	500	0	0.0
Min	500	500	-3306	-20.3
Max	17135	13962	113	7.0
Mean	2872	2771	-102	-1.1
Median	2217	2221	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	51.2
1.1<=X<10.0		19.5
X>=5.0		3.7
X>=10.0		0.0
-10.0<X<=-1.1		23.2
X<=-5.0		8.5
X<=-10.0		6.1
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-6.1**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	45.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		35.0
X<=-5.0		20.0
X<=-10.0		10.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-10.0**

Lower American River Flow at the Mouth - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	20640	17110	-3530	-17.1
2.4	18108	15358	-2750	-15.2
3.6	16102	14803	-1299	-8.1
4.8	15475	14341	-1134	-7.3
6.0	14348	13422	-926	-6.5
7.2	13866	11392	-2474	-17.8
8.4	9017	9049	32	0.4
9.6	8841	8842	1	0.0
10.8	7138	7230	92	1.3
12.0	6659	6659	0	0.0
13.3	5475	5475	0	0.0
14.5	4890	4975	85	1.7
15.7	4779	4890	111	2.3
16.9	3987	3937	-50	-1.3
18.1	3870	3870	0	0.0
19.3	3477	3643	166	4.8
20.5	3292	3299	7	0.2
21.7	3154	3175	21	0.7
22.9	3050	3050	0	0.0
24.1	2703	2872	169	6.3
25.3	2437	2437	0	0.0
26.5	2068	2067	-1	0.0
27.7	2014	2014	0	0.0
28.9	2008	2008	0	0.0
30.1	1992	1987	-5	-0.3
31.3	1984	1984	0	0.0
32.5	1981	1981	0	0.0
33.7	1968	1968	0	0.0
34.9	1959	1959	0	0.0
36.1	1946	1946	0	0.0
37.3	1938	1938	0	0.0
38.6	1932	1932	0	0.0
39.8	1932	1932	0	0.0
41.0	1925	1925	0	0.0
42.2	1917	1919	2	0.1
43.4	1910	1917	7	0.4
44.6	1907	1910	3	0.2
45.8	1905	1908	3	0.2
47.0	1904	1905	1	0.1
48.2	1904	1904	0	0.0
49.4	1902	1904	2	0.1
50.6	1897	1902	5	0.3
51.8	1893	1898	5	0.3
53.0	1888	1893	5	0.3
54.2	1888	1888	0	0.0
55.4	1886	1887	1	0.1
56.6	1886	1886	0	0.0
57.8	1884	1886	2	0.1
59.0	1877	1883	6	0.3
60.2	1875	1883	8	0.4
61.4	1874	1877	3	0.2
62.7	1866	1875	9	0.5
63.9	1866	1874	8	0.4
65.1	1861	1867	6	0.3
66.3	1861	1866	5	0.3
67.5	1802	1861	59	3.3
68.7	1788	1861	73	4.1
69.9	1680	1785	105	6.3
71.1	1676	1689	13	0.8
72.3	1673	1677	4	0.2
73.5	1672	1676	4	0.2
74.7	1641	1641	0	0.0
75.9	1632	1626	-6	-0.4
77.1	1627	1553	-74	-4.5
78.3	1562	1541	-21	-1.3
79.5	1502	1494	-8	-0.5
80.7	1471	1494	23	1.6
81.9	1444	1452	8	0.6
83.1	1343	1341	-2	-0.1
84.3	1224	1222	-2	-0.2
85.5	1193	1210	17	1.4
86.7	1154	1163	9	0.8
88.0	1123	1082	-41	-3.7
89.2	1093	992	-101	-9.2
90.4	1000	842	-158	-15.8
91.6	842	807	-35	-4.2
92.8	832	804	-28	-3.4
94.0	807	753	-54	-6.7
95.2	753	731	-22	-2.9
96.4	728	728	0	0.0
97.6	500	500	0	0.0
98.8	500	500	0	0.0
Min	500	500	-3530	-17.8
Max	20640	17110	169	6.3
Mean	3303	3161	-142	-1.0
Median	1900	1903	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	68.3
1.1<=X<10.0		12.2
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		14.6
X<=-5.0		11.0
X<=-10.0		4.9
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-4.9**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	45.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		40.0
X<=-5.0		15.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-5.0**

Lower American River Flow at the Mouth - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	29318	26209	-3109	-10.6
2.4	21047	17946	-3101	-14.7
3.6	18380	15857	-2523	-13.7
4.8	15498	15637	139	0.9
6.0	14645	14195	-450	-3.1
7.2	12903	12834	-69	-0.5
8.4	11676	11454	-222	-1.9
9.6	11552	10602	-950	-8.2
10.8	10638	10360	-278	-2.6
12.0	9889	10266	377	3.8
13.3	9188	9187	-1	0.0
14.5	9091	9091	0	0.0
15.7	9030	9030	0	0.0
16.9	8083	8431	348	4.3
18.1	7365	7365	0	0.0
19.3	6975	6787	-188	-2.7
20.5	6526	6593	67	1.0
21.7	6403	6526	123	1.9
22.9	5954	5954	0	0.0
24.1	5912	5598	-314	-5.3
25.3	5123	5122	-1	0.0
26.5	5030	5030	0	0.0
27.7	4915	4915	0	0.0
28.9	4646	4642	-4	-0.1
30.1	4610	4448	-162	-3.5
31.3	4448	4115	-333	-7.5
32.5	4228	3909	-319	-7.5
33.7	4049	3534	-515	-12.7
34.9	3745	3438	-307	-8.2
36.1	3668	3331	-337	-9.2
37.3	3535	3125	-410	-11.6
38.6	3324	3123	-201	-6.0
39.8	3191	2852	-339	-10.6
41.0	2852	2762	-90	-3.2
42.2	2722	2722	0	0.0
43.4	2710	2537	-173	-6.4
44.6	2437	2433	-4	-0.2
45.8	2356	2353	-3	-0.1
47.0	2156	2154	-2	-0.1
48.2	1839	1813	-26	-1.4
49.4	1714	1714	0	0.0
50.6	1673	1673	0	0.0
51.8	1669	1669	0	0.0
53.0	1665	1665	0	0.0
54.2	1663	1663	0	0.0
55.4	1654	1654	0	0.0
56.6	1649	1649	0	0.0
57.8	1647	1647	0	0.0
59.0	1641	1641	0	0.0
60.2	1641	1641	0	0.0
61.4	1636	1636	0	0.0
62.7	1631	1631	0	0.0
63.9	1626	1626	0	0.0
65.1	1621	1621	0	0.0
66.3	1620	1620	0	0.0
67.5	1618	1618	0	0.0
68.7	1618	1618	0	0.0
69.9	1617	1617	0	0.0
71.1	1610	1614	4	0.2
72.3	1608	1610	2	0.1
73.5	1607	1608	1	0.1
74.7	1584	1607	23	1.5
75.9	1583	1584	1	0.1
77.1	1582	1583	1	0.1
78.3	1546	1582	36	2.3
79.5	1539	1559	20	1.3
80.7	1434	1529	95	6.6
81.9	1429	1434	5	0.3
83.1	1428	1428	0	0.0
84.3	1385	1385	0	0.0
85.5	1222	1254	32	2.6
86.7	1212	1220	8	0.7
88.0	1156	1172	16	1.4
89.2	982	974	-8	-0.8
90.4	950	958	8	0.8
91.6	925	915	-10	-1.1
92.8	880	783	-97	-11.0
94.0	795	718	-77	-9.7
95.2	718	718	0	0.0
96.4	718	718	0	0.0
97.6	250	250	0	0.0
98.8	250	250	0	0.0
Min	250	250	-3109	-14.7
Max	29318	26209	377	6.6
Mean	4386	4224	-162	-1.8
Median	1694	1694	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	59.8
1.1<=X<10.0		11.0
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		20.7
X<=-5.0		19.5
X<=-10.0		8.5
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-8.5**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		25.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		10.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-5.0**

Lower American River Flow at the Mouth - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	33726	29618	-4108	-12.2
2.4	15671	13791	-1880	-12.0
3.6	14198	13062	-1136	-8.0
4.8	13410	12579	-831	-6.2
6.0	13142	12282	-860	-6.5
7.2	13132	12268	-864	-6.6
8.4	12298	12113	-185	-1.5
9.6	12289	11408	-881	-7.2
10.8	11908	11162	-746	-6.3
12.0	11812	10908	-904	-7.7
13.3	11616	10360	-1256	-10.8
14.5	10171	9677	-494	-4.9
15.7	9875	9175	-700	-7.1
16.9	9786	9137	-649	-6.6
18.1	9715	9020	-695	-7.2
19.3	9392	8869	-523	-5.6
20.5	8439	8505	66	0.8
21.7	8227	7723	-504	-6.1
22.9	8159	7546	-613	-7.5
24.1	7960	7096	-864	-10.9
25.3	7677	6573	-1104	-14.4
26.5	7024	6503	-521	-7.4
27.7	6682	6034	-648	-9.7
28.9	6145	5907	-238	-3.9
30.1	6064	5876	-188	-3.1
31.3	6056	5871	-185	-3.1
32.5	5972	5421	-551	-9.2
33.7	5874	5355	-519	-8.8
34.9	5505	5080	-425	-7.7
36.1	5446	4740	-706	-13.0
37.3	5383	4640	-743	-13.8
38.6	5267	4635	-632	-12.0
39.8	4625	3962	-663	-14.3
41.0	4511	3765	-746	-16.5
42.2	4328	3607	-721	-16.7
43.4	4205	3338	-867	-20.6
44.6	4093	3243	-850	-20.8
45.8	3962	3215	-747	-18.9
47.0	3776	3185	-591	-15.7
48.2	3602	3169	-433	-12.0
49.4	3244	3014	-230	-7.1
50.6	3112	2828	-284	-9.1
51.8	3094	2718	-376	-12.2
53.0	3014	2536	-478	-15.9
54.2	2965	2192	-773	-26.1
55.4	2828	2146	-682	-24.1
56.6	2717	2015	-702	-25.8
57.8	2333	1854	-479	-20.5
59.0	2248	1821	-427	-19.0
60.2	2231	1694	-537	-24.1
61.4	2033	1665	-368	-18.1
62.7	1989	1656	-333	-16.7
63.9	1854	1653	-201	-10.8
65.1	1821	1633	-188	-10.3
66.3	1656	1613	-43	-2.6
67.5	1653	1608	-45	-2.7
68.7	1633	1605	-28	-1.7
69.9	1625	1568	-57	-3.5
71.1	1613	1452	-161	-10.0
72.3	1452	1404	-48	-3.3
73.5	1404	1400	-4	-0.3
74.7	1400	1388	-12	-0.9
75.9	1388	1377	-11	-0.8
77.1	1377	1375	-2	-0.1
78.3	1375	1345	-30	-2.2
79.5	1356	1337	-19	-1.4
80.7	1345	1334	-11	-0.8
81.9	1334	1331	-3	-0.2
83.1	1331	1329	-2	-0.2
84.3	1329	1287	-42	-3.2
85.5	1318	1198	-120	-9.1
86.7	1280	1198	-82	-6.4
88.0	1198	1181	-17	-1.4
89.2	1198	1162	-36	-3.0
90.4	1177	1155	-22	-1.9
91.6	1162	1057	-105	-9.0
92.8	1021	973	-48	-4.7
94.0	960	826	-134	-14.0
95.2	826	697	-129	-15.6
96.4	250	250	0	0.0
97.6	250	250	0	0.0
98.8	250	250	0	0.0
Min	250	250	-4108	-26.1
Max	33726	29618	66	0.8
Mean	5131	4668	-463	-8.8
Median	3178	2921	-426	-7.5

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	13.4
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		48.8
X<=-5.0		65.9
X<=-10.0		37.8
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-37.8**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	40.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		50.0
X<=-5.0		25.0
X<=-10.0		10.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-10.0**

Lower American River Flow at the Mouth - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	17806	18115	309	1.7
2.4	16477	16550	73	0.4
3.6	12686	13808	1122	8.8
4.8	11988	13095	1107	9.2
6.0	11010	12151	1141	10.4
7.2	10931	10964	33	0.3
8.4	10674	10710	36	0.3
9.6	9285	10550	1265	13.6
10.8	8410	9993	1583	18.8
12.0	7248	7788	540	7.5
13.3	6699	7561	862	12.9
14.5	6137	7502	1365	22.2
15.7	6126	6910	784	12.8
16.9	6065	6693	628	10.4
18.1	5951	6495	544	9.1
19.3	5743	6280	537	9.4
20.5	5676	6148	472	8.3
21.7	4720	5842	1122	23.8
22.9	4567	5706	1139	24.9
24.1	4417	5022	605	13.7
25.3	4349	5008	659	15.2
26.5	4337	4843	506	11.7
27.7	4286	4811	525	12.2
28.9	4001	4681	680	17.0
30.1	3939	4358	419	10.6
31.3	3933	4232	299	7.6
32.5	3812	4147	335	8.8
33.7	3743	4131	388	10.4
34.9	3706	3858	152	4.1
36.1	3553	3727	174	4.9
37.3	3509	3690	181	5.2
38.6	3330	3678	348	10.5
39.8	3308	3591	283	8.6
41.0	3274	3584	310	9.5
42.2	3208	3508	300	9.4
43.4	3063	3491	428	14.0
44.6	3017	3217	200	6.6
45.8	3009	3114	105	3.5
47.0	2941	3114	173	5.9
48.2	2400	2970	570	23.8
49.4	2328	2813	485	20.8
50.6	2282	2750	468	20.5
51.8	2218	2551	333	15.0
53.0	2164	2449	285	13.2
54.2	2153	2433	280	13.0
55.4	2040	2430	390	19.1
56.6	1992	2160	168	8.4
57.8	1964	2094	130	6.6
59.0	1821	1821	0	0.0
60.2	1700	1813	113	6.6
61.4	1696	1712	16	0.9
62.7	1663	1700	37	2.2
63.9	1646	1689	43	2.6
65.1	1639	1658	19	1.2
66.3	1628	1643	15	0.9
67.5	1617	1628	11	0.7
68.7	1613	1615	2	0.1
69.9	1604	1613	9	0.6
71.1	1602	1610	8	0.5
72.3	1570	1423	-147	-9.4
73.5	1569	1371	-198	-12.6
74.7	1423	1339	-84	-5.9
75.9	1371	1308	-63	-4.6
77.1	1339	1297	-42	-3.1
78.3	1182	1182	0	0.0
79.5	1079	1079	0	0.0
80.7	1028	1000	-28	-2.7
81.9	1000	984	-16	-1.6
83.1	907	907	0	0.0
84.3	884	883	-1	-0.1
85.5	830	813	-17	-2.0
86.7	813	758	-55	-6.8
88.0	789	752	-37	-4.7
89.2	758	748	-10	-1.3
90.4	752	743	-9	-1.2
91.6	748	729	-19	-2.5
92.8	743	717	-26	-3.5
94.0	729	707	-22	-3.0
95.2	717	669	-48	-6.7
96.4	708	666	-42	-5.9
97.6	669	662	-7	-1.0
98.8	250	250	0	0.0
Min	250	250	-198	-12.6
Max	17806	18115	1583	24.9
Mean	3665	3961	296	5.8
Median	2305	2782	171	5.6

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	19.5
1.1<=X<10.0		29.3
X>=5.0		51.2
X>=10.0		30.5
-10.0<X<=-1.1		19.5
X<=-5.0		7.3
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**29.3**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	30.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		70.0
X<=-5.0		15.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Lower American River Flow at the Mouth - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	14168	15106	938	6.6
2.4	10312	9612	-700	-6.8
3.6	8479	8889	410	4.8
4.8	7895	8844	949	12.0
6.0	7730	8178	448	5.8
7.2	7667	7610	-57	-0.7
8.4	6569	7442	873	13.3
9.6	6484	6986	502	7.7
10.8	6419	6957	538	8.4
12.0	6210	6947	737	11.9
13.3	6062	6947	885	14.6
14.5	5908	6523	615	10.4
15.7	5797	6488	691	11.9
16.9	5738	5891	153	2.7
18.1	5318	5795	477	9.0
19.3	4912	5755	843	17.2
20.5	4885	5200	315	6.4
21.7	4808	5190	382	7.9
22.9	4553	5143	590	13.0
24.1	4551	4733	182	4.0
25.3	4529	4658	129	2.8
26.5	4311	4575	264	6.1
27.7	4236	4468	232	5.5
28.9	4151	4269	118	2.8
30.1	4093	4225	132	3.2
31.3	3825	4205	380	9.9
32.5	3759	4189	430	11.4
33.7	3685	4065	380	10.3
34.9	3586	4023	437	12.2
36.1	3490	4019	529	15.2
37.3	3336	3996	660	19.8
38.6	3319	3904	585	17.6
39.8	3079	3740	661	21.5
41.0	2753	3698	945	34.3
42.2	2711	3536	825	30.4
43.4	2703	3435	732	27.1
44.6	2669	3230	561	21.0
45.8	2662	3117	455	17.1
47.0	2446	3078	632	25.8
48.2	2429	3043	614	25.3
49.4	2402	2948	546	22.7
50.6	2289	2877	588	25.7
51.8	2260	2823	563	24.9
53.0	2233	2788	555	24.9
54.2	2201	2766	565	25.7
55.4	2053	2652	599	29.2
56.6	2046	2115	69	3.4
57.8	2022	1964	-58	-2.9
59.0	1942	1942	0	0.0
60.2	1792	1821	29	1.6
61.4	1753	1778	25	1.4
62.7	1723	1724	1	0.1
63.9	1589	1589	0	0.0
65.1	1573	1578	5	0.3
66.3	1565	1566	1	0.1
67.5	1559	1560	1	0.1
68.7	1554	1554	0	0.0
69.9	1551	1545	-6	-0.4
71.1	1551	1533	-18	-1.2
72.3	1548	1520	-28	-1.8
73.5	1545	1466	-79	-5.1
74.7	1538	1290	-248	-16.1
75.9	1283	1275	-8	-0.6
77.1	1275	1241	-34	-2.7
78.3	1241	1225	-16	-1.3
79.5	1217	1160	-57	-4.7
80.7	1151	1079	-72	-6.3
81.9	1079	1020	-59	-5.5
83.1	1020	977	-43	-4.2
84.3	977	922	-55	-5.6
85.5	922	849	-73	-7.9
86.7	782	783	1	0.1
88.0	781	781	0	0.0
89.2	760	760	0	0.0
90.4	658	660	2	0.3
91.6	646	646	0	0.0
92.8	627	627	0	0.0
94.0	616	616	0	0.0
95.2	606	606	0	0.0
96.4	605	605	0	0.0
97.6	250	250	0	0.0
98.8	250	250	0	0.0
Min	250	250	-700	-16.1
Max	14168	15106	949	34.3
Mean	3162	3432	270	7.0
Median	2346	2913	143	3.3

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	25.6
1.1<=X<10.0		23.2
X>=5.0		46.3
X>=10.0		34.1
-10.0<X<=-1.1		15.9
X<=-5.0		8.5
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**32.9**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		40.0
X<=-5.0		20.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Lower American River Flow at the Mouth - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	11257	11301	44	0.4
2.4	11067	11112	45	0.4
3.6	10169	10217	48	0.5
4.8	9687	9742	55	0.6
6.0	9269	9324	55	0.6
7.2	9153	9198	45	0.5
8.4	8956	8996	40	0.4
9.6	8868	8913	45	0.5
10.8	8104	8154	50	0.6
12.0	8017	8057	40	0.5
13.3	6812	6849	37	0.5
14.5	6650	6683	33	0.5
15.7	6419	6464	45	0.7
16.9	6143	6197	54	0.9
18.1	5096	5141	45	0.9
19.3	4898	4889	-9	-0.2
20.5	4844	4819	-25	-0.5
21.7	4774	4732	-42	-0.9
22.9	4685	4652	-33	-0.7
24.1	4534	4573	39	0.9
25.3	4411	4455	44	1.0
26.5	4268	4317	49	1.1
27.7	4255	4298	43	1.0
28.9	4027	4072	45	1.1
30.1	4024	4072	48	1.2
31.3	3850	3890	40	1.0
32.5	3748	3796	48	1.3
33.7	3737	3782	45	1.2
34.9	3600	3648	48	1.3
36.1	3540	3584	44	1.2
37.3	3451	3476	25	0.7
38.6	3378	3469	91	2.7
39.8	3368	3427	59	1.8
41.0	3363	3413	50	1.5
42.2	3326	3409	83	2.5
43.4	3287	3396	109	3.3
44.6	3219	3320	101	3.1
45.8	3166	3268	102	3.2
47.0	2881	3044	163	5.7
48.2	2876	2961	85	3.0
49.4	2724	2928	204	7.5
50.6	2590	2803	213	8.2
51.8	2491	2761	270	10.8
53.0	2284	2685	401	17.6
54.2	2186	2635	449	20.5
55.4	2140	2529	389	18.2
56.6	2130	2330	200	9.4
57.8	1989	2320	331	16.6
59.0	1564	2254	690	44.1
60.2	1553	2231	678	43.7
61.4	1553	2139	586	37.7
62.7	1551	2032	481	31.0
63.9	1551	1784	233	15.0
65.1	1550	1562	12	0.8
66.3	1549	1553	4	0.3
67.5	1544	1553	9	0.6
68.7	1534	1551	17	1.1
69.9	1525	1549	24	1.6
71.1	1519	1544	25	1.6
72.3	1491	1537	46	3.1
73.5	1464	1486	22	1.5
74.7	1339	1352	13	1.0
75.9	1309	1334	25	1.9
77.1	1282	1309	27	2.1
78.3	1260	1287	27	2.1
79.5	1254	1260	6	0.5
80.7	1227	1254	27	2.2
81.9	1157	1227	70	6.1
83.1	1032	1157	125	12.1
84.3	983	1032	49	5.0
85.5	980	987	7	0.7
86.7	953	980	27	2.8
88.0	840	844	4	0.5
89.2	764	764	0	0.0
90.4	739	739	0	0.0
91.6	627	661	34	5.4
92.8	621	627	6	1.0
94.0	609	609	0	0.0
95.2	606	606	0	0.0
96.4	604	604	0	0.0
97.6	250	250	0	0.0
98.8	250	250	0	0.0
Min	250	250	-42	-0.9
Max	11257	11301	690	44.1
Mean	3394	3488	93	4.6
Median	2657	2866	45	1.1

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	47.6
1.1<=X<10.0		39.0
X>=5.0		22.0
X>=10.0		13.4
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**13.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		40.0
X>=5.0		20.0
X>=10.0		5.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**5.0**

Lower American River Flow at the Mouth - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	14076	14076	0	0.0
2.4	10859	10859	0	0.0
3.6	10190	10190	0	0.0
4.8	10143	10142	-1	0.0
6.0	10058	10057	-1	0.0
7.2	9020	9020	0	0.0
8.4	8522	8522	0	0.0
9.6	7395	7395	0	0.0
10.8	6962	6961	-1	0.0
12.0	6302	6302	0	0.0
13.3	6036	6035	-1	0.0
14.5	6005	6007	2	0.0
15.7	5760	5760	0	0.0
16.9	5563	5563	0	0.0
18.1	5074	5073	-1	0.0
19.3	5054	5053	-1	0.0
20.5	4791	4791	0	0.0
21.7	4726	4726	0	0.0
22.9	4637	4636	-1	0.0
24.1	4579	4579	0	0.0
25.3	4539	4538	-1	0.0
26.5	4084	4147	63	1.5
27.7	4050	4050	0	0.0
28.9	3947	3946	-1	0.0
30.1	3910	3910	0	0.0
31.3	3885	3883	-2	-0.1
32.5	3745	3867	122	3.3
33.7	3358	3744	386	11.5
34.9	3253	3358	105	3.2
36.1	3000	3223	223	7.4
37.3	2975	3000	25	0.8
38.6	2955	2974	19	0.6
39.8	2950	2974	24	0.8
41.0	2918	2954	36	1.2
42.2	2900	2949	49	1.7
43.4	2890	2889	-1	0.0
44.6	2815	2815	0	0.0
45.8	2754	2804	50	1.8
47.0	2727	2754	27	1.0
48.2	2726	2730	4	0.1
49.4	2659	2659	0	0.0
50.6	2605	2608	3	0.1
51.8	2593	2603	10	0.4
53.0	2572	2593	21	0.8
54.2	2524	2523	-1	0.0
55.4	2424	2421	-3	-0.1
56.6	2411	2411	0	0.0
57.8	2405	2409	4	0.2
59.0	2214	2336	122	5.5
60.2	1983	2179	196	9.9
61.4	1953	1952	-1	-0.1
62.7	1947	1948	1	0.1
63.9	1883	1886	3	0.2
65.1	1802	1834	32	1.8
66.3	1723	1723	0	0.0
67.5	1721	1713	-8	-0.5
68.7	1708	1649	-59	-3.5
69.9	1696	1638	-58	-3.4
71.1	1649	1618	-31	-1.9
72.3	1638	1592	-46	-2.8
73.5	1593	1521	-72	-4.5
74.7	1520	1517	-3	-0.2
75.9	1517	1516	-1	-0.1
77.1	1516	1502	-14	-0.9
78.3	1506	1499	-7	-0.5
79.5	1503	1497	-6	-0.4
80.7	1502	1495	-7	-0.5
81.9	1495	1491	-4	-0.3
83.1	1487	1486	-1	-0.1
84.3	1444	1486	42	2.9
85.5	1320	1369	49	3.7
86.7	1290	1321	31	2.4
88.0	1218	1313	95	7.8
89.2	1184	1184	0	0.0
90.4	1139	1139	0	0.0
91.6	1035	1047	12	1.2
92.8	954	1037	83	8.7
94.0	719	719	0	0.0
95.2	636	636	0	0.0
96.4	597	597	0	0.0
97.6	576	576	0	0.0
98.8	250	250	0	0.0
Min	250	250	-72	-4.5
Max	14076	14076	386	11.5
Mean	3418	3436	18	0.7
Median	2632	2634	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	73.2
1.1<=X<10.0		19.5
X>=5.0		7.3
X>=10.0		1.2
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		30.0
X>=5.0		10.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Lower American River Flow at the Mouth - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	5566	5566	0	0.0
2.4	5038	5165	127	2.5
3.6	4760	4760	0	0.0
4.8	4759	4759	0	0.0
6.0	4756	4756	0	0.0
7.2	4755	4755	0	0.0
8.4	4754	4754	0	0.0
9.6	4753	4753	0	0.0
10.8	4752	4752	0	0.0
12.0	4751	4751	0	0.0
13.3	4751	4751	0	0.0
14.5	4750	4751	1	0.0
15.7	4749	4750	1	0.0
16.9	4747	4747	0	0.0
18.1	4747	4747	0	0.0
19.3	4745	4745	0	0.0
20.5	4743	4743	0	0.0
21.7	4742	4740	-2	0.0
22.9	4742	4740	-2	0.0
24.1	4738	4738	0	0.0
25.3	4737	4737	0	0.0
26.5	4736	4735	-1	0.0
27.7	4728	4728	0	0.0
28.9	4727	4727	0	0.0
30.1	4724	4724	0	0.0
31.3	4713	4722	9	0.2
32.5	4708	4713	5	0.1
33.7	4545	4545	0	0.0
34.9	4480	4479	-1	0.0
36.1	4457	4456	-1	0.0
37.3	4426	4424	-2	0.0
38.6	4399	4400	1	0.0
39.8	4284	4355	71	1.7
41.0	4022	4283	261	6.5
42.2	3881	4100	219	5.6
43.4	3858	4022	164	4.3
44.6	3834	3878	44	1.1
45.8	3813	3861	48	1.3
47.0	3806	3838	32	0.8
48.2	3713	3813	100	2.7
49.4	3643	3806	163	4.5
50.6	3593	3680	87	2.4
51.8	3535	3643	108	3.1
53.0	3527	3585	58	1.6
54.2	3481	3541	60	1.7
55.4	3167	3535	368	11.6
56.6	3157	3482	325	10.3
57.8	3152	3400	248	7.9
59.0	3111	3166	55	1.8
60.2	3065	3160	95	3.1
61.4	3060	3084	24	0.8
62.7	3051	3060	9	0.3
63.9	3021	3051	30	1.0
65.1	3004	3034	30	1.0
66.3	2962	2964	2	0.1
67.5	2948	2948	0	0.0
68.7	2831	2939	108	3.8
69.9	2815	2917	102	3.6
71.1	2808	2854	46	1.6
72.3	2777	2811	34	1.2
73.5	2699	2808	109	4.0
74.7	2688	2777	89	3.3
75.9	2686	2765	79	2.9
77.1	2588	2699	111	4.3
78.3	2547	2688	141	5.5
79.5	2481	2547	66	2.7
80.7	2415	2481	66	2.7
81.9	2407	2438	31	1.3
83.1	2404	2414	10	0.4
84.3	2255	2407	152	6.7
85.5	2149	2333	184	8.6
86.7	2081	2148	67	3.2
88.0	1892	2001	109	5.8
89.2	1833	1933	100	5.5
90.4	1807	1818	11	0.6
91.6	1784	1784	0	0.0
92.8	1657	1680	23	1.4
94.0	1426	1641	215	15.1
95.2	1277	1420	143	11.2
96.4	807	1259	452	56.0
97.6	547	871	324	59.2
98.8	250	250	0	0.0
Min	250	250	-2	0.0
Max	5566	5566	452	59.2
Mean	3513	3580	67	3.5
Median	3618	3743	30	1.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	51.2
1.1<=X<10.0		41.5
X>=5.0		17.1
X>=10.0		7.3
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**7.3**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	20.0
1.1<=X<10.0		60.0
X>=5.0		45.0
X>=10.0		20.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**20.0**

Lower American River Flow at the Mouth - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	4682	4682	0	0.0
2.4	4458	4458	0	0.0
3.6	4252	4252	0	0.0
4.8	4195	4138	-57	-1.4
6.0	4138	4095	-43	-1.0
7.2	4095	4060	-35	-0.9
8.4	4060	4031	-29	-0.7
9.6	4031	4029	-2	0.0
10.8	4029	4024	-5	-0.1
12.0	4024	3996	-28	-0.7
13.3	3996	3993	-3	-0.1
14.5	3993	3988	-5	-0.1
15.7	3988	3980	-8	-0.2
16.9	3980	3905	-75	-1.9
18.1	3905	3845	-60	-1.5
19.3	3845	3669	-176	-4.6
20.5	3669	3516	-153	-4.2
21.7	3572	3388	-184	-5.2
22.9	3516	3292	-224	-6.4
24.1	3107	3084	-23	-0.7
25.3	3021	3029	8	0.3
26.5	2912	2898	-14	-0.5
27.7	2687	2849	162	6.0
28.9	2627	2748	121	4.6
30.1	2493	2684	191	7.7
31.3	2466	2619	153	6.2
32.5	2443	2509	66	2.7
33.7	2427	2467	40	1.6
34.9	2411	2456	45	1.9
36.1	2392	2447	55	2.3
37.3	2359	2427	68	2.9
38.6	2301	2416	115	5.0
39.8	2245	2412	167	7.4
41.0	2208	2361	153	6.9
42.2	2205	2301	96	4.4
43.4	2185	2221	36	1.6
44.6	2164	2214	50	2.3
45.8	2148	2189	41	1.9
47.0	2076	2148	72	3.5
48.2	2004	2141	137	6.8
49.4	1948	2073	125	6.4
50.6	1928	2032	104	5.4
51.8	1876	1950	74	3.9
53.0	1849	1948	99	5.4
54.2	1762	1929	167	9.5
55.4	1699	1865	166	9.8
56.6	1657	1848	191	11.5
57.8	1655	1833	178	10.8
59.0	1645	1689	44	2.7
60.2	1593	1644	51	3.2
61.4	1553	1599	46	3.0
62.7	1514	1590	76	5.0
63.9	1513	1521	8	0.5
65.1	1508	1514	6	0.4
66.3	1504	1508	4	0.3
67.5	1500	1503	3	0.2
68.7	1500	1500	0	0.0
69.9	1499	1500	1	0.1
71.1	1497	1499	2	0.1
72.3	1497	1497	0	0.0
73.5	1495	1495	0	0.0
74.7	1494	1494	0	0.0
75.9	1494	1494	0	0.0
77.1	1491	1491	0	0.0
78.3	1486	1486	0	0.0
79.5	1484	1484	0	0.0
80.7	1393	1393	0	0.0
81.9	1312	1315	3	0.2
83.1	1275	1240	-35	-2.7
84.3	1221	1231	10	0.8
85.5	1214	1208	-6	-0.5
86.7	1177	1177	0	0.0
88.0	1118	1113	-5	-0.4
89.2	926	926	0	0.0
90.4	721	722	1	0.1
91.6	596	596	0	0.0
92.8	593	582	-11	-1.9
94.0	583	581	-2	-0.3
95.2	572	572	0	0.0
96.4	570	570	0	0.0
97.6	570	569	-1	-0.2
98.8	569	568	-1	-0.2
Min	569	568	-224	-6.4
Max	4682	4682	191	11.5
Mean	2236	2260	24	1.5
Median	1938	2053	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	52.4
1.1<=X<10.0		34.1
X>=5.0		18.3
X>=10.0		2.4
-10.0<X<=-1.1		11.0
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Lower American River Flow at the Mouth - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	4846	4846	0	0.0
2.4	4821	4821	0	0.0
3.6	4815	4817	2	0.0
4.8	4813	4815	2	0.0
6.0	4803	4811	8	0.2
7.2	4796	4803	7	0.1
8.4	4796	4796	0	0.0
9.6	4794	4796	2	0.0
10.8	4788	4794	6	0.1
12.0	4786	4788	2	0.0
13.3	4653	4786	133	2.9
14.5	4646	4653	7	0.2
15.7	4546	4646	100	2.2
16.9	4484	4582	98	2.2
18.1	4381	4546	165	3.8
19.3	4312	4312	0	0.0
20.5	4136	4150	14	0.3
21.7	4081	4081	0	0.0
22.9	4058	4058	0	0.0
24.1	3999	3999	0	0.0
25.3	3697	3696	-1	0.0
26.5	3472	3445	-27	-0.8
27.7	3360	3361	1	0.0
28.9	3114	3113	-1	0.0
30.1	3066	3066	0	0.0
31.3	2990	2968	-22	-0.7
32.5	2910	2916	6	0.2
33.7	2893	2892	-1	0.0
34.9	2681	2681	0	0.0
36.1	2627	2629	2	0.1
37.3	2528	2603	75	3.0
38.6	2464	2564	100	4.1
39.8	2428	2546	118	4.9
41.0	2422	2528	106	4.4
42.2	2404	2464	60	2.5
43.4	2350	2422	72	3.1
44.6	2266	2407	141	6.2
45.8	2256	2350	94	4.2
47.0	2177	2324	147	6.8
48.2	2163	2164	1	0.0
49.4	2132	2162	30	1.4
50.6	2088	2153	65	3.1
51.8	2056	2088	32	1.6
53.0	2026	2086	60	3.0
54.2	2011	2056	45	2.2
55.4	1929	2011	82	4.3
56.6	1862	1862	0	0.0
57.8	1848	1848	0	0.0
59.0	1754	1749	-5	-0.3
60.2	1700	1700	0	0.0
61.4	1637	1652	15	0.9
62.7	1591	1629	38	2.4
63.9	1492	1591	99	6.6
65.1	1423	1472	49	3.4
66.3	1387	1415	28	2.0
67.5	1370	1388	18	1.3
68.7	1355	1371	16	1.2
69.9	1354	1365	11	0.8
71.1	1350	1355	5	0.4
72.3	1350	1350	0	0.0
73.5	1345	1350	5	0.4
74.7	1345	1343	-2	-0.1
75.9	1335	1335	0	0.0
77.1	1331	1334	3	0.2
78.3	1243	1273	30	2.4
79.5	1031	1243	212	20.6
80.7	929	1050	121	13.0
81.9	863	1031	168	19.5
83.1	841	868	27	3.2
84.3	821	841	20	2.4
85.5	790	830	40	5.1
86.7	717	821	104	14.5
88.0	641	790	149	23.2
89.2	637	641	4	0.6
90.4	634	637	3	0.5
91.6	630	634	4	0.6
92.8	629	630	1	0.2
94.0	629	629	0	0.0
95.2	628	628	0	0.0
96.4	628	628	0	0.0
97.6	375	375	0	0.0
98.8	375	375	0	0.0
Min	375	375	-27	-0.8
Max	4846	4846	212	23.2
Mean	2411	2447	35	2.3
Median	2110	2158	6	0.4

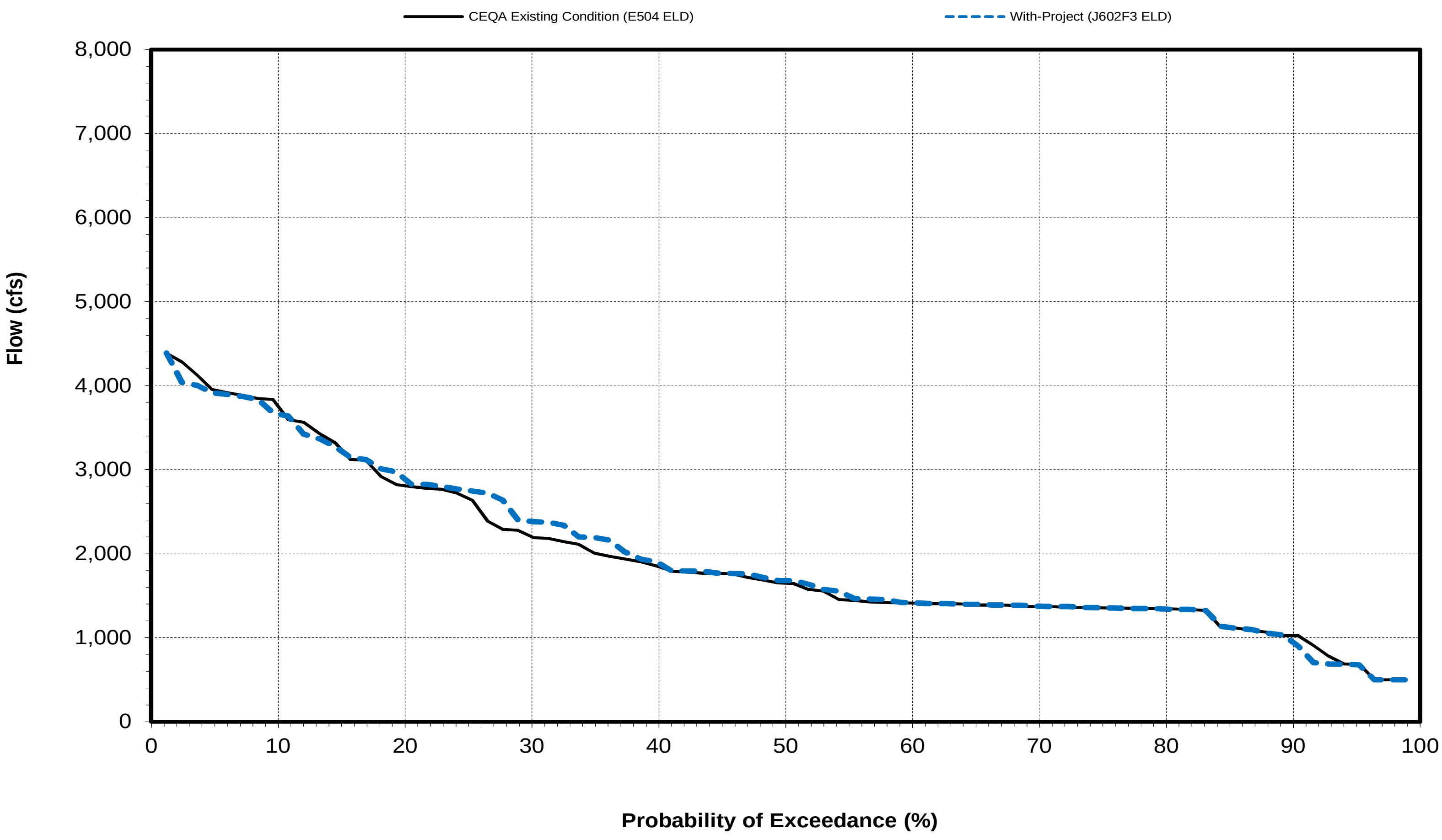
Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	58.5
1.1<=X<10.0		35.4
X>=5.0		11.0
X>=10.0		6.1
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**6.1**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		20.0
X>=5.0		30.0
X>=10.0		25.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**25.0**

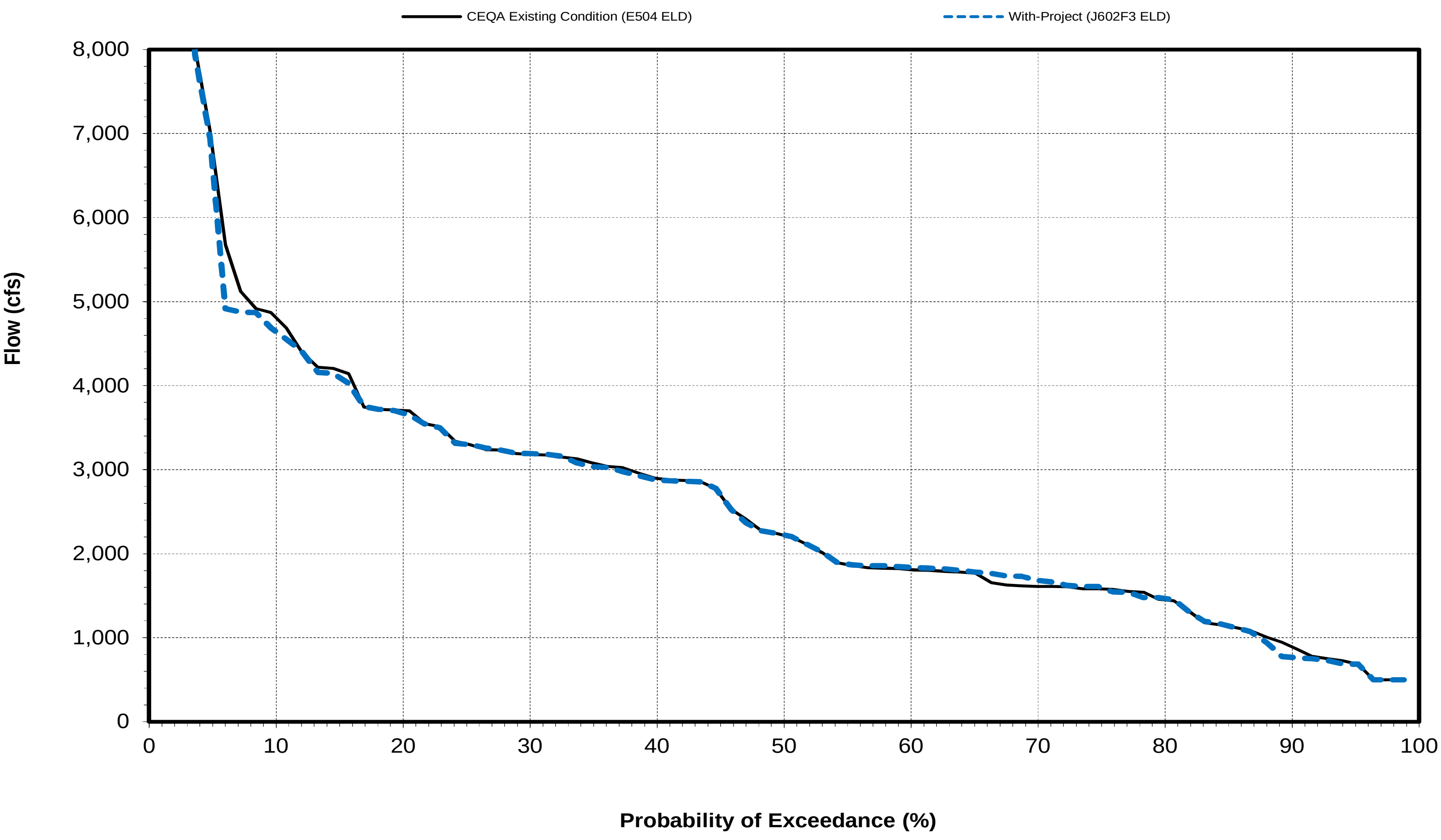
Lower American River Flow at the Mouth **October**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

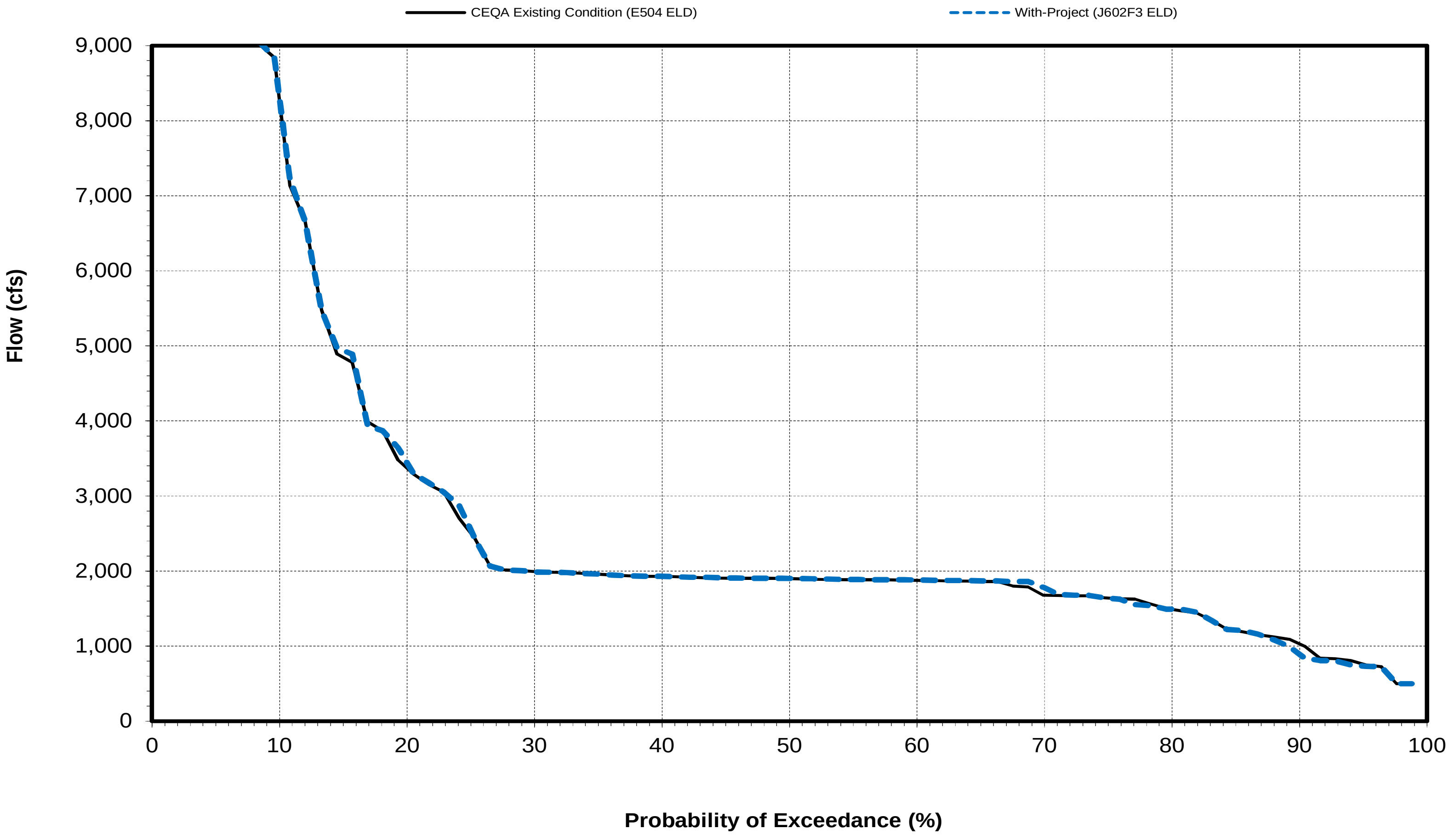
Lower American River Flow at the Mouth

November



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

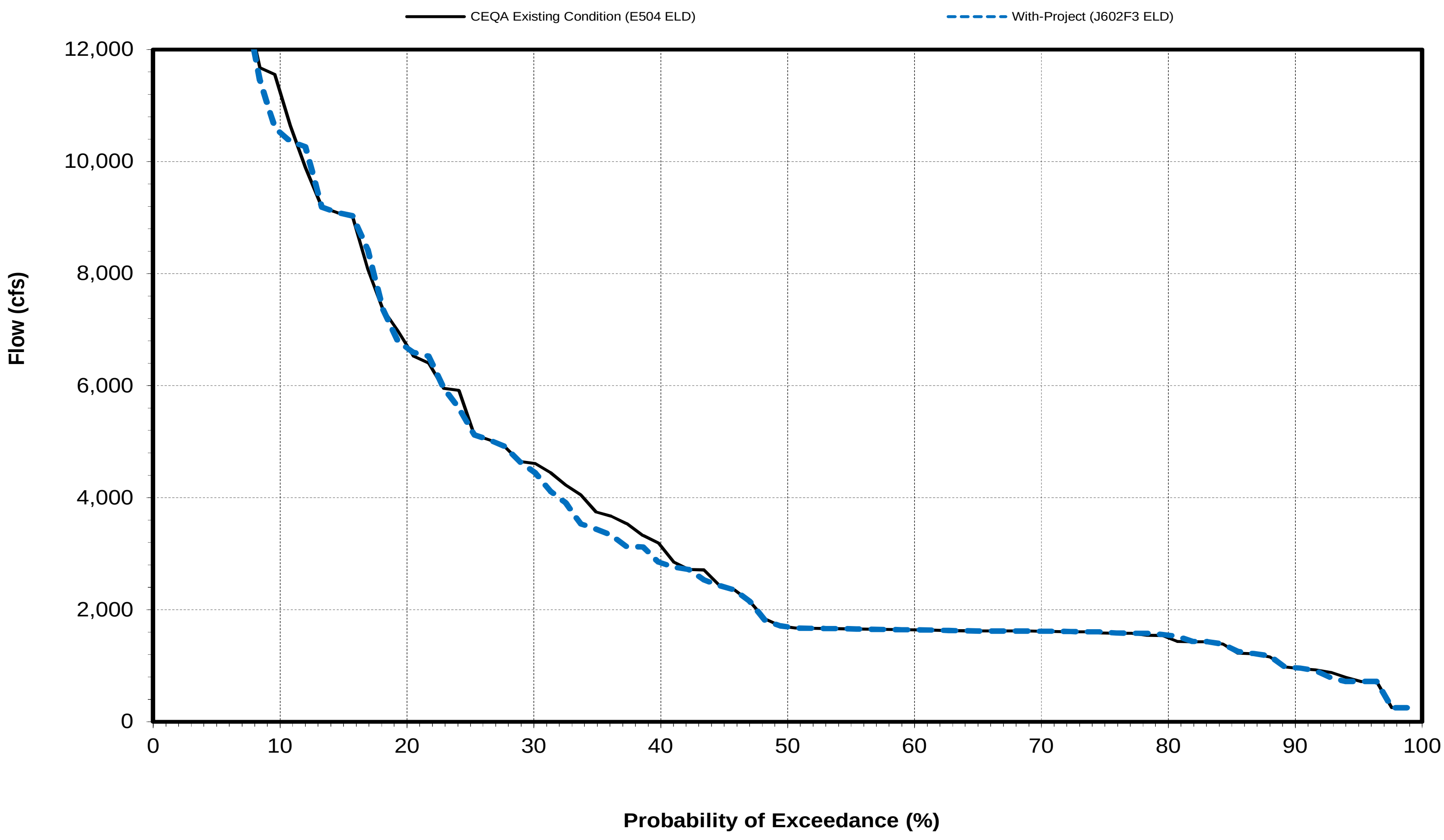
Lower American River Flow at the Mouth **December**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

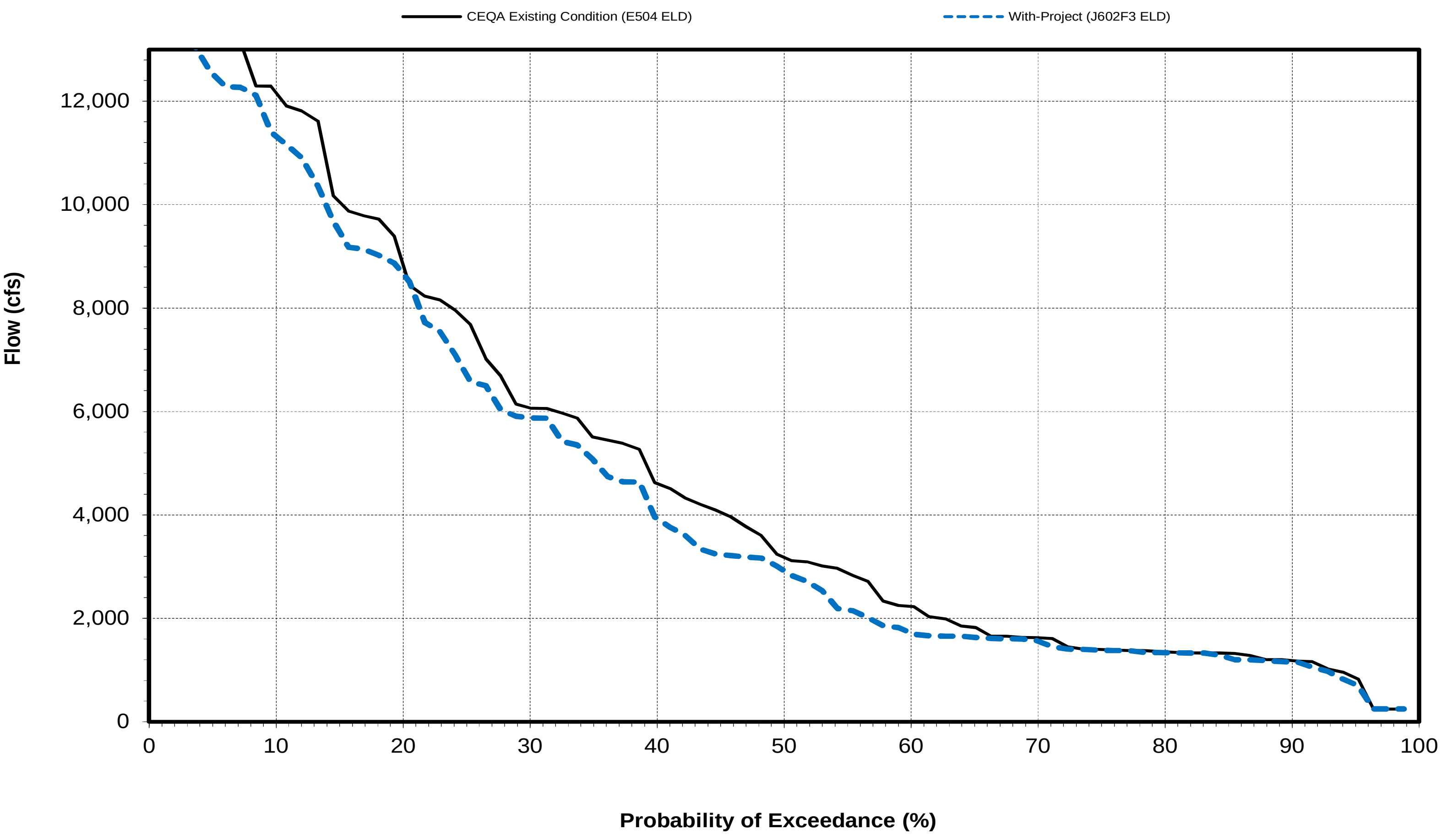
Lower American River Flow at the Mouth **January**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

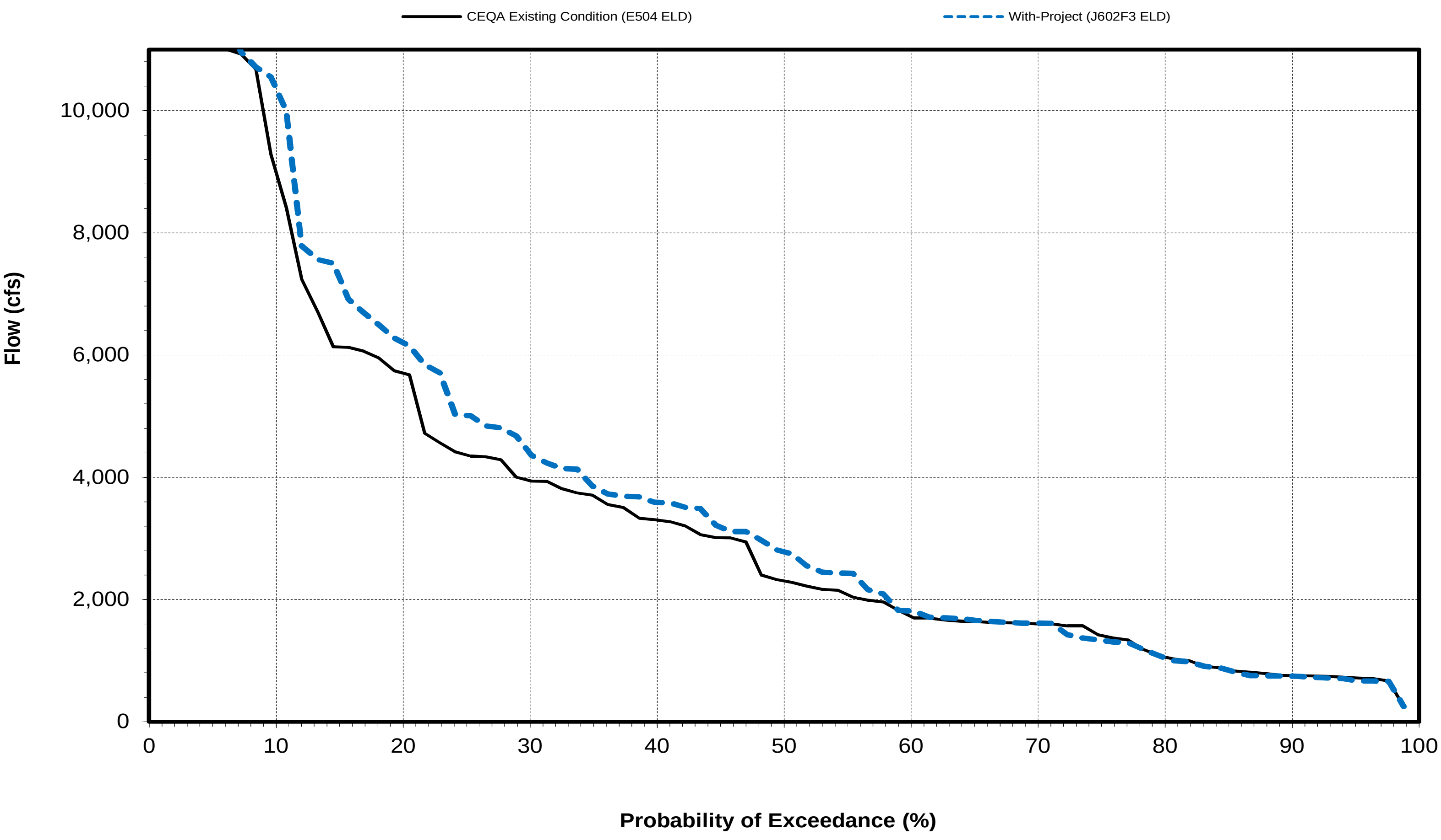
Created: 7/26/2016

Lower American River Flow at the Mouth **February**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Lower American River Flow at the Mouth **March**

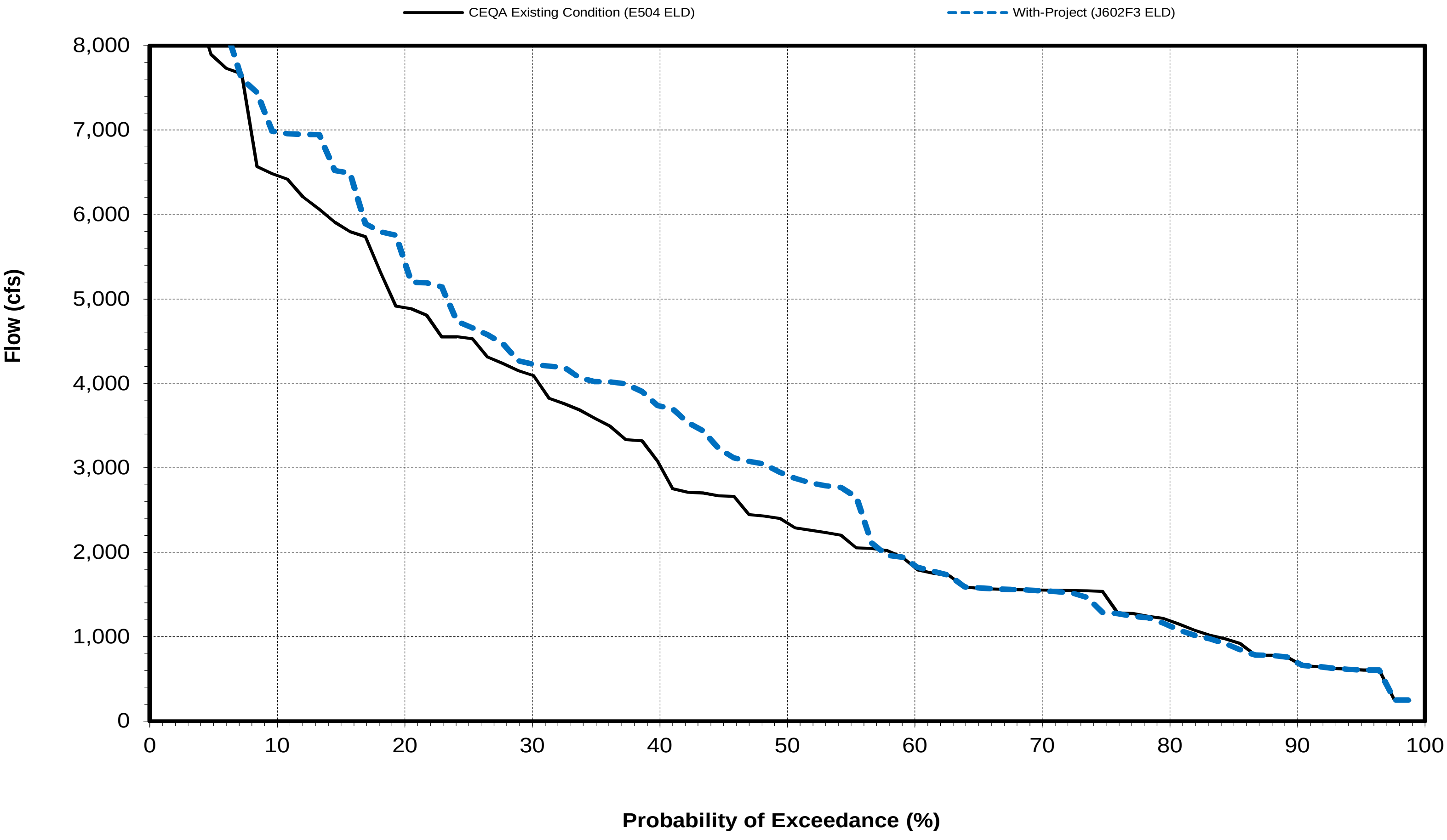


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Lower American River Flow at the Mouth

April

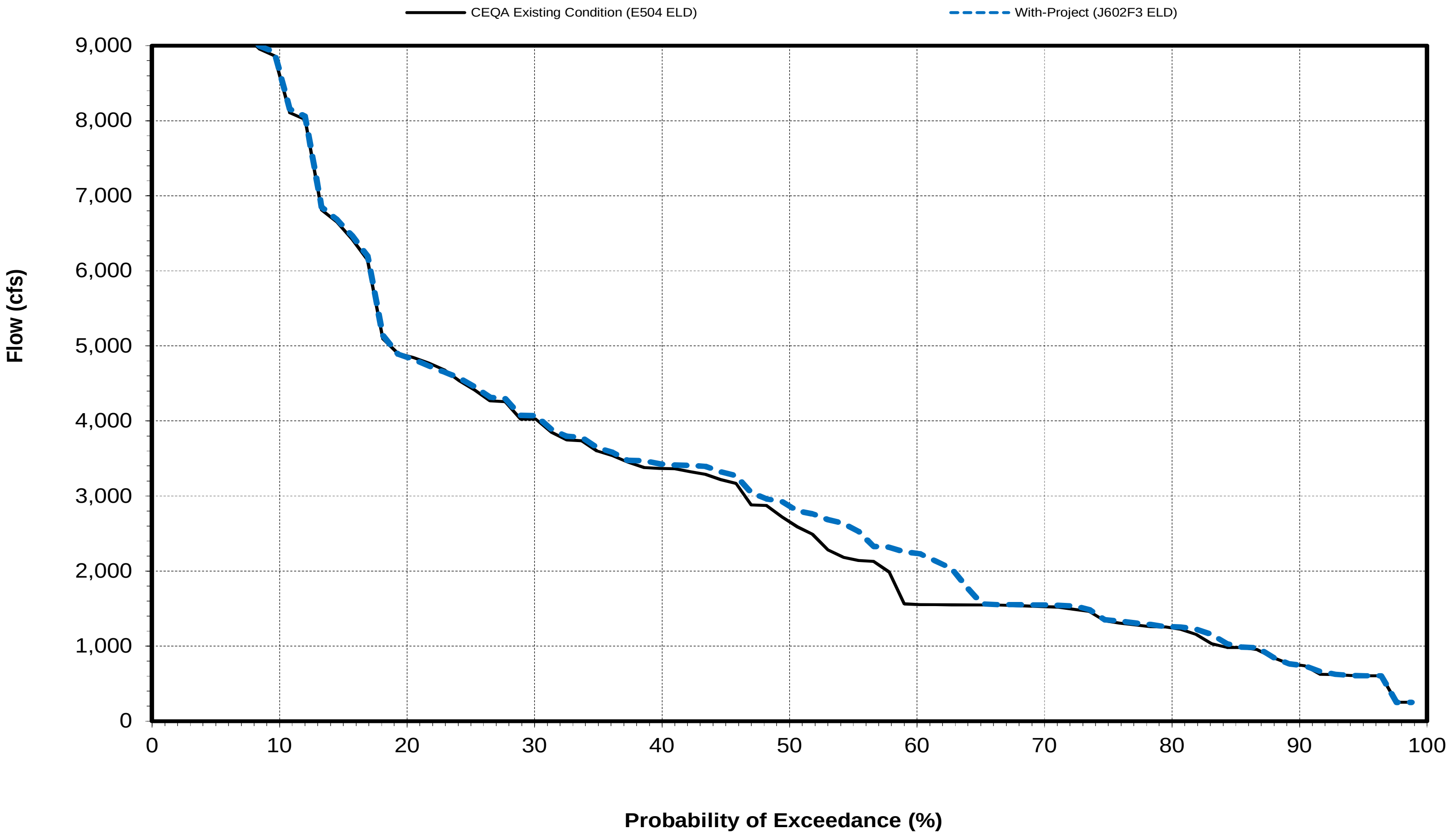


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

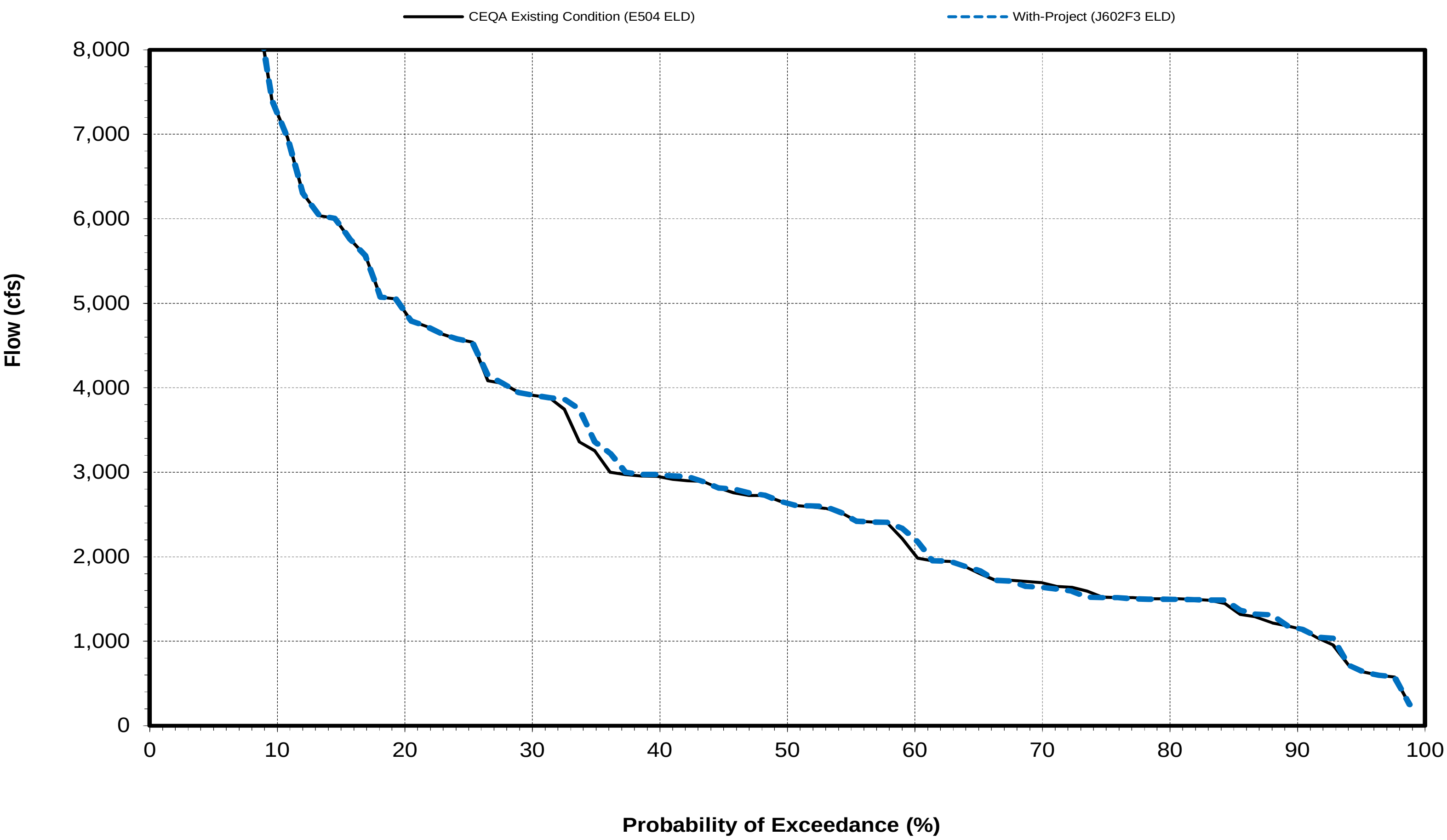
Lower American River Flow at the Mouth

May



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

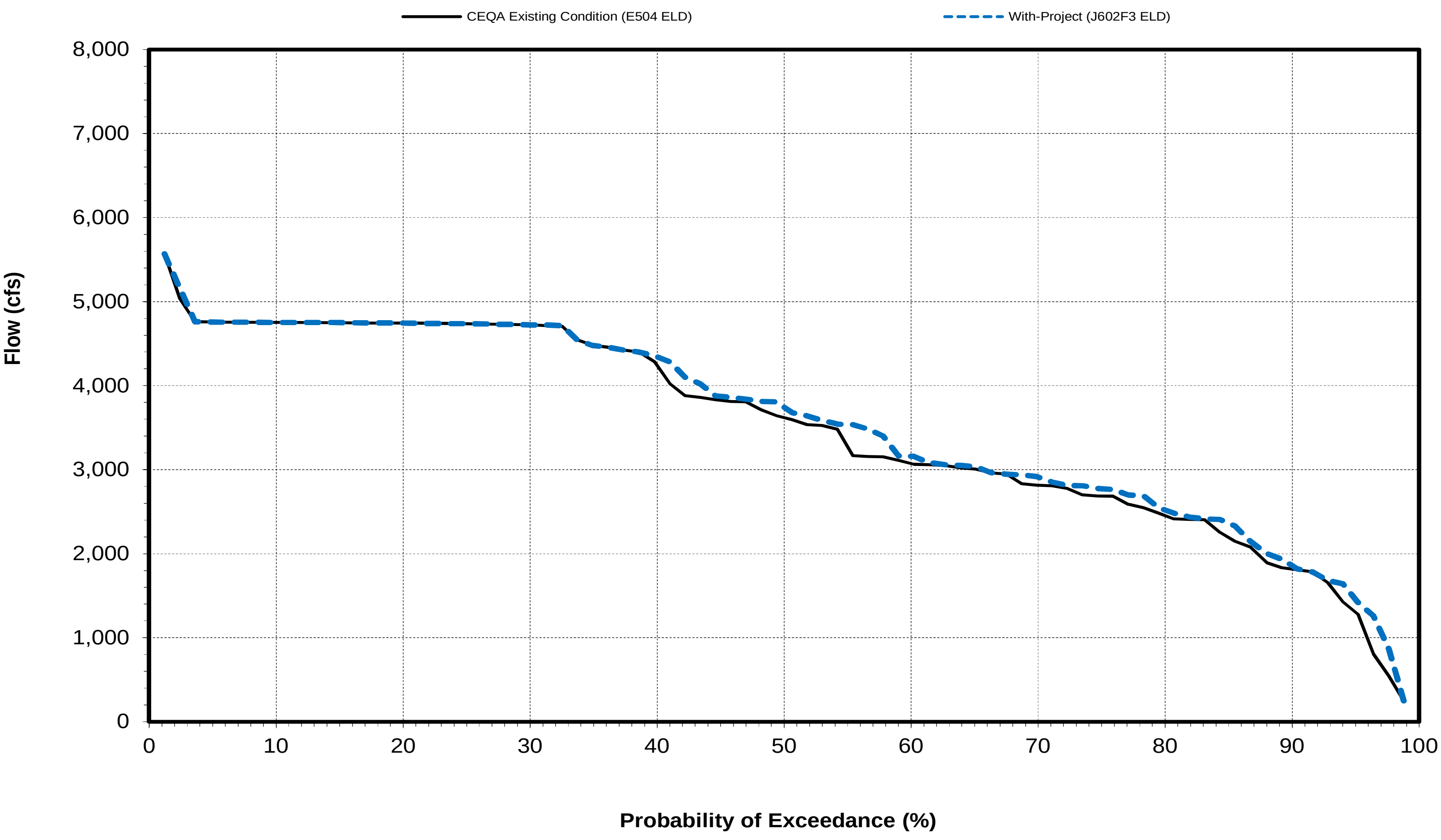
Lower American River Flow at the Mouth **June**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

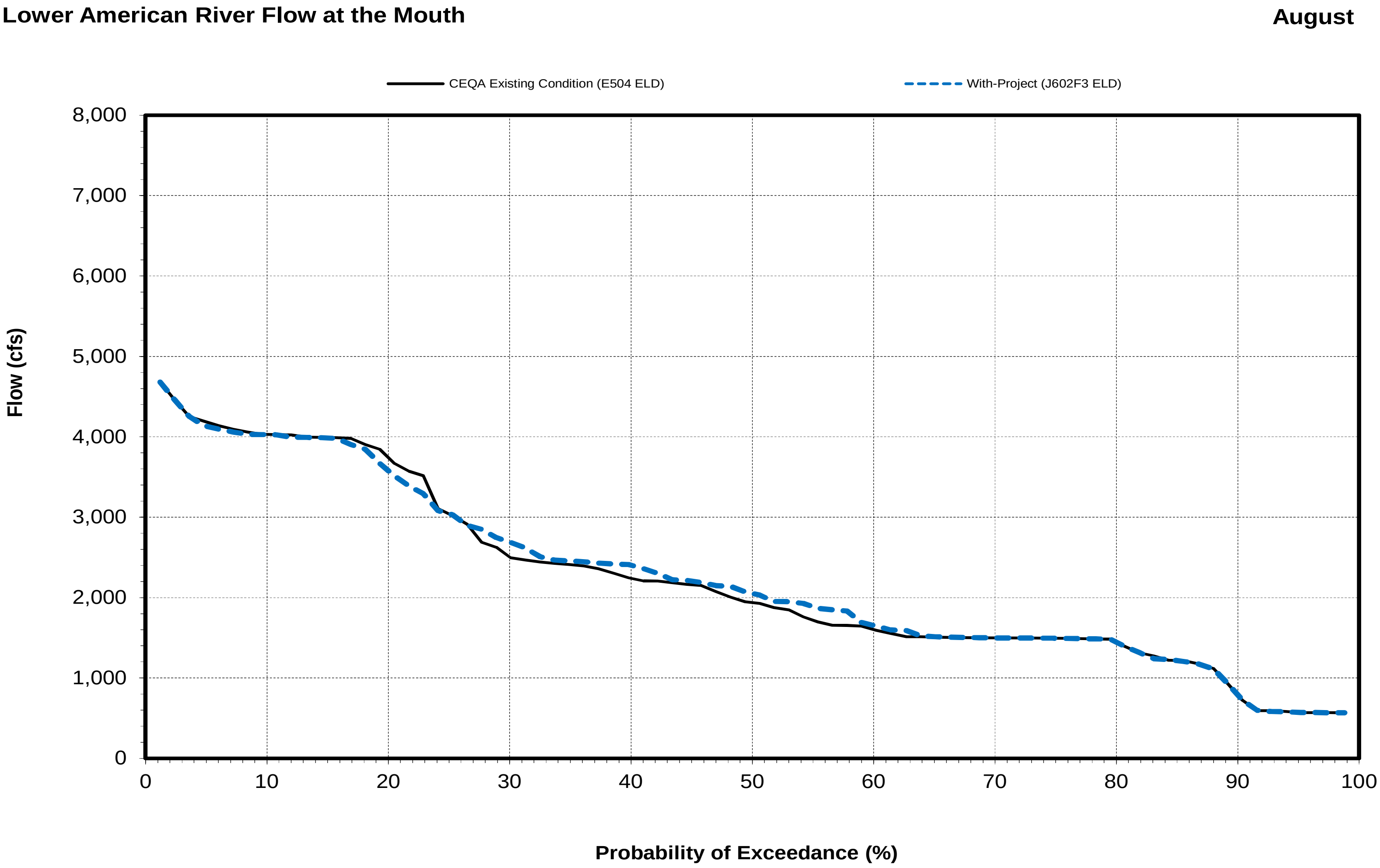
Lower American River Flow at the Mouth

July



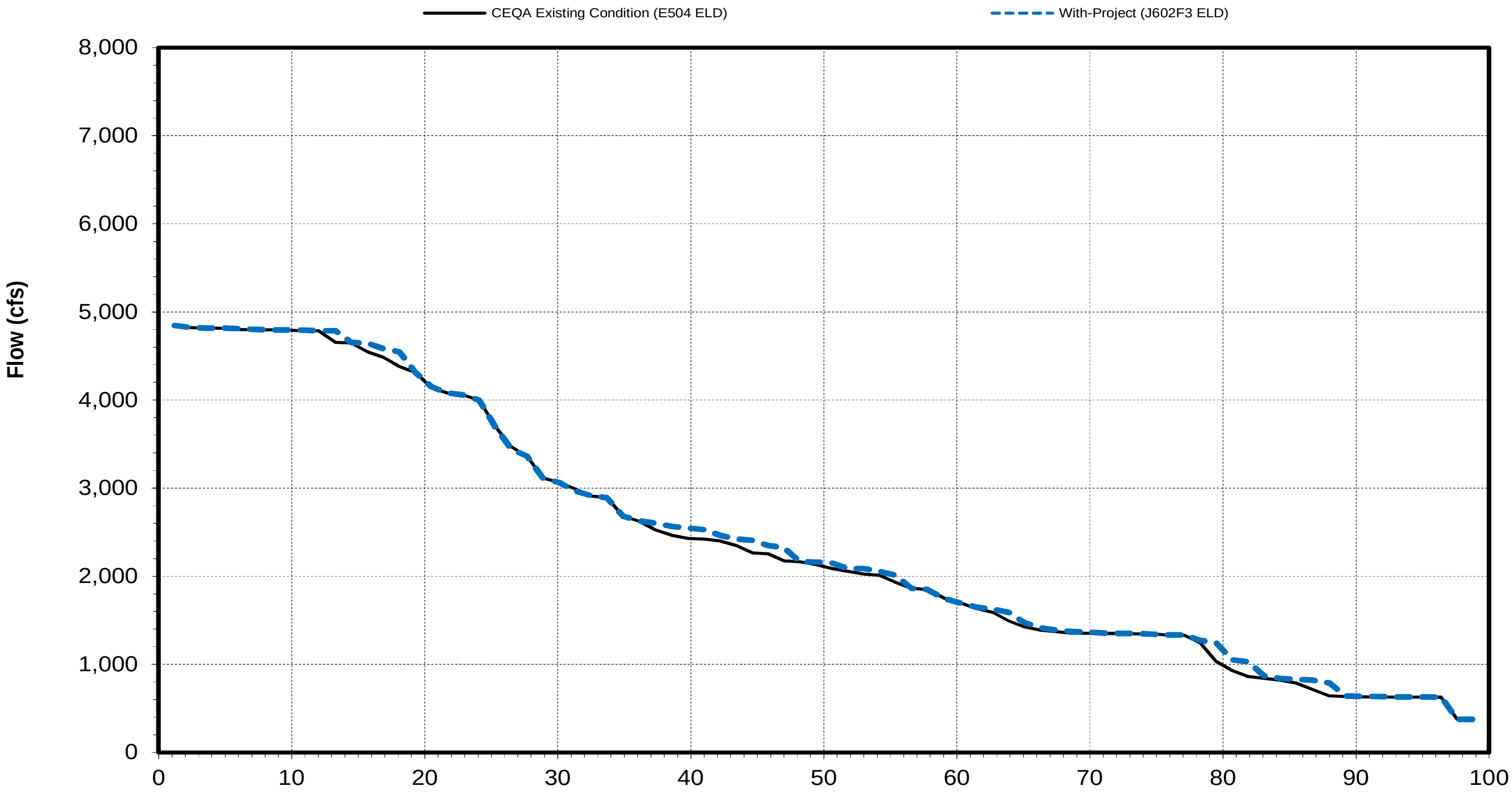
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Lower American River Flow at the Mouth **September**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Long-term and Water Year Type Average of Shasta Reservoir End of Month Storage Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Storage (TAF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	2,592	2,551	2,722	2,999	3,275	3,636	3,933	3,958	3,657	3,178	2,857	2,674
With-Project (J602F3 ELD)	2,593	2,552	2,722	2,997	3,273	3,633	3,929	3,954	3,655	3,179	2,856	2,673
Difference	1	1	0	-2	-2	-3	-4	-4	-2	1	-1	-1
Percent Difference[3]	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	2,823	2,832	3,127	3,416	3,640	3,860	4,315	4,471	4,285	3,876	3,525	3,111
With-Project (J602F3 ELD)	2,829	2,837	3,131	3,419	3,640	3,861	4,316	4,470	4,283	3,873	3,522	3,109
Difference	6	5	4	3	0	1	1	-1	-2	-3	-3	-2
Percent Difference	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
Above Normal												
CEQA Existing Condition (E504 ELD)	2,526	2,466	2,629	3,125	3,400	3,969	4,412	4,474	4,118	3,539	3,211	3,058
With-Project (J602F3 ELD)	2,531	2,472	2,632	3,128	3,403	3,971	4,414	4,470	4,116	3,535	3,208	3,052
Difference	5	6	3	3	3	2	2	-4	-2	-4	-3	-6
Percent Difference	0.2	0.2	0.1	0.1	0.1	0.1	0.0	-0.1	0.0	-0.1	-0.1	-0.2
Below Normal												
CEQA Existing Condition (E504 ELD)	2,624	2,548	2,614	2,940	3,288	3,685	4,057	4,075	3,741	3,236	2,920	2,851
With-Project (J602F3 ELD)	2,624	2,550	2,616	2,942	3,292	3,689	4,061	4,079	3,753	3,241	2,928	2,859
Difference	0	2	2	2	4	4	4	4	12	5	8	8
Percent Difference	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.3	0.3
Dry												
CEQA Existing Condition (E504 ELD)	2,537	2,505	2,661	2,836	3,206	3,688	3,829	3,741	3,372	2,861	2,559	2,510
With-Project (J602F3 ELD)	2,533	2,500	2,655	2,828	3,196	3,676	3,817	3,727	3,363	2,863	2,555	2,505
Difference	-4	-5	-6	-8	-10	-12	-12	-14	-9	2	-4	-5
Percent Difference	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.4	-0.3	0.1	-0.2	-0.2
Critical												
CEQA Existing Condition (E504 ELD)	2,202	2,103	2,160	2,281	2,450	2,685	2,634	2,523	2,166	1,717	1,428	1,381
With-Project (J602F3 ELD)	2,194	2,094	2,149	2,270	2,439	2,673	2,623	2,514	2,158	1,719	1,431	1,382
Difference	-8	-9	-11	-11	-11	-12	-11	-9	-8	2	3	1
Percent Difference	-0.4	-0.4	-0.5	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	0.1	0.2	0.1

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

Shasta Reservoir End of Month Storage - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3250	3250	0	0.0
2.4	3250	3250	0	0.0
3.6	3250	3250	0	0.0
4.8	3250	3250	0	0.0
6.0	3250	3250	0	0.0
7.2	3250	3250	0	0.0
8.4	3250	3250	0	0.0
9.6	3250	3250	0	0.0
10.8	3244	3244	0	0.0
12.0	3213	3213	0	0.0
13.3	3208	3208	0	0.0
14.5	3203	3203	0	0.0
15.7	3201	3200	-1	0.0
16.9	3200	3200	0	0.0
18.1	3200	3200	0	0.0
19.3	3195	3196	1	0.0
20.5	3191	3186	-5	-0.2
21.7	3179	3179	0	0.0
22.9	3178	3178	0	0.0
24.1	3152	3147	-5	-0.2
25.3	3118	3118	0	0.0
26.5	3110	3109	-1	0.0
27.7	3096	3090	-6	-0.2
28.9	3083	3086	3	0.1
30.1	3069	3083	14	0.5
31.3	3060	3069	9	0.3
32.5	3054	3054	0	0.0
33.7	3049	3053	4	0.1
34.9	3030	3024	-6	-0.2
36.1	3024	3003	-21	-0.7
37.3	3003	2964	-39	-1.3
38.6	2975	2955	-20	-0.7
39.8	2941	2941	0	0.0
41.0	2917	2915	-2	-0.1
42.2	2904	2915	11	0.4
43.4	2880	2902	22	0.8
44.6	2867	2863	-4	-0.1
45.8	2866	2861	-5	-0.2
47.0	2861	2852	-9	-0.3
48.2	2823	2831	8	0.3
49.4	2821	2820	-1	0.0
50.6	2793	2778	-15	-0.5
51.8	2780	2765	-15	-0.5
53.0	2759	2759	0	0.0
54.2	2738	2751	13	0.5
55.4	2732	2738	6	0.2
56.6	2713	2717	4	0.1
57.8	2699	2706	7	0.3
59.0	2685	2702	17	0.6
60.2	2677	2677	0	0.0
61.4	2664	2675	11	0.4
62.7	2601	2615	14	0.5
63.9	2586	2602	16	0.6
65.1	2568	2585	17	0.7
66.3	2556	2567	11	0.4
67.5	2532	2532	0	0.0
68.7	2517	2520	3	0.1
69.9	2464	2465	1	0.0
71.1	2433	2438	5	0.2
72.3	2421	2414	-7	-0.3
73.5	2406	2403	-3	-0.1
74.7	2403	2394	-9	-0.4
75.9	2294	2319	25	1.1
77.1	2277	2281	4	0.2
78.3	2233	2205	-28	-1.3
79.5	2140	2164	24	1.1
80.7	2110	2147	37	1.8
81.9	2104	2102	-2	-0.1
83.1	2033	2029	-4	-0.2
84.3	1967	2008	41	2.1
85.5	1823	1824	1	0.1
86.7	1783	1804	21	1.2
88.0	1699	1677	-22	-1.3
89.2	1457	1465	8	0.5
90.4	1435	1441	6	0.4
91.6	1158	1159	1	0.1
92.8	1071	1047	-24	-2.2
94.0	892	850	-42	-4.7
95.2	650	650	0	0.0
96.4	633	633	0	0.0
97.6	570	575	5	0.9
98.8	558	558	0	0.0
Min	558	558	-42	-4.7
Max	3250	3250	41	2.1
Mean	2592	2593	1	0.0
Median	2807	2799	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		25.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3252	3252	0	0.0
2.4	3252	3252	0	0.0
3.6	3252	3252	0	0.0
4.8	3252	3252	0	0.0
6.0	3252	3252	0	0.0
7.2	3252	3252	0	0.0
8.4	3252	3252	0	0.0
9.6	3252	3252	0	0.0
10.8	3252	3252	0	0.0
12.0	3252	3252	0	0.0
13.3	3223	3241	18	0.6
14.5	3219	3218	-1	0.0
15.7	3205	3206	1	0.0
16.9	3169	3169	0	0.0
18.1	3150	3149	-1	0.0
19.3	3071	3071	0	0.0
20.5	3050	3050	0	0.0
21.7	3000	3011	11	0.4
22.9	2994	2994	0	0.0
24.1	2971	2972	1	0.0
25.3	2960	2966	6	0.2
26.5	2956	2960	4	0.1
27.7	2937	2949	12	0.4
28.9	2929	2930	1	0.0
30.1	2915	2911	-4	-0.1
31.3	2904	2903	-1	0.0
32.5	2881	2881	0	0.0
33.7	2880	2879	-1	0.0
34.9	2877	2877	0	0.0
36.1	2847	2857	10	0.4
37.3	2840	2848	8	0.3
38.6	2837	2846	9	0.3
39.8	2828	2837	9	0.3
41.0	2822	2836	14	0.5
42.2	2815	2815	0	0.0
43.4	2800	2800	0	0.0
44.6	2791	2797	6	0.2
45.8	2780	2781	1	0.0
47.0	2769	2770	1	0.0
48.2	2750	2755	5	0.2
49.4	2745	2750	5	0.2
50.6	2736	2744	8	0.3
51.8	2726	2736	10	0.4
53.0	2724	2736	12	0.4
54.2	2722	2722	0	0.0
55.4	2721	2713	-8	-0.3
56.6	2694	2688	-6	-0.2
57.8	2692	2680	-12	-0.4
59.0	2676	2676	0	0.0
60.2	2653	2660	7	0.3
61.4	2646	2646	0	0.0
62.7	2643	2644	1	0.0
63.9	2641	2644	3	0.1
65.1	2621	2621	0	0.0
66.3	2595	2547	-48	-1.8
67.5	2555	2545	-10	-0.4
68.7	2513	2544	31	1.2
69.9	2491	2513	22	0.9
71.1	2489	2489	0	0.0
72.3	2482	2481	-1	0.0
73.5	2444	2429	-15	-0.6
74.7	2416	2417	1	0.0
75.9	2380	2384	4	0.2
77.1	2293	2299	6	0.3
78.3	2254	2189	-65	-2.9
79.5	2164	2128	-36	-1.7
80.7	2054	2064	10	0.5
81.9	2016	2013	-3	-0.1
83.1	2008	2013	5	0.2
84.3	1951	1983	32	1.6
85.5	1901	1879	-22	-1.2
86.7	1756	1756	0	0.0
88.0	1723	1745	22	1.3
89.2	1379	1384	5	0.4
90.4	1319	1320	1	0.1
91.6	1309	1311	2	0.2
92.8	1040	1016	-24	-2.3
94.0	843	781	-62	-7.4
95.2	649	670	21	3.2
96.4	638	642	4	0.6
97.6	615	638	23	3.7
98.8	597	597	0	0.0
Min	597	597	-65	-7.4
Max	3252	3252	32	3.7
Mean	2551	2552	0	0.0
Median	2741	2747	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3360	3360	0	0.0
2.4	3355	3354	-1	0.0
3.6	3349	3349	0	0.0
4.8	3349	3349	0	0.0
6.0	3346	3346	0	0.0
7.2	3338	3338	0	0.0
8.4	3335	3335	0	0.0
9.6	3328	3328	0	0.0
10.8	3322	3322	0	0.0
12.0	3320	3320	0	0.0
13.3	3319	3319	0	0.0
14.5	3317	3317	0	0.0
15.7	3316	3316	0	0.0
16.9	3310	3310	0	0.0
18.1	3309	3310	1	0.0
19.3	3306	3309	3	0.1
20.5	3293	3309	16	0.5
21.7	3291	3306	15	0.5
22.9	3285	3293	8	0.2
24.1	3276	3291	15	0.5
25.3	3275	3285	10	0.3
26.5	3267	3276	9	0.3
27.7	3265	3267	2	0.1
28.9	3253	3265	12	0.4
30.1	3252	3252	0	0.0
31.3	3252	3252	0	0.0
32.5	3252	3252	0	0.0
33.7	3223	3223	0	0.0
34.9	3202	3200	-2	-0.1
36.1	3181	3181	0	0.0
37.3	3146	3146	0	0.0
38.6	3142	3138	-4	-0.1
39.8	3119	3128	9	0.3
41.0	3100	3102	2	0.1
42.2	3099	3100	1	0.0
43.4	3077	3094	17	0.6
44.6	3055	3092	37	1.2
45.8	3051	3055	4	0.1
47.0	3037	3052	15	0.5
48.2	3031	3027	-4	-0.1
49.4	3022	3022	0	0.0
50.6	3018	3018	0	0.0
51.8	2972	2972	0	0.0
53.0	2913	2919	6	0.2
54.2	2890	2891	1	0.0
55.4	2838	2839	1	0.0
56.6	2830	2819	-11	-0.4
57.8	2817	2817	0	0.0
59.0	2776	2763	-13	-0.5
60.2	2762	2745	-17	-0.6
61.4	2746	2726	-20	-0.7
62.7	2733	2703	-30	-1.1
63.9	2703	2687	-16	-0.6
65.1	2687	2670	-17	-0.6
66.3	2670	2670	0	0.0
67.5	2656	2622	-34	-1.3
68.7	2575	2574	-1	0.0
69.9	2535	2540	5	0.2
71.1	2505	2508	3	0.1
72.3	2469	2480	11	0.4
73.5	2465	2469	4	0.2
74.7	2449	2449	0	0.0
75.9	2432	2420	-12	-0.5
77.1	2420	2417	-3	-0.1
78.3	2364	2364	0	0.0
79.5	2299	2310	11	0.5
80.7	2299	2299	0	0.0
81.9	2243	2154	-89	-4.0
83.1	2153	2150	-3	-0.1
84.3	2129	2113	-16	-0.8
85.5	1984	1997	13	0.7
86.7	1935	1961	26	1.3
88.0	1716	1738	22	1.3
89.2	1435	1436	1	0.1
90.4	1425	1431	6	0.4
91.6	1306	1308	2	0.2
92.8	1033	1032	-1	-0.1
94.0	1029	1005	-24	-2.3
95.2	967	904	-63	-6.5
96.4	839	867	28	3.3
97.6	816	816	0	0.0
98.8	684	705	21	3.1
Min	684	705	-89	-6.5
Max	3360	3360	37	3.3
Mean	2722	2722	-1	0.0
Median	3020	3020	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	65.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3678	3678	0	0.0
2.4	3650	3650	0	0.0
3.6	3648	3648	0	0.0
4.8	3640	3640	0	0.0
6.0	3624	3624	0	0.0
7.2	3624	3624	0	0.0
8.4	3622	3622	0	0.0
9.6	3616	3616	0	0.0
10.8	3604	3604	0	0.0
12.0	3587	3587	0	0.0
13.3	3552	3552	0	0.0
14.5	3552	3552	0	0.0
15.7	3551	3551	0	0.0
16.9	3547	3547	0	0.0
18.1	3541	3542	1	0.0
19.3	3531	3541	10	0.3
20.5	3528	3531	3	0.1
21.7	3515	3528	13	0.4
22.9	3515	3515	0	0.0
24.1	3506	3515	9	0.3
25.3	3477	3509	32	0.9
26.5	3475	3506	31	0.9
27.7	3461	3461	0	0.0
28.9	3453	3454	1	0.0
30.1	3444	3443	-1	0.0
31.3	3435	3428	-7	-0.2
32.5	3389	3389	0	0.0
33.7	3382	3382	0	0.0
34.9	3371	3371	0	0.0
36.1	3368	3368	0	0.0
37.3	3366	3366	0	0.0
38.6	3358	3364	6	0.2
39.8	3339	3358	19	0.6
41.0	3330	3339	9	0.3
42.2	3317	3317	0	0.0
43.4	3276	3271	-5	-0.2
44.6	3252	3252	0	0.0
45.8	3252	3252	0	0.0
47.0	3252	3252	0	0.0
48.2	3252	3252	0	0.0
49.4	3252	3252	0	0.0
50.6	3228	3229	1	0.0
51.8	3219	3216	-3	-0.1
53.0	3216	3203	-13	-0.4
54.2	3203	3194	-9	-0.3
55.4	3179	3179	0	0.0
56.6	3117	3118	1	0.0
57.8	3084	3088	4	0.1
59.0	3058	3064	6	0.2
60.2	3056	3045	-11	-0.4
61.4	3048	3030	-18	-0.6
62.7	3041	3028	-13	-0.4
63.9	3032	2988	-44	-1.5
65.1	2988	2959	-29	-1.0
66.3	2959	2950	-9	-0.3
67.5	2946	2946	0	0.0
68.7	2935	2934	-1	0.0
69.9	2927	2928	1	0.0
71.1	2882	2859	-23	-0.8
72.3	2859	2857	-2	-0.1
73.5	2808	2769	-39	-1.4
74.7	2776	2760	-16	-0.6
75.9	2730	2754	24	0.9
77.1	2711	2744	33	1.2
78.3	2661	2661	0	0.0
79.5	2629	2629	0	0.0
80.7	2592	2591	-1	0.0
81.9	2501	2501	0	0.0
83.1	2500	2500	0	0.0
84.3	2373	2395	22	0.9
85.5	2325	2315	-10	-0.4
86.7	2316	2195	-121	-5.2
88.0	2104	2129	25	1.2
89.2	2086	2064	-22	-1.1
90.4	1843	1905	62	3.4
91.6	1700	1700	0	0.0
92.8	1484	1511	27	1.8
94.0	1341	1343	2	0.1
95.2	1252	1190	-62	-5.0
96.4	1056	1032	-24	-2.3
97.6	1038	1014	-24	-2.3
98.8	956	977	21	2.2
Min	956	977	-121	-5.2
Max	3678	3678	62	3.4
Mean	2999	2997	-2	-0.1
Median	3240	3241	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		25.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		10.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	4433	4433	0	0.0
2.4	4022	4022	0	0.0
3.6	3994	3994	0	0.0
4.8	3944	3944	0	0.0
6.0	3920	3920	0	0.0
7.2	3914	3914	0	0.0
8.4	3901	3900	-1	0.0
9.6	3852	3852	0	0.0
10.8	3848	3848	0	0.0
12.0	3848	3848	0	0.0
13.3	3818	3811	-7	-0.2
14.5	3812	3811	-1	0.0
15.7	3805	3805	0	0.0
16.9	3794	3794	0	0.0
18.1	3777	3777	0	0.0
19.3	3772	3772	0	0.0
20.5	3743	3743	0	0.0
21.7	3739	3739	0	0.0
22.9	3737	3738	1	0.0
24.1	3735	3724	-11	-0.3
25.3	3713	3713	0	0.0
26.5	3694	3694	0	0.0
27.7	3675	3675	0	0.0
28.9	3661	3661	0	0.0
30.1	3654	3654	0	0.0
31.3	3654	3654	0	0.0
32.5	3647	3636	-11	-0.3
33.7	3636	3627	-9	-0.2
34.9	3611	3612	1	0.0
36.1	3570	3570	0	0.0
37.3	3567	3567	0	0.0
38.6	3560	3560	0	0.0
39.8	3530	3530	0	0.0
41.0	3524	3518	-6	-0.2
42.2	3516	3517	1	0.0
43.4	3503	3516	13	0.4
44.6	3493	3503	10	0.3
45.8	3482	3493	11	0.3
47.0	3480	3480	0	0.0
48.2	3463	3462	-1	0.0
49.4	3462	3431	-31	-0.9
50.6	3431	3423	-8	-0.2
51.8	3423	3403	-20	-0.6
53.0	3401	3396	-5	-0.1
54.2	3389	3373	-16	-0.5
55.4	3373	3366	-7	-0.2
56.6	3361	3362	1	0.0
57.8	3334	3334	0	0.0
59.0	3322	3322	0	0.0
60.2	3298	3296	-2	-0.1
61.4	3296	3294	-2	-0.1
62.7	3292	3292	0	0.0
63.9	3288	3288	0	0.0
65.1	3286	3288	2	0.1
66.3	3282	3286	4	0.1
67.5	3282	3282	0	0.0
68.7	3255	3276	21	0.6
69.9	3255	3256	1	0.0
71.1	3252	3252	0	0.0
72.3	3252	3252	0	0.0
73.5	3252	3252	0	0.0
74.7	3252	3252	0	0.0
75.9	3148	3100	-48	-1.5
77.1	3081	3081	0	0.0
78.3	2933	2902	-31	-1.1
79.5	2901	2901	0	0.0
80.7	2895	2895	0	0.0
81.9	2817	2851	34	1.2
83.1	2814	2817	3	0.1
84.3	2808	2814	6	0.2
85.5	2802	2802	0	0.0
86.7	2413	2354	-59	-2.4
88.0	2355	2283	-72	-3.1
89.2	2208	2235	27	1.2
90.4	2190	2209	19	0.9
91.6	2184	2167	-17	-0.8
92.8	1984	1986	2	0.1
94.0	1873	1935	62	3.3
95.2	1568	1505	-63	-4.0
96.4	1284	1305	21	1.6
97.6	1172	1149	-23	-2.0
98.8	1075	1051	-24	-2.2
Min	1075	1051	-72	-4.0
Max	4433	4433	62	3.3
Mean	3275	3273	-3	-0.1
Median	3447	3427	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	45.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		35.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	4411	4411	0	0.0
2.4	4280	4280	0	0.0
3.6	4253	4253	0	0.0
4.8	4249	4249	0	0.0
6.0	4246	4246	0	0.0
7.2	4229	4229	0	0.0
8.4	4226	4226	0	0.0
9.6	4226	4226	0	0.0
10.8	4221	4221	0	0.0
12.0	4221	4221	0	0.0
13.3	4199	4199	0	0.0
14.5	4162	4162	0	0.0
15.7	4129	4129	0	0.0
16.9	4124	4124	0	0.0
18.1	4118	4118	0	0.0
19.3	4106	4106	0	0.0
20.5	4105	4105	0	0.0
21.7	4086	4086	0	0.0
22.9	4071	4071	0	0.0
24.1	4066	4040	-26	-0.6
25.3	4045	4033	-12	-0.3
26.5	4033	4030	-3	-0.1
27.7	4030	4022	-8	-0.2
28.9	4022	4021	-1	0.0
30.1	4021	4010	-11	-0.3
31.3	4010	4000	-10	-0.2
32.5	4000	3981	-19	-0.5
33.7	3980	3980	0	0.0
34.9	3977	3976	-1	0.0
36.1	3976	3969	-7	-0.2
37.3	3970	3966	-4	-0.1
38.6	3965	3965	0	0.0
39.8	3960	3960	0	0.0
41.0	3956	3957	1	0.0
42.2	3953	3953	0	0.0
43.4	3940	3940	0	0.0
44.6	3940	3940	0	0.0
45.8	3884	3874	-10	-0.3
47.0	3874	3873	-1	0.0
48.2	3873	3838	-35	-0.9
49.4	3859	3836	-23	-0.6
50.6	3823	3819	-4	-0.1
51.8	3817	3813	-4	-0.1
53.0	3795	3795	0	0.0
54.2	3791	3791	0	0.0
55.4	3778	3778	0	0.0
56.6	3762	3763	1	0.0
57.8	3756	3756	0	0.0
59.0	3682	3691	9	0.2
60.2	3681	3685	4	0.1
61.4	3667	3681	14	0.4
62.7	3664	3675	11	0.3
63.9	3662	3667	5	0.1
65.1	3651	3662	11	0.3
66.3	3567	3572	5	0.1
67.5	3551	3545	-6	-0.2
68.7	3534	3534	0	0.0
69.9	3504	3504	0	0.0
71.1	3458	3462	4	0.1
72.3	3455	3458	3	0.1
73.5	3435	3435	0	0.0
74.7	3417	3417	0	0.0
75.9	3417	3417	0	0.0
77.1	3416	3416	0	0.0
78.3	3416	3416	0	0.0
79.5	3416	3416	0	0.0
80.7	3398	3398	0	0.0
81.9	3263	3268	5	0.2
83.1	3177	3155	-22	-0.7
84.3	3073	3116	43	1.4
85.5	3069	3029	-40	-1.3
86.7	2987	2987	0	0.0
88.0	2837	2862	25	0.9
89.2	2837	2834	-3	-0.1
90.4	2581	2451	-130	-5.0
91.6	2423	2431	8	0.3
92.8	2322	2361	39	1.7
94.0	2299	2321	22	1.0
95.2	1821	1759	-62	-3.4
96.4	1678	1700	22	1.3
97.6	1672	1648	-24	-1.4
98.8	1630	1606	-24	-1.5
Min	1630	1606	-130	-5.0
Max	4411	4411	43	1.7
Mean	3636	3633	-3	-0.1
Median	3841	3828	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	90.2
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	4552	4552	0	0.0
2.4	4552	4552	0	0.0
3.6	4552	4552	0	0.0
4.8	4552	4552	0	0.0
6.0	4552	4552	0	0.0
7.2	4552	4552	0	0.0
8.4	4546	4546	0	0.0
9.6	4541	4541	0	0.0
10.8	4522	4522	0	0.0
12.0	4503	4503	0	0.0
13.3	4500	4500	0	0.0
14.5	4497	4497	0	0.0
15.7	4489	4484	-5	-0.1
16.9	4479	4479	0	0.0
18.1	4472	4469	-3	-0.1
19.3	4461	4461	0	0.0
20.5	4456	4456	0	0.0
21.7	4451	4451	0	0.0
22.9	4437	4437	0	0.0
24.1	4434	4434	0	0.0
25.3	4432	4432	0	0.0
26.5	4424	4415	-9	-0.2
27.7	4416	4413	-3	-0.1
28.9	4400	4400	0	0.0
30.1	4380	4380	0	0.0
31.3	4374	4378	4	0.1
32.5	4367	4367	0	0.0
33.7	4341	4341	0	0.0
34.9	4329	4329	0	0.0
36.1	4324	4325	1	0.0
37.3	4304	4324	20	0.5
38.6	4299	4299	0	0.0
39.8	4298	4296	-2	0.0
41.0	4292	4292	0	0.0
42.2	4290	4290	0	0.0
43.4	4289	4289	0	0.0
44.6	4284	4261	-23	-0.5
45.8	4257	4229	-28	-0.7
47.0	4230	4217	-13	-0.3
48.2	4217	4205	-12	-0.3
49.4	4173	4173	0	0.0
50.6	4142	4152	10	0.2
51.8	4137	4137	0	0.0
53.0	4131	4131	0	0.0
54.2	4130	4131	1	0.0
55.4	4094	4094	0	0.0
56.6	4074	4074	0	0.0
57.8	4058	4060	2	0.0
59.0	4044	4058	14	0.3
60.2	4033	4044	11	0.3
61.4	4029	4030	1	0.0
62.7	4028	4006	-22	-0.5
63.9	4012	4005	-7	-0.2
65.1	3967	3963	-4	-0.1
66.3	3964	3957	-7	-0.2
67.5	3945	3950	5	0.1
68.7	3926	3919	-7	-0.2
69.9	3919	3908	-11	-0.3
71.1	3913	3906	-7	-0.2
72.3	3897	3900	3	0.1
73.5	3878	3897	19	0.5
74.7	3809	3793	-16	-0.4
75.9	3772	3762	-10	-0.3
77.1	3759	3758	-1	0.0
78.3	3735	3735	0	0.0
79.5	3647	3642	-5	-0.1
80.7	3536	3556	20	0.6
81.9	3531	3505	-26	-0.7
83.1	3261	3267	6	0.2
84.3	3210	3188	-22	-0.7
85.5	3086	3050	-36	-1.2
86.7	3031	3032	1	0.0
88.0	2893	2936	43	1.5
89.2	2719	2740	21	0.8
90.4	2673	2681	8	0.3
91.6	2601	2599	-2	-0.1
92.8	2461	2522	61	2.5
94.0	2285	2156	-129	-5.6
95.2	1934	1933	-1	-0.1
96.4	1849	1825	-24	-1.3
97.6	1803	1740	-63	-3.5
98.8	1741	1718	-23	-1.3
Min	1741	1718	-129	-5.6
Max	4552	4552	61	2.5
Mean	3933	3929	-3	-0.1
Median	4158	4163	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	91.5
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	65.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	4552	4552	0	0.0
2.4	4552	4552	0	0.0
3.6	4552	4552	0	0.0
4.8	4552	4552	0	0.0
6.0	4552	4552	0	0.0
7.2	4552	4552	0	0.0
8.4	4552	4552	0	0.0
9.6	4552	4552	0	0.0
10.8	4552	4552	0	0.0
12.0	4552	4552	0	0.0
13.3	4552	4552	0	0.0
14.5	4552	4552	0	0.0
15.7	4552	4552	0	0.0
16.9	4552	4552	0	0.0
18.1	4552	4552	0	0.0
19.3	4552	4552	0	0.0
20.5	4552	4552	0	0.0
21.7	4552	4552	0	0.0
22.9	4552	4552	0	0.0
24.1	4552	4552	0	0.0
25.3	4552	4552	0	0.0
26.5	4552	4552	0	0.0
27.7	4552	4552	0	0.0
28.9	4552	4552	0	0.0
30.1	4552	4552	0	0.0
31.3	4552	4552	0	0.0
32.5	4552	4552	0	0.0
33.7	4552	4552	0	0.0
34.9	4543	4543	0	0.0
36.1	4526	4526	0	0.0
37.3	4498	4488	-10	-0.2
38.6	4488	4485	-3	-0.1
39.8	4488	4453	-35	-0.8
41.0	4452	4447	-5	-0.1
42.2	4447	4441	-6	-0.1
43.4	4428	4428	0	0.0
44.6	4428	4419	-9	-0.2
45.8	4387	4386	-1	0.0
47.0	4350	4344	-6	-0.1
48.2	4283	4289	6	0.1
49.4	4273	4277	4	0.1
50.6	4267	4262	-5	-0.1
51.8	4257	4256	-1	0.0
53.0	4221	4216	-5	-0.1
54.2	4204	4205	1	0.0
55.4	4154	4157	3	0.1
56.6	4145	4145	0	0.0
57.8	4136	4135	-1	0.0
59.0	4082	4086	4	0.1
60.2	4080	4038	-42	-1.0
61.4	4056	4036	-20	-0.5
62.7	4037	4034	-3	-0.1
63.9	3956	3963	7	0.2
65.1	3938	3950	12	0.3
66.3	3800	3802	2	0.1
67.5	3778	3794	16	0.4
68.7	3773	3772	-1	0.0
69.9	3771	3756	-15	-0.4
71.1	3699	3719	20	0.5
72.3	3698	3698	0	0.0
73.5	3689	3689	0	0.0
74.7	3621	3614	-7	-0.2
75.9	3614	3602	-12	-0.3
77.1	3605	3598	-7	-0.2
78.3	3578	3577	-1	0.0
79.5	3550	3504	-46	-1.3
80.7	3515	3455	-60	-1.7
81.9	3460	3451	-9	-0.3
83.1	3231	3210	-21	-0.6
84.3	3130	3136	6	0.2
85.5	3064	3107	43	1.4
86.7	3050	3062	12	0.4
88.0	3035	3017	-18	-0.6
89.2	2927	2927	0	0.0
90.4	2417	2478	61	2.5
91.6	2349	2359	10	0.4
92.8	2291	2289	-2	-0.1
94.0	2005	1918	-87	-4.3
95.2	1942	1896	-46	-2.4
96.4	1924	1876	-48	-2.5
97.6	1810	1809	-1	-0.1
98.8	1675	1638	-37	-2.2
Min	1675	1638	-87	-4.3
Max	4552	4552	61	2.5
Mean	3958	3954	-4	-0.2
Median	4270	4270	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	90.2
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	4500	4500	0	0.0
2.4	4500	4500	0	0.0
3.6	4500	4500	0	0.0
4.8	4500	4500	0	0.0
6.0	4500	4500	0	0.0
7.2	4500	4500	0	0.0
8.4	4500	4500	0	0.0
9.6	4500	4500	0	0.0
10.8	4467	4467	0	0.0
12.0	4466	4466	0	0.0
13.3	4461	4459	-2	0.0
14.5	4442	4442	0	0.0
15.7	4422	4422	0	0.0
16.9	4350	4351	1	0.0
18.1	4350	4350	0	0.0
19.3	4343	4343	0	0.0
20.5	4340	4340	0	0.0
21.7	4334	4334	0	0.0
22.9	4330	4331	1	0.0
24.1	4320	4320	0	0.0
25.3	4288	4289	1	0.0
26.5	4268	4266	-2	0.0
27.7	4245	4245	0	0.0
28.9	4245	4244	-1	0.0
30.1	4234	4234	0	0.0
31.3	4224	4224	0	0.0
32.5	4199	4200	1	0.0
33.7	4191	4191	0	0.0
34.9	4189	4180	-9	-0.2
36.1	4180	4168	-12	-0.3
37.3	4167	4167	0	0.0
38.6	4073	4073	0	0.0
39.8	4061	4072	11	0.3
41.0	4052	4052	0	0.0
42.2	4015	4042	27	0.7
43.4	4008	3999	-9	-0.2
44.6	3998	3991	-7	-0.2
45.8	3997	3989	-8	-0.2
47.0	3981	3980	-1	0.0
48.2	3906	3925	19	0.5
49.4	3879	3891	12	0.3
50.6	3835	3877	42	1.1
51.8	3828	3832	4	0.1
53.0	3821	3824	3	0.1
54.2	3801	3792	-9	-0.2
55.4	3789	3779	-10	-0.3
56.6	3779	3771	-8	-0.2
57.8	3742	3743	1	0.0
59.0	3730	3741	11	0.3
60.2	3727	3730	3	0.1
61.4	3695	3695	0	0.0
62.7	3651	3636	-15	-0.4
63.9	3577	3601	24	0.7
65.1	3551	3544	-7	-0.2
66.3	3446	3464	18	0.5
67.5	3441	3419	-22	-0.6
68.7	3417	3418	1	0.0
69.9	3409	3395	-14	-0.4
71.1	3408	3393	-15	-0.4
72.3	3344	3384	40	1.2
73.5	3340	3344	4	0.1
74.7	3317	3317	0	0.0
75.9	3239	3239	0	0.0
77.1	3200	3200	0	0.0
78.3	3197	3185	-12	-0.4
79.5	3137	3134	-3	-0.1
80.7	3129	3050	-79	-2.5
81.9	3070	3033	-37	-1.2
83.1	3024	2996	-28	-0.9
84.3	2919	2962	43	1.5
85.5	2722	2749	27	1.0
86.7	2679	2685	6	0.2
88.0	2650	2650	0	0.0
89.2	2638	2606	-32	-1.2
90.4	2129	2190	61	2.9
91.6	1913	1911	-2	-0.1
92.8	1790	1767	-23	-1.3
94.0	1747	1741	-6	-0.3
95.2	1730	1720	-10	-0.6
96.4	1654	1526	-128	-7.7
97.6	1352	1316	-36	-2.7
98.8	1302	1301	-1	-0.1
Min	1302	1301	-128	-7.7
Max	4500	4500	61	2.9
Mean	3657	3655	-2	-0.1
Median	3857	3884	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	4150	4150	0	0.0
2.4	4150	4150	0	0.0
3.6	4150	4150	0	0.0
4.8	4150	4150	0	0.0
6.0	4150	4150	0	0.0
7.2	4150	4150	0	0.0
8.4	4150	4150	0	0.0
9.6	4114	4114	0	0.0
10.8	4103	4103	0	0.0
12.0	4054	4054	0	0.0
13.3	4048	4048	0	0.0
14.5	4028	4028	0	0.0
15.7	3998	3998	0	0.0
16.9	3989	3987	-2	-0.1
18.1	3977	3977	0	0.0
19.3	3975	3975	0	0.0
20.5	3934	3935	1	0.0
21.7	3926	3926	0	0.0
22.9	3892	3892	0	0.0
24.1	3875	3875	0	0.0
25.3	3757	3759	2	0.1
26.5	3751	3752	1	0.0
27.7	3737	3735	-2	-0.1
28.9	3721	3722	1	0.0
30.1	3716	3717	1	0.0
31.3	3699	3699	0	0.0
32.5	3642	3641	-1	0.0
33.7	3632	3631	-1	0.0
34.9	3618	3618	0	0.0
36.1	3597	3587	-10	-0.3
37.3	3586	3566	-20	-0.6
38.6	3585	3563	-22	-0.6
39.8	3461	3461	0	0.0
41.0	3423	3415	-8	-0.2
42.2	3416	3414	-2	-0.1
43.4	3401	3398	-3	-0.1
44.6	3401	3387	-14	-0.4
45.8	3394	3376	-18	-0.5
47.0	3384	3365	-19	-0.6
48.2	3359	3350	-9	-0.3
49.4	3338	3343	5	0.1
50.6	3331	3336	5	0.2
51.8	3325	3331	6	0.2
53.0	3311	3311	0	0.0
54.2	3307	3305	-2	-0.1
55.4	3277	3302	25	0.8
56.6	3206	3296	90	2.8
57.8	3199	3218	19	0.6
59.0	3192	3177	-15	-0.5
60.2	3186	3177	-9	-0.3
61.4	3141	3150	9	0.3
62.7	3133	3141	8	0.3
63.9	3105	3106	1	0.0
65.1	3076	3065	-11	-0.4
66.3	2953	2965	12	0.4
67.5	2939	2938	-1	0.0
68.7	2878	2883	5	0.2
69.9	2865	2877	12	0.4
71.1	2843	2865	22	0.8
72.3	2839	2842	3	0.1
73.5	2816	2809	-7	-0.2
74.7	2797	2786	-11	-0.4
75.9	2776	2776	0	0.0
77.1	2746	2768	22	0.8
78.3	2712	2746	34	1.3
79.5	2703	2694	-9	-0.3
80.7	2683	2643	-40	-1.5
81.9	2589	2586	-3	-0.1
83.1	2505	2470	-35	-1.4
84.3	2405	2458	53	2.2
85.5	2300	2323	23	1.0
86.7	2265	2265	0	0.0
88.0	2121	2094	-27	-1.3
89.2	2083	2086	3	0.1
90.4	1807	1860	53	2.9
91.6	1570	1570	0	0.0
92.8	1538	1515	-23	-1.5
94.0	1467	1443	-24	-1.6
95.2	1251	1183	-68	-5.4
96.4	1078	1088	10	0.9
97.6	956	986	30	3.1
98.8	780	779	-1	-0.1
Min	780	779	-68	-5.4
Max	4150	4150	90	3.1
Mean	3178	3179	0	0.0
Median	3335	3340	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3700	3700	0	0.0
2.4	3700	3700	0	0.0
3.6	3700	3700	0	0.0
4.8	3700	3700	0	0.0
6.0	3700	3700	0	0.0
7.2	3700	3700	0	0.0
8.4	3700	3700	0	0.0
9.6	3700	3700	0	0.0
10.8	3700	3700	0	0.0
12.0	3700	3700	0	0.0
13.3	3700	3700	0	0.0
14.5	3700	3700	0	0.0
15.7	3700	3700	0	0.0
16.9	3695	3691	-4	-0.1
18.1	3662	3663	1	0.0
19.3	3635	3634	-1	0.0
20.5	3625	3625	0	0.0
21.7	3602	3603	1	0.0
22.9	3592	3592	0	0.0
24.1	3577	3578	1	0.0
25.3	3486	3489	3	0.1
26.5	3423	3395	-28	-0.8
27.7	3386	3387	1	0.0
28.9	3386	3386	0	0.0
30.1	3379	3375	-4	-0.1
31.3	3362	3362	0	0.0
32.5	3329	3320	-9	-0.3
33.7	3320	3308	-12	-0.4
34.9	3301	3305	4	0.1
36.1	3290	3301	11	0.3
37.3	3283	3289	6	0.2
38.6	3264	3254	-10	-0.3
39.8	3206	3206	0	0.0
41.0	3129	3157	28	0.9
42.2	3123	3122	-1	0.0
43.4	3099	3082	-17	-0.5
44.6	3074	3076	2	0.1
45.8	3065	3063	-2	-0.1
47.0	3062	3058	-4	-0.1
48.2	3051	3052	1	0.0
49.4	3011	3011	0	0.0
50.6	2994	2986	-8	-0.3
51.8	2991	2985	-6	-0.2
53.0	2972	2978	6	0.2
54.2	2965	2970	5	0.2
55.4	2936	2959	23	0.8
56.6	2925	2945	20	0.7
57.8	2922	2915	-7	-0.2
59.0	2917	2899	-18	-0.6
60.2	2895	2885	-10	-0.3
61.4	2852	2870	18	0.6
62.7	2798	2784	-14	-0.5
63.9	2756	2755	-1	0.0
65.1	2720	2719	-1	0.0
66.3	2718	2718	0	0.0
67.5	2672	2640	-32	-1.2
68.7	2630	2630	0	0.0
69.9	2626	2626	0	0.0
71.1	2605	2605	0	0.0
72.3	2577	2587	10	0.4
73.5	2537	2566	29	1.1
74.7	2505	2514	9	0.4
75.9	2505	2510	5	0.2
77.1	2474	2461	-13	-0.5
78.3	2427	2429	2	0.1
79.5	2385	2349	-36	-1.5
80.7	2309	2318	9	0.4
81.9	2253	2225	-28	-1.2
83.1	2220	2219	-1	0.0
84.3	2057	2113	56	2.7
85.5	1993	2005	12	0.6
86.7	1984	1994	10	0.5
88.0	1856	1832	-24	-1.3
89.2	1624	1670	46	2.8
90.4	1617	1630	13	0.8
91.6	1343	1344	1	0.1
92.8	1269	1245	-24	-1.9
94.0	1120	1096	-24	-2.1
95.2	876	838	-38	-4.3
96.4	711	719	8	1.1
97.6	650	650	0	0.0
98.8	563	563	0	0.0
Min	563	563	-38	-4.3
Max	3700	3700	56	2.8
Mean	2857	2856	0	0.0
Median	3003	2999	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3400	3400	0	0.0
2.4	3400	3400	0	0.0
3.6	3400	3400	0	0.0
4.8	3400	3400	0	0.0
6.0	3400	3400	0	0.0
7.2	3384	3384	0	0.0
8.4	3379	3379	0	0.0
9.6	3364	3364	0	0.0
10.8	3363	3363	0	0.0
12.0	3312	3309	-3	-0.1
13.3	3305	3305	0	0.0
14.5	3304	3303	-1	0.0
15.7	3248	3248	0	0.0
16.9	3212	3212	0	0.0
18.1	3209	3209	0	0.0
19.3	3200	3200	0	0.0
20.5	3200	3200	0	0.0
21.7	3199	3199	0	0.0
22.9	3194	3194	0	0.0
24.1	3186	3186	0	0.0
25.3	3180	3179	-1	0.0
26.5	3179	3157	-22	-0.7
27.7	3153	3144	-9	-0.3
28.9	3138	3138	0	0.0
30.1	3129	3129	0	0.0
31.3	3106	3074	-32	-1.0
32.5	3073	3069	-4	-0.1
33.7	3069	3068	-1	0.0
34.9	3069	3068	-1	0.0
36.1	3029	3062	33	1.1
37.3	3025	3029	4	0.1
38.6	3024	3021	-3	-0.1
39.8	3004	3007	3	0.1
41.0	3001	2988	-13	-0.4
42.2	2994	2986	-8	-0.3
43.4	2986	2981	-5	-0.2
44.6	2985	2974	-11	-0.4
45.8	2976	2947	-29	-1.0
47.0	2950	2939	-11	-0.4
48.2	2920	2911	-9	-0.3
49.4	2906	2890	-16	-0.6
50.6	2881	2884	3	0.1
51.8	2871	2871	0	0.0
53.0	2867	2864	-3	-0.1
54.2	2850	2863	13	0.5
55.4	2847	2847	0	0.0
56.6	2841	2845	4	0.1
57.8	2831	2840	9	0.3
59.0	2824	2817	-7	-0.2
60.2	2792	2792	0	0.0
61.4	2746	2764	18	0.7
62.7	2690	2690	0	0.0
63.9	2674	2673	-1	0.0
65.1	2660	2660	0	0.0
66.3	2621	2621	0	0.0
67.5	2578	2583	5	0.2
68.7	2572	2578	6	0.2
69.9	2512	2570	58	2.3
71.1	2506	2510	4	0.2
72.3	2479	2485	6	0.2
73.5	2474	2484	10	0.4
74.7	2473	2462	-11	-0.4
75.9	2375	2380	5	0.2
77.1	2357	2349	-8	-0.3
78.3	2349	2272	-77	-3.3
79.5	2271	2257	-14	-0.6
80.7	2210	2242	32	1.4
81.9	2181	2179	-2	-0.1
83.1	2147	2120	-27	-1.3
84.3	2035	2098	63	3.1
85.5	1931	1931	0	0.0
86.7	1871	1893	22	1.2
88.0	1816	1792	-24	-1.3
89.2	1580	1588	8	0.5
90.4	1577	1583	6	0.4
91.6	1179	1180	1	0.1
92.8	1169	1145	-24	-2.1
94.0	1003	983	-20	-2.0
95.2	741	752	11	1.5
96.4	724	687	-37	-5.1
97.6	617	621	4	0.6
98.8	581	581	0	0.0
Min	581	581	-77	-5.1
Max	3400	3400	63	3.1
Mean	2674	2673	-1	-0.1
Median	2894	2887	0	0.0

Entire 82-Year Simulation Period

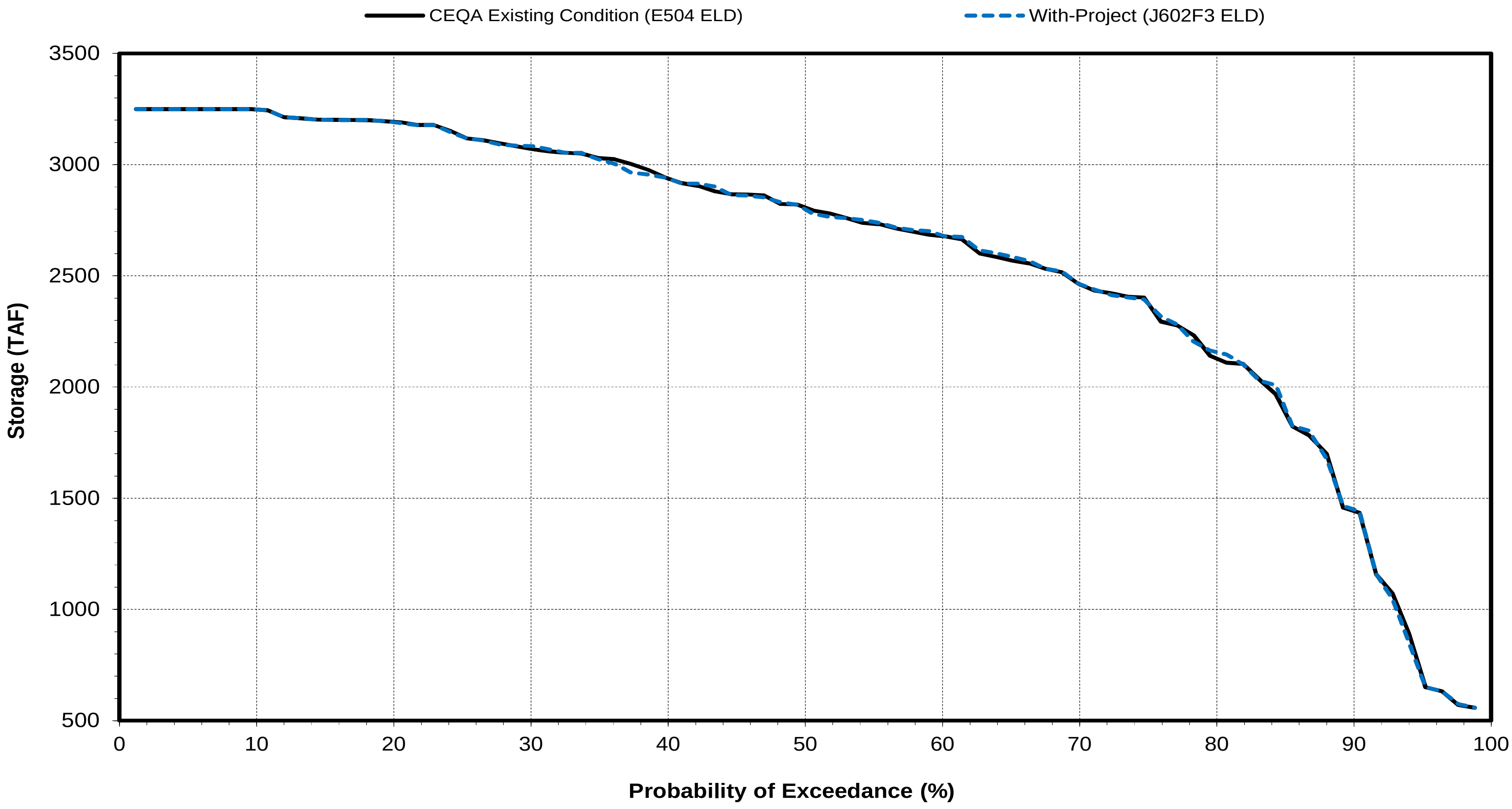
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Shasta Reservoir End of Month Storage

October

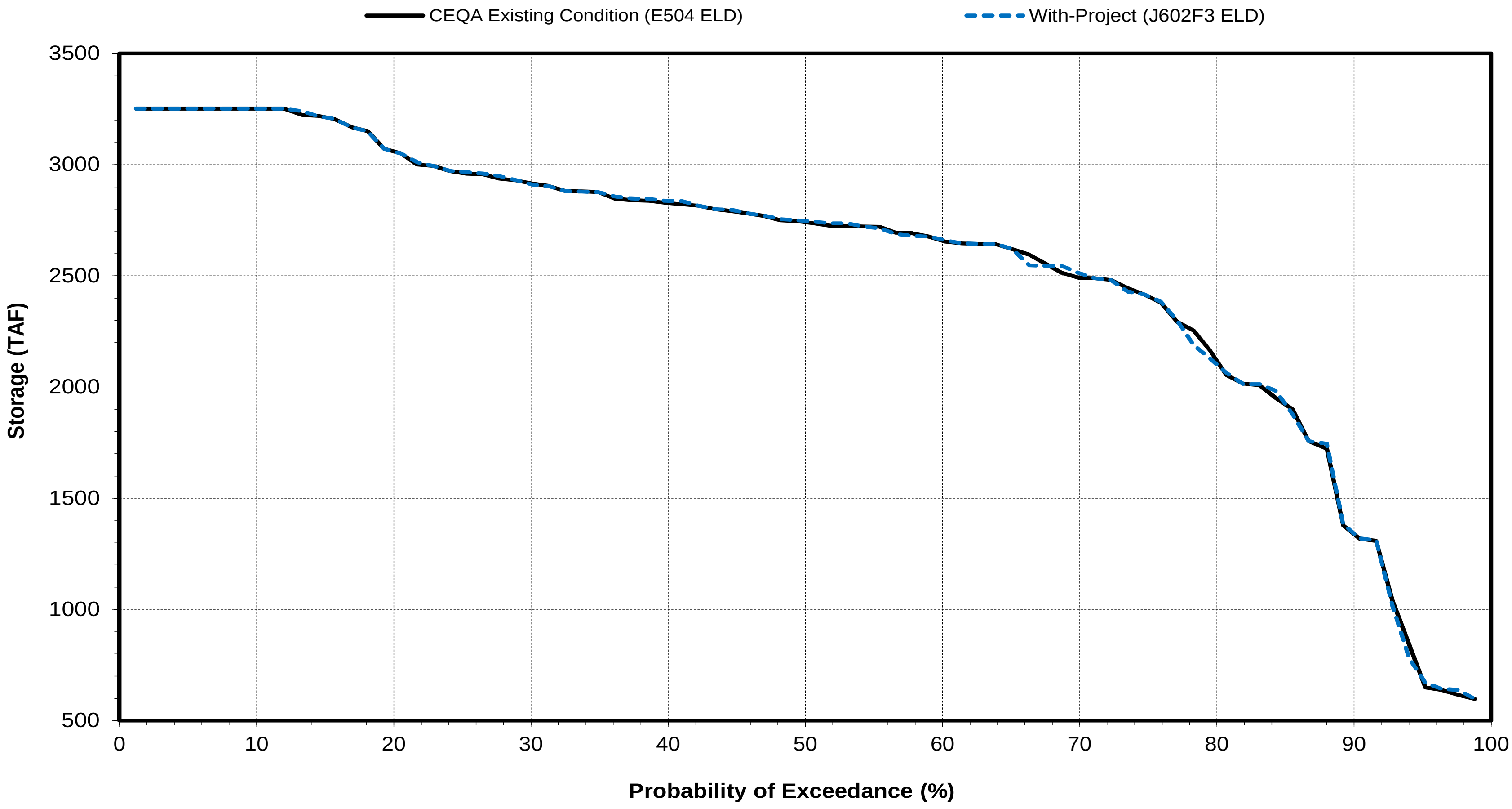


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Shasta Reservoir End of Month Storage

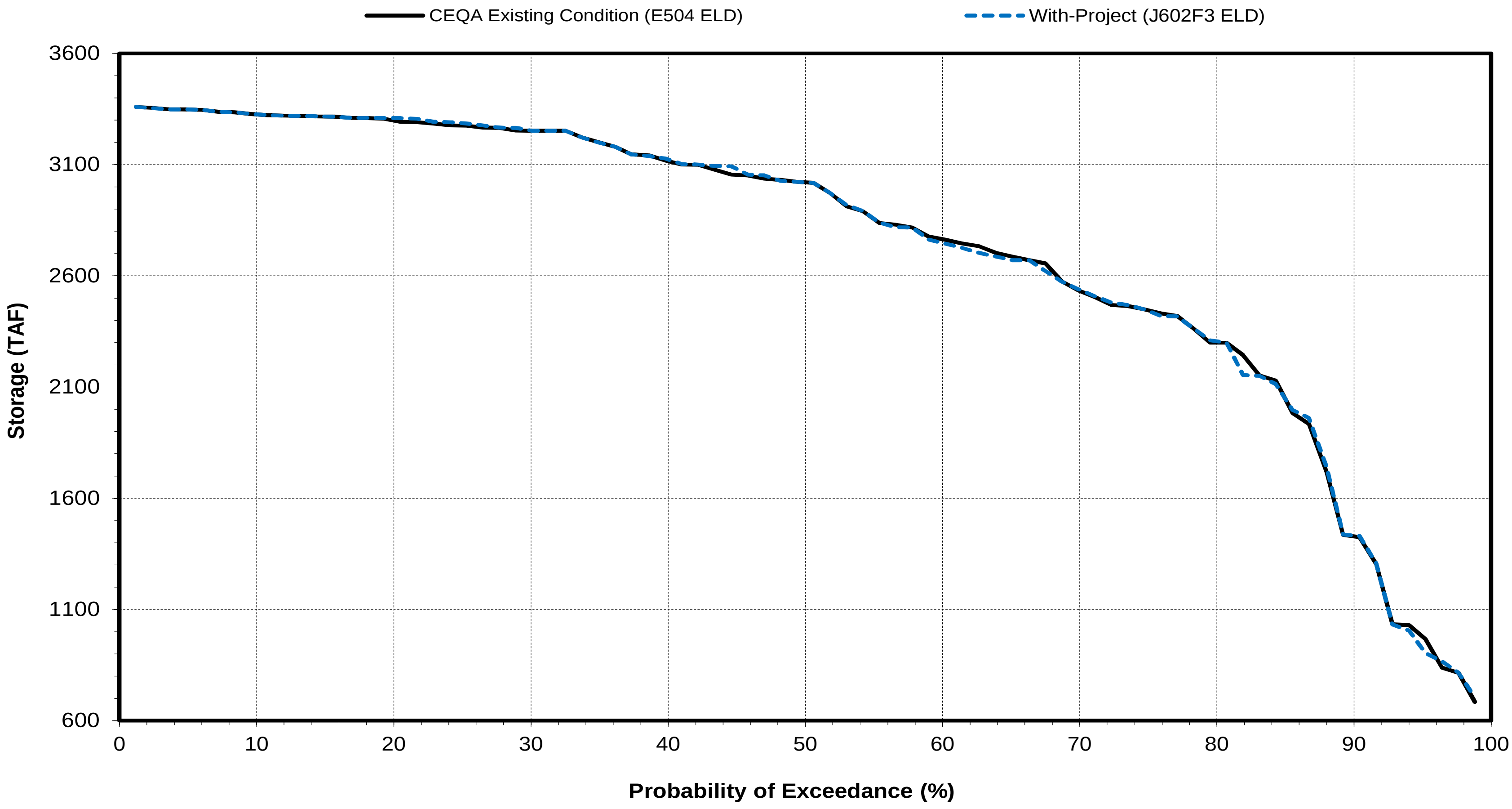
November



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Shasta Reservoir End of Month Storage

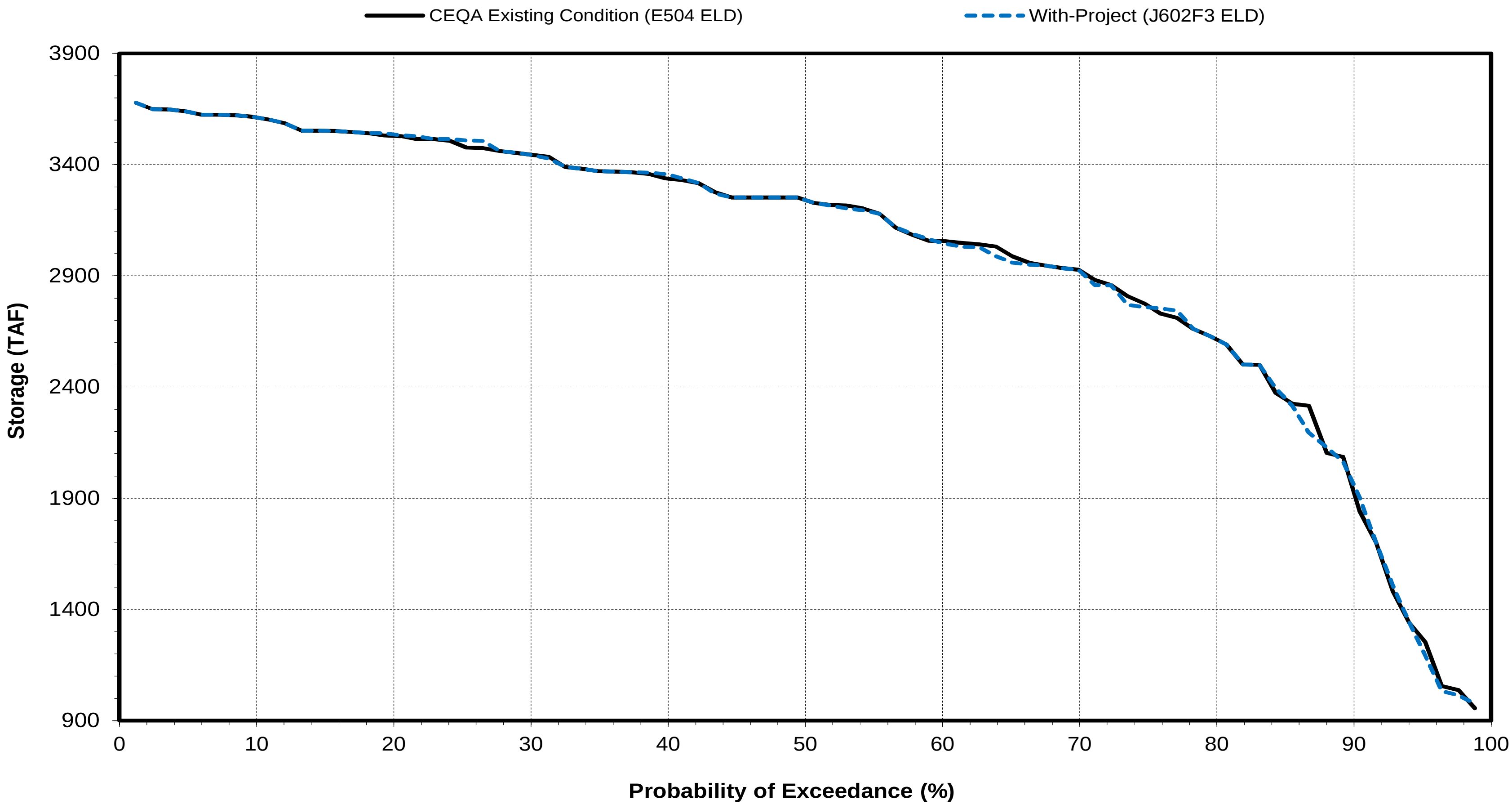
December



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Shasta Reservoir End of Month Storage

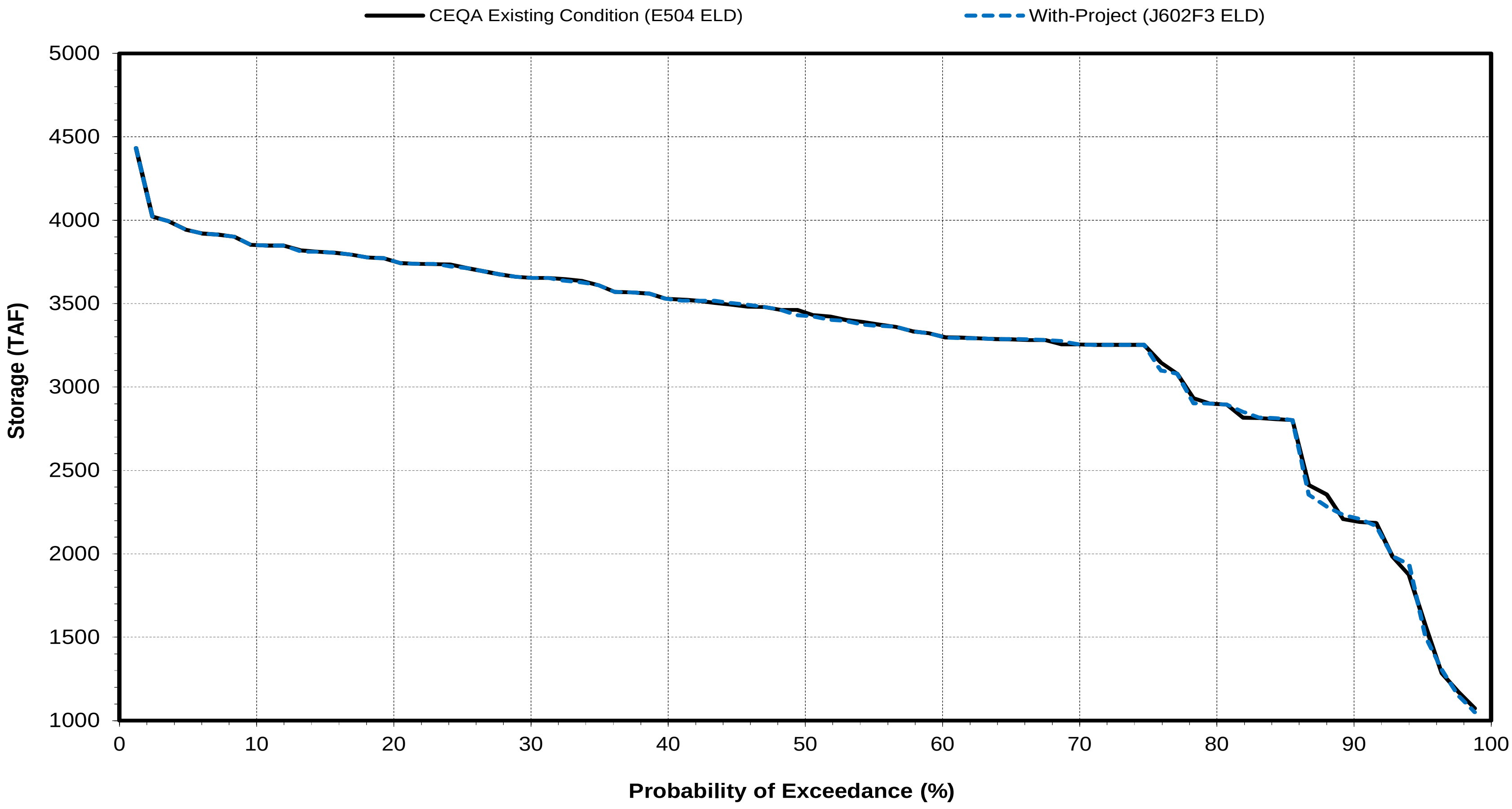
January



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

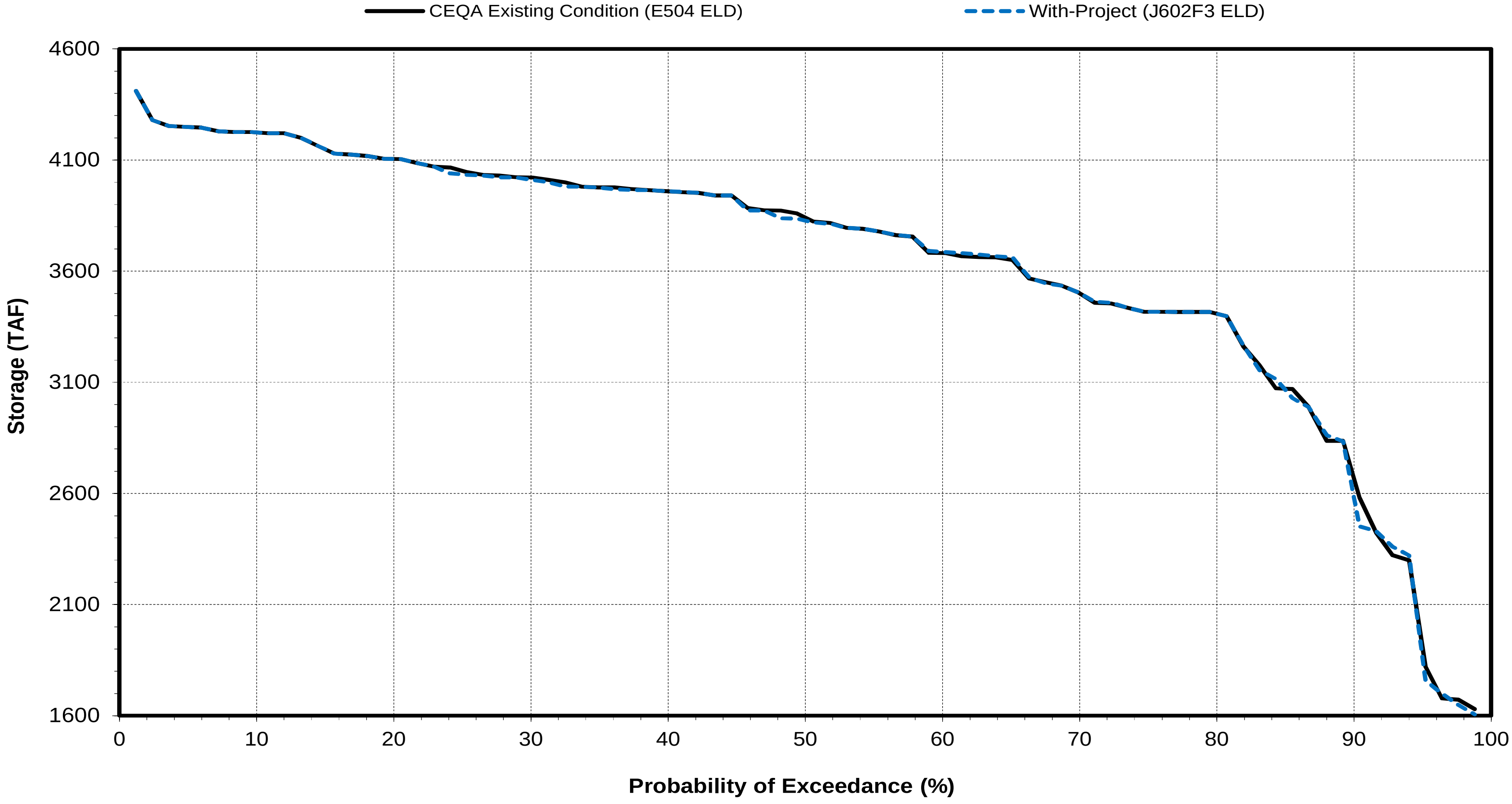
Shasta Reservoir End of Month Storage

February



Shasta Reservoir End of Month Storage

March

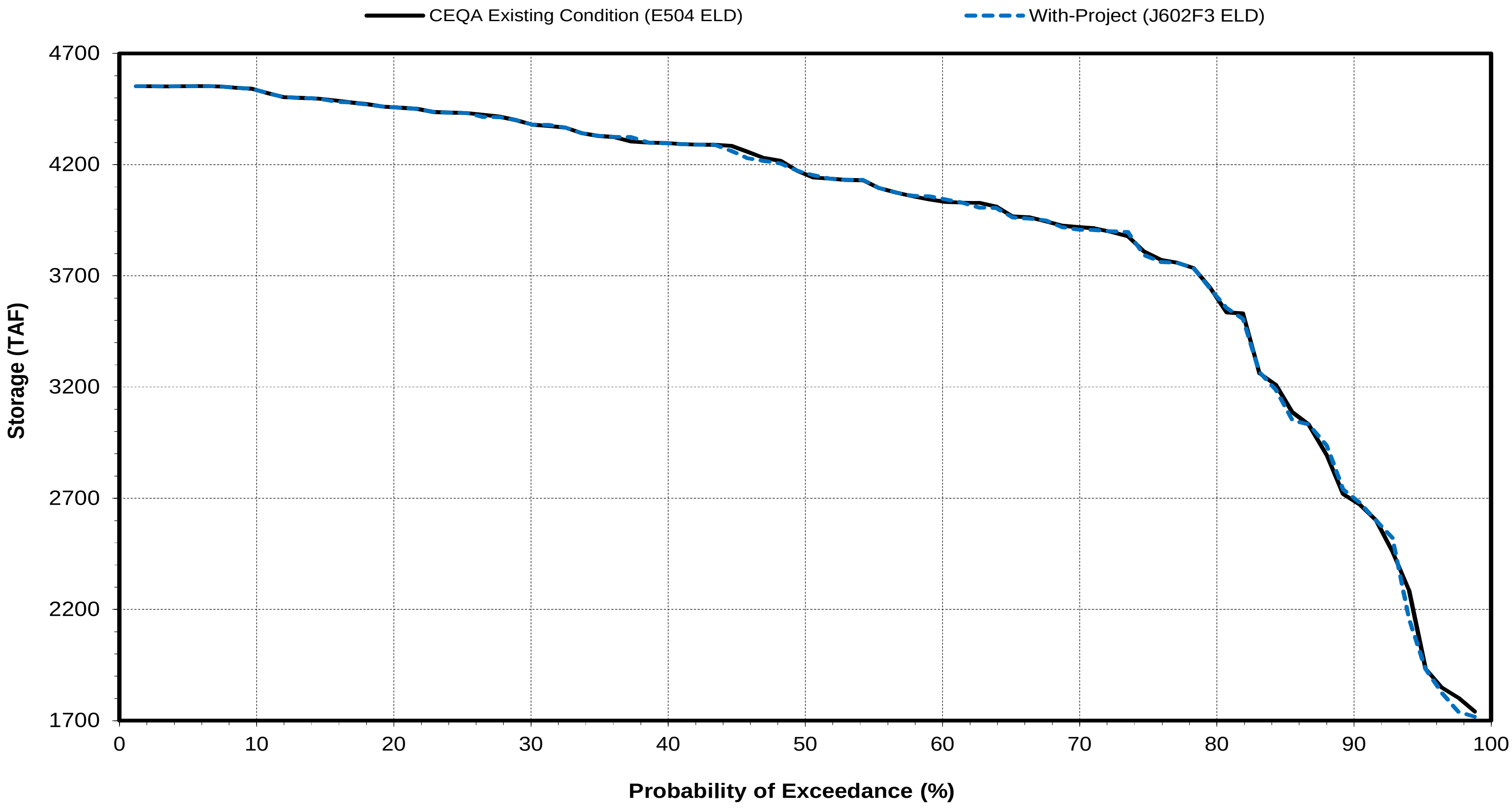


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Shasta Reservoir End of Month Storage

April

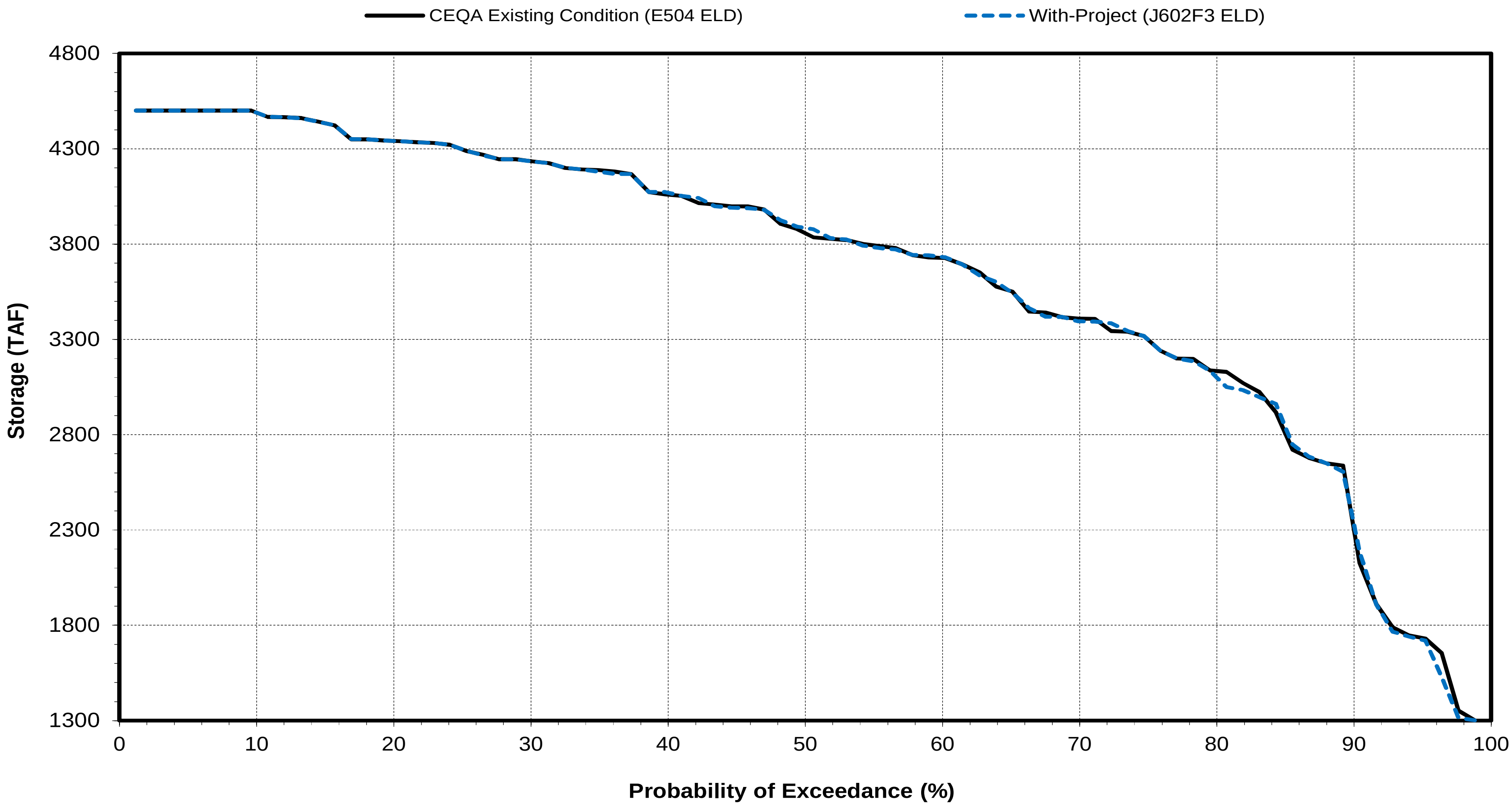


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Shasta Reservoir End of Month Storage

June

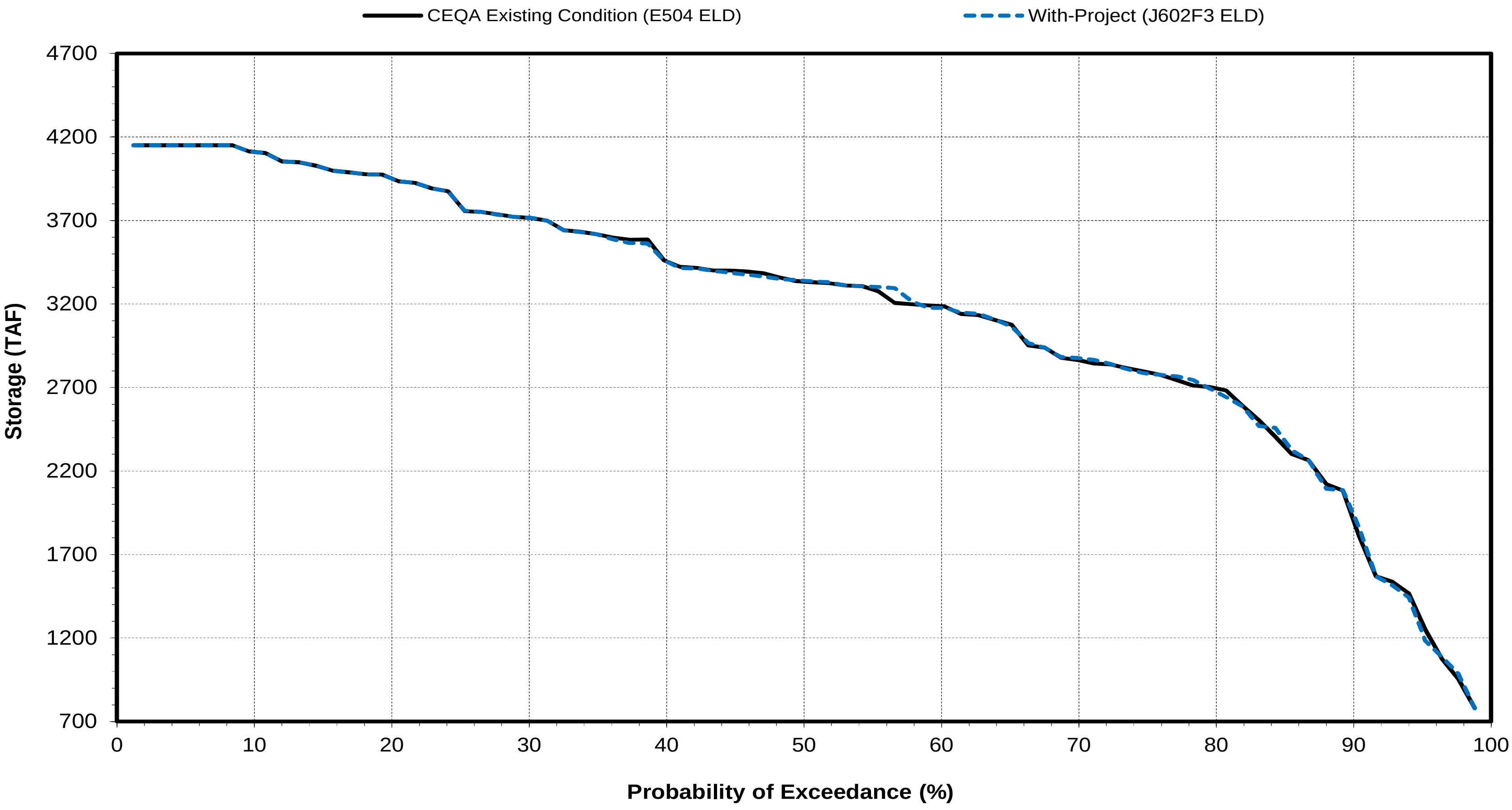


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

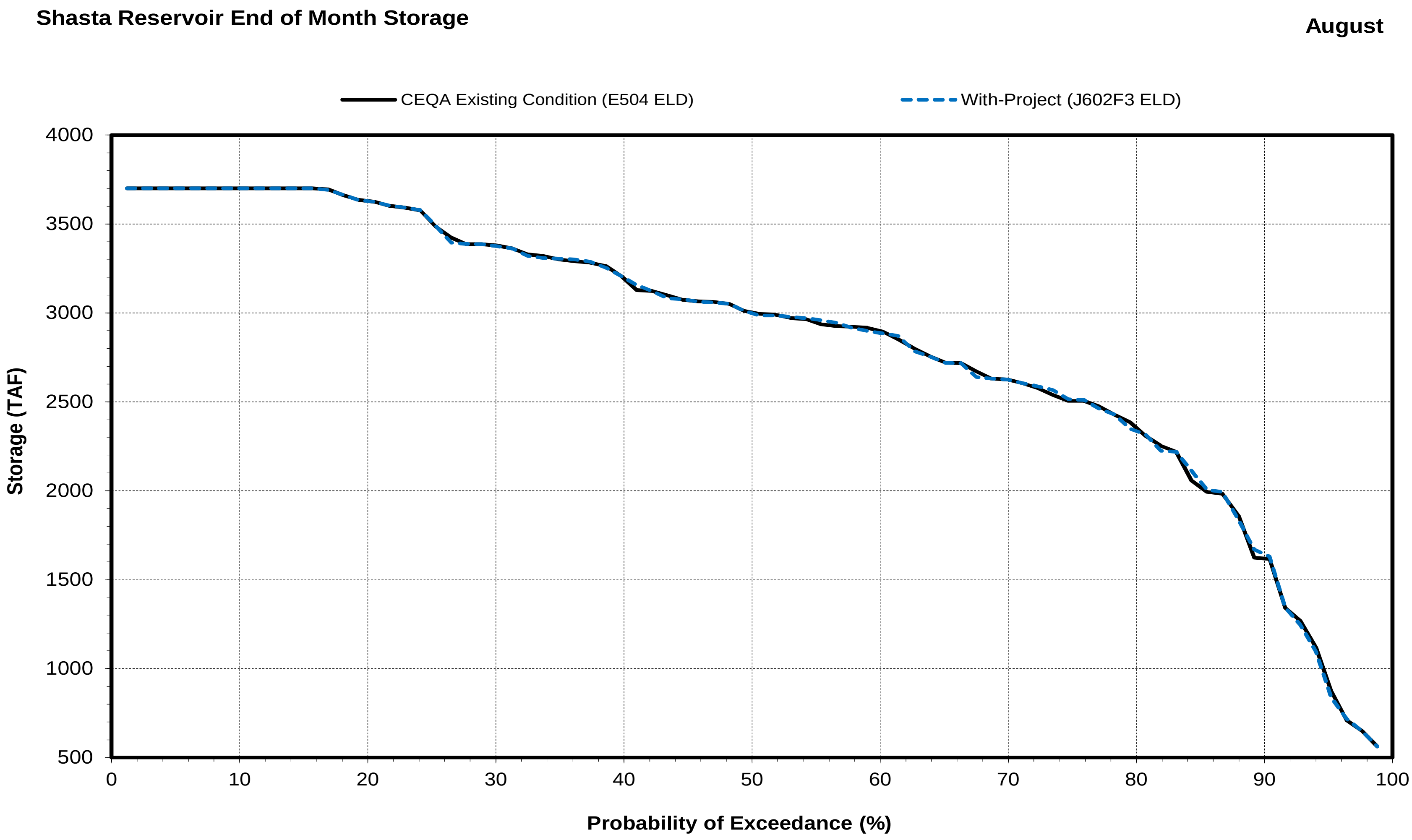
Created: 7/26/2016

Shasta Reservoir End of Month Storage

July



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Long-term and Water Year Type Average Sacramento River Flow below Keswick Dam Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	6,236	6,906	6,630	8,252	10,232	8,466	6,980	7,964	10,719	13,080	10,285	8,057
With-Project (J602F3 ELD)	6,214	6,931	6,644	8,262	10,255	8,466	6,991	7,979	10,695	13,022	10,286	8,059
Difference	-22	25	14	10	23	0	11	15	-24	-58	1	2
Percent Difference[3]	-0.4	0.4	0.2	0.1	0.2	0.0	0.2	0.2	-0.2	-0.4	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	6,878	8,230	10,932	15,825	18,367	16,213	9,503	9,491	10,532	12,802	11,071	13,021
With-Project (J602F3 ELD)	6,764	8,230	10,943	15,857	18,416	16,215	9,513	9,478	10,547	12,806	11,085	13,020
Difference	-114	0	11	32	49	2	10	-13	15	4	14	-1
Percent Difference[3]	-1.7	0.0	0.1	0.2	0.3	0.0	0.1	-0.1	0.1	0.0	0.1	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	5,956	7,137	5,732	7,516	14,291	8,124	6,088	7,934	11,271	14,374	10,444	8,007
With-Project (J602F3 ELD)	5,933	7,195	5,774	7,514	14,285	8,110	6,094	8,029	11,236	14,373	10,432	8,067
Difference	-23	58	42	-2	-6	-14	6	95	-35	-1	-12	60
Percent Difference[3]	-0.4	0.8	0.7	0.0	0.0	-0.2	0.1	1.2	-0.3	0.0	-0.1	0.7
Below Normal												
CEQA Existing Condition (E504 ELD)	6,415	6,461	5,325	4,044	5,898	4,718	5,278	7,096	10,667	12,941	9,959	5,569
With-Project (J602F3 ELD)	6,411	6,452	5,324	4,044	5,866	4,710	5,280	7,105	10,583	12,949	9,945	5,577
Difference	-4	-9	-1	0	-32	-8	2	9	-84	8	-14	8
Percent Difference[3]	-0.1	-0.1	0.0	0.0	-0.5	-0.2	0.0	0.1	-0.8	0.1	-0.1	0.1
Dry												
CEQA Existing Condition (E504 ELD)	5,862	6,093	3,985	3,920	3,601	3,777	5,706	7,276	11,138	13,536	9,854	5,156
With-Project (J602F3 ELD)	5,895	6,146	3,985	3,921	3,658	3,778	5,733	7,294	11,103	13,381	9,940	5,126
Difference	33	53	0	1	57	1	27	18	-35	-155	86	-30
Percent Difference[3]	0.6	0.9	0.0	0.0	1.6	0.0	0.5	0.2	-0.3	-1.1	0.9	-0.6
Critical												
CEQA Existing Condition (E504 ELD)	5,475	5,543	3,700	3,984	3,547	3,431	6,304	6,731	10,002	11,866	9,451	4,607
With-Project (J602F3 ELD)	5,550	5,591	3,730	3,986	3,559	3,445	6,304	6,725	9,995	11,687	9,329	4,595
Difference	75	48	30	2	12	14	0	-6	-7	-179	-122	-12
Percent Difference[3]	1.4	0.9	0.8	0.1	0.3	0.4	0.0	-0.1	-0.1	-1.5	-1.3	-0.3

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

Sacramento River Flow below Keswick Dam - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	9499	9499	0	0.0
2.4	9474	9474	0	0.0
3.6	9416	9416	0	0.0
4.8	8861	8860	-1	0.0
6.0	8510	8509	-1	0.0
7.2	8362	8363	1	0.0
8.4	8361	8361	0	0.0
9.6	8268	8268	0	0.0
10.8	8198	8171	-27	-0.3
12.0	7963	7962	-1	0.0
13.3	7957	7925	-32	-0.4
14.5	7925	7897	-28	-0.4
15.7	7892	7881	-11	-0.1
16.9	7884	7816	-68	-0.9
18.1	7836	7505	-331	-4.2
19.3	7817	7477	-340	-4.3
20.5	7506	7358	-148	-2.0
21.7	7441	7334	-107	-1.4
22.9	7438	7259	-179	-2.4
24.1	7345	7151	-194	-2.6
25.3	7260	7084	-176	-2.4
26.5	7158	7079	-79	-1.1
27.7	7153	7034	-119	-1.7
28.9	7079	6992	-87	-1.2
30.1	6947	6890	-57	-0.8
31.3	6919	6807	-112	-1.6
32.5	6818	6751	-67	-1.0
33.7	6751	6726	-25	-0.4
34.9	6726	6668	-58	-0.9
36.1	6679	6662	-17	-0.3
37.3	6675	6589	-86	-1.3
38.6	6532	6497	-35	-0.5
39.8	6426	6432	6	0.1
41.0	6413	6356	-57	-0.9
42.2	6354	6316	-38	-0.6
43.4	6287	6301	14	0.2
44.6	6254	6254	0	0.0
45.8	6248	6248	0	0.0
47.0	6148	6148	0	0.0
48.2	6040	6039	-1	0.0
49.4	5976	5976	0	0.0
50.6	5957	5953	-4	-0.1
51.8	5938	5952	14	0.2
53.0	5929	5928	-1	0.0
54.2	5915	5915	0	0.0
55.4	5821	5910	89	1.5
56.6	5806	5806	0	0.0
57.8	5717	5717	0	0.0
59.0	5629	5631	2	0.0
60.2	5580	5614	34	0.6
61.4	5561	5583	22	0.4
62.7	5559	5562	3	0.1
63.9	5537	5562	25	0.5
65.1	5509	5550	41	0.7
66.3	5452	5451	-1	0.0
67.5	5450	5378	-72	-1.3
68.7	5393	5374	-19	-0.4
69.9	5373	5332	-41	-0.8
71.1	5322	5200	-122	-2.3
72.3	5184	5192	8	0.2
73.5	5179	5170	-9	-0.2
74.7	5143	5141	-2	0.0
75.9	5129	5127	-2	0.0
77.1	5064	5113	49	1.0
78.3	4989	5061	72	1.4
79.5	4952	5008	56	1.1
80.7	4941	4992	51	1.0
81.9	4933	4952	19	0.4
83.1	4658	4941	283	6.1
84.3	4612	4824	212	4.6
85.5	4610	4608	-2	0.0
86.7	4606	4562	-44	-1.0
88.0	4486	4493	7	0.2
89.2	4473	4474	1	0.0
90.4	4464	4464	0	0.0
91.6	4463	4463	0	0.0
92.8	4370	4374	4	0.1
94.0	4326	4326	0	0.0
95.2	4205	4205	0	0.0
96.4	4199	4197	-2	0.0
97.6	4090	4091	1	0.0
98.8	4000	4000	0	0.0
Min	4000	4000	-340	-4.3
Max	9499	9499	283	6.1
Mean	6236	6214	-22	-0.2
Median	5967	5965	-1	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	76.8
1.1<=X<10.0		6.1
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		17.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		20.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	26990	26990	0	0.0
2.4	13648	13648	0	0.0
3.6	12405	12419	14	0.1
4.8	11703	11787	84	0.7
6.0	11699	11692	-7	-0.1
7.2	11326	11326	0	0.0
8.4	11300	11299	-1	0.0
9.6	11056	11284	228	2.1
10.8	11018	11057	39	0.4
12.0	10931	10931	0	0.0
13.3	10745	10745	0	0.0
14.5	10604	10604	0	0.0
15.7	10596	10595	-1	0.0
16.9	10309	10470	161	1.6
18.1	10281	10390	109	1.1
19.3	9673	9797	124	1.3
20.5	9549	9678	129	1.4
21.7	9401	9548	147	1.6
22.9	9396	9401	5	0.1
24.1	9321	9321	0	0.0
25.3	9188	9284	96	1.0
26.5	9183	9204	21	0.2
27.7	9177	9110	-67	-0.7
28.9	8870	8869	-1	0.0
30.1	8677	8649	-28	-0.3
31.3	8521	8515	-6	-0.1
32.5	8407	8407	0	0.0
33.7	8159	8159	0	0.0
34.9	7792	7801	9	0.1
36.1	7491	7503	12	0.2
37.3	7204	7184	-20	-0.3
38.6	7020	7020	0	0.0
39.8	6950	6951	1	0.0
41.0	6758	6758	0	0.0
42.2	6724	6724	0	0.0
43.4	6384	6376	-8	-0.1
44.6	6099	6164	65	1.1
45.8	5964	5941	-23	-0.4
47.0	5629	5631	2	0.0
48.2	5529	5600	71	1.3
49.4	5522	5522	0	0.0
50.6	5500	5521	21	0.4
51.8	5496	5505	9	0.2
53.0	5496	5347	-149	-2.7
54.2	5363	5321	-42	-0.8
55.4	5321	5275	-46	-0.9
56.6	5273	5239	-34	-0.6
57.8	5092	5174	82	1.6
59.0	5063	5138	75	1.5
60.2	5036	5074	38	0.8
61.4	4997	4997	0	0.0
62.7	4955	4971	16	0.3
63.9	4894	4955	61	1.2
65.1	4867	4893	26	0.5
66.3	4817	4842	25	0.5
67.5	4678	4744	66	1.4
68.7	4585	4677	92	2.0
69.9	4578	4584	6	0.1
71.1	4473	4579	106	2.4
72.3	4458	4473	15	0.3
73.5	4404	4404	0	0.0
74.7	4291	4290	-1	0.0
75.9	4279	4279	0	0.0
77.1	4242	4242	0	0.0
78.3	4212	4215	3	0.1
79.5	4204	4204	0	0.0
80.7	4006	4077	71	1.8
81.9	4000	4007	7	0.2
83.1	4000	4000	0	0.0
84.3	4000	4000	0	0.0
85.5	4000	4000	0	0.0
86.7	3885	4000	115	3.0
88.0	3747	3886	139	3.7
89.2	3722	3885	163	4.4
90.4	3674	3757	83	2.3
91.6	3618	3618	0	0.0
92.8	3481	3481	0	0.0
94.0	3346	3346	0	0.0
95.2	3250	3250	0	0.0
96.4	3250	3250	0	0.0
97.6	3250	3250	0	0.0
98.8	3250	3250	0	0.0
Min	3250	3250	-149	-2.7
Max	26990	26990	228	4.4
Mean	6906	6931	26	0.4
Median	5511	5522	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	75.6
1.1<=X<10.0		23.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		25.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	25997	25478	-519	-2.0
2.4	24622	24622	0	0.0
3.6	23229	23048	-181	-0.8
4.8	22565	22565	0	0.0
6.0	22258	22258	0	0.0
7.2	20314	20314	0	0.0
8.4	17590	17882	292	1.7
9.6	16781	16770	-11	-0.1
10.8	15051	15051	0	0.0
12.0	14833	14833	0	0.0
13.3	12898	12898	0	0.0
14.5	12071	12071	0	0.0
15.7	11307	11307	0	0.0
16.9	10077	10369	292	2.9
18.1	9830	10330	500	5.1
19.3	9613	9613	0	0.0
20.5	8872	8872	0	0.0
21.7	8292	8080	-212	-2.6
22.9	6907	6907	0	0.0
24.1	6226	6457	231	3.7
25.3	5813	6218	405	7.0
26.5	5644	5642	-2	0.0
27.7	5642	5639	-3	-0.1
28.9	5569	5572	3	0.1
30.1	5435	5434	-1	0.0
31.3	5423	5423	0	0.0
32.5	5310	5310	0	0.0
33.7	5130	5130	0	0.0
34.9	4903	4903	0	0.0
36.1	4843	4843	0	0.0
37.3	4582	4584	2	0.0
38.6	4498	4498	0	0.0
39.8	4378	4378	0	0.0
41.0	4279	4279	0	0.0
42.2	4252	4252	0	0.0
43.4	4198	4192	-6	-0.1
44.6	4180	4180	0	0.0
45.8	4029	4028	-1	0.0
47.0	4000	4000	0	0.0
48.2	4000	4000	0	0.0
49.4	4000	4000	0	0.0
50.6	4000	4000	0	0.0
51.8	4000	4000	0	0.0
53.0	4000	4000	0	0.0
54.2	4000	4000	0	0.0
55.4	4000	4000	0	0.0
56.6	4000	4000	0	0.0
57.8	4000	4000	0	0.0
59.0	4000	4000	0	0.0
60.2	3778	3960	182	4.8
61.4	3764	3764	0	0.0
62.7	3744	3744	0	0.0
63.9	3707	3707	0	0.0
65.1	3690	3690	0	0.0
66.3	3650	3650	0	0.0
67.5	3609	3609	0	0.0
68.7	3556	3556	0	0.0
69.9	3494	3494	0	0.0
71.1	3493	3493	0	0.0
72.3	3490	3490	0	0.0
73.5	3472	3472	0	0.0
74.7	3471	3471	0	0.0
75.9	3439	3439	0	0.0
77.1	3388	3388	0	0.0
78.3	3251	3349	98	3.0
79.5	3250	3325	75	2.3
80.7	3250	3250	0	0.0
81.9	3250	3250	0	0.0
83.1	3250	3250	0	0.0
84.3	3250	3250	0	0.0
85.5	3250	3250	0	0.0
86.7	3250	3250	0	0.0
88.0	3250	3250	0	0.0
89.2	3250	3250	0	0.0
90.4	3250	3250	0	0.0
91.6	3250	3250	0	0.0
92.8	3250	3250	0	0.0
94.0	3250	3250	0	0.0
95.2	3250	3250	0	0.0
96.4	3250	3250	0	0.0
97.6	3250	3250	0	0.0
98.8	3250	3250	0	0.0
Min	3250	3250	-519	-2.6
Max	25997	25478	500	7.0
Mean	6630	6644	14	0.3
Median	4000	4000	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		9.8
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	52735	52735	0	0.0
2.4	38615	38615	0	0.0
3.6	34203	34203	0	0.0
4.8	30587	30587	0	0.0
6.0	28186	28187	1	0.0
7.2	25153	25153	0	0.0
8.4	23113	23685	572	2.5
9.6	20927	20927	0	0.0
10.8	19053	19053	0	0.0
12.0	18323	18323	0	0.0
13.3	17926	17906	-20	-0.1
14.5	14826	14826	0	0.0
15.7	14598	14598	0	0.0
16.9	14544	14544	0	0.0
18.1	13878	13878	0	0.0
19.3	10339	10511	172	1.7
20.5	9852	9852	0	0.0
21.7	9429	9430	1	0.0
22.9	9231	9235	4	0.0
24.1	8932	8951	19	0.2
25.3	8860	8949	89	1.0
26.5	8333	8333	0	0.0
27.7	7628	7628	0	0.0
28.9	7626	7626	0	0.0
30.1	7565	7565	0	0.0
31.3	7446	7446	0	0.0
32.5	7419	7419	0	0.0
33.7	7049	7049	0	0.0
34.9	4790	4786	-4	-0.1
36.1	4500	4500	0	0.0
37.3	4500	4500	0	0.0
38.6	4500	4500	0	0.0
39.8	4500	4500	0	0.0
41.0	4500	4500	0	0.0
42.2	4500	4500	0	0.0
43.4	4500	4500	0	0.0
44.6	4500	4500	0	0.0
45.8	4500	4500	0	0.0
47.0	4500	4500	0	0.0
48.2	4500	4500	0	0.0
49.4	4465	4465	0	0.0
50.6	4202	4202	0	0.0
51.8	4165	4165	0	0.0
53.0	4082	4082	0	0.0
54.2	4040	4040	0	0.0
55.4	4025	4025	0	0.0
56.6	3979	3979	0	0.0
57.8	3926	3926	0	0.0
59.0	3734	3734	0	0.0
60.2	3641	3638	-3	-0.1
61.4	3638	3636	-2	-0.1
62.7	3629	3629	0	0.0
63.9	3613	3621	8	0.2
65.1	3584	3584	0	0.0
66.3	3502	3502	0	0.0
67.5	3255	3255	0	0.0
68.7	3250	3250	0	0.0
69.9	3250	3250	0	0.0
71.1	3250	3250	0	0.0
72.3	3250	3250	0	0.0
73.5	3250	3250	0	0.0
74.7	3250	3250	0	0.0
75.9	3250	3250	0	0.0
77.1	3250	3250	0	0.0
78.3	3250	3250	0	0.0
79.5	3250	3250	0	0.0
80.7	3250	3250	0	0.0
81.9	3250	3250	0	0.0
83.1	3250	3250	0	0.0
84.3	3250	3250	0	0.0
85.5	3250	3250	0	0.0
86.7	3250	3250	0	0.0
88.0	3250	3250	0	0.0
89.2	3250	3250	0	0.0
90.4	3250	3250	0	0.0
91.6	3250	3250	0	0.0
92.8	3250	3250	0	0.0
94.0	3250	3250	0	0.0
95.2	3250	3250	0	0.0
96.4	3250	3250	0	0.0
97.6	3250	3250	0	0.0
98.8	3250	3250	0	0.0
Min	3250	3250	-20	-0.1
Max	52735	52735	572	2.5
Mean	8252	8262	10	0.1
Median	4334	4334	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	97.6
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	44007	44007	0	0.0
2.4	43219	43305	86	0.2
3.6	35476	35476	0	0.0
4.8	32474	32474	0	0.0
6.0	31888	31873	-15	0.0
7.2	30235	30234	-1	0.0
8.4	30069	30069	0	0.0
9.6	28992	28992	0	0.0
10.8	27713	28017	304	1.1
12.0	27512	27664	152	0.6
13.3	26846	27512	666	2.5
14.5	23696	23696	0	0.0
15.7	23127	23127	0	0.0
16.9	22775	22775	0	0.0
18.1	21451	21451	0	0.0
19.3	21309	21309	0	0.0
20.5	18799	18799	0	0.0
21.7	18422	18422	0	0.0
22.9	18321	18321	0	0.0
24.1	15705	15705	0	0.0
25.3	15503	15051	-452	-2.9
26.5	13598	13598	0	0.0
27.7	13212	13212	0	0.0
28.9	11393	11402	9	0.1
30.1	8875	9218	343	3.9
31.3	8436	8873	437	5.2
32.5	8323	8436	113	1.4
33.7	8205	8323	118	1.4
34.9	8164	8164	0	0.0
36.1	7324	7324	0	0.0
37.3	5576	5712	136	2.4
38.6	5550	5550	0	0.0
39.8	4500	4500	0	0.0
41.0	4500	4500	0	0.0
42.2	4500	4500	0	0.0
43.4	4500	4500	0	0.0
44.6	4500	4500	0	0.0
45.8	4500	4500	0	0.0
47.0	4500	4500	0	0.0
48.2	4500	4500	0	0.0
49.4	4500	4500	0	0.0
50.6	4500	4500	0	0.0
51.8	4500	4500	0	0.0
53.0	4500	4500	0	0.0
54.2	4491	4491	0	0.0
55.4	4451	4451	0	0.0
56.6	4207	4207	0	0.0
57.8	4146	4146	0	0.0
59.0	3679	3679	0	0.0
60.2	3488	3488	0	0.0
61.4	3423	3423	0	0.0
62.7	3414	3414	0	0.0
63.9	3250	3250	0	0.0
65.1	3250	3250	0	0.0
66.3	3250	3250	0	0.0
67.5	3250	3250	0	0.0
68.7	3250	3250	0	0.0
69.9	3250	3250	0	0.0
71.1	3250	3250	0	0.0
72.3	3250	3250	0	0.0
73.5	3250	3250	0	0.0
74.7	3250	3250	0	0.0
75.9	3250	3250	0	0.0
77.1	3250	3250	0	0.0
78.3	3250	3250	0	0.0
79.5	3250	3250	0	0.0
80.7	3250	3250	0	0.0
81.9	3250	3250	0	0.0
83.1	3250	3250	0	0.0
84.3	3250	3250	0	0.0
85.5	3250	3250	0	0.0
86.7	3250	3250	0	0.0
88.0	3250	3250	0	0.0
89.2	3250	3250	0	0.0
90.4	3250	3250	0	0.0
91.6	3250	3250	0	0.0
92.8	3250	3250	0	0.0
94.0	3250	3250	0	0.0
95.2	3250	3250	0	0.0
96.4	3250	3250	0	0.0
97.6	3250	3250	0	0.0
98.8	3250	3250	0	0.0
Min	3250	3250	-452	-2.9
Max	44007	44007	666	5.2
Mean	10232	10255	23	0.2
Median	4500	4500	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	90.2
1.1<=X<10.0		8.5
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	46295	46295	0	0.0
2.4	41091	41091	0	0.0
3.6	40251	40251	0	0.0
4.8	35227	35227	0	0.0
6.0	34284	34284	0	0.0
7.2	26147	26148	1	0.0
8.4	20521	20521	0	0.0
9.6	19854	19854	0	0.0
10.8	18544	18544	0	0.0
12.0	17033	17136	103	0.6
13.3	15812	15812	0	0.0
14.5	14297	14297	0	0.0
15.7	13482	13482	0	0.0
16.9	13072	13072	0	0.0
18.1	12834	12834	0	0.0
19.3	12569	12569	0	0.0
20.5	11926	11815	-111	-0.9
21.7	11215	11221	6	0.1
22.9	11165	11165	0	0.0
24.1	11097	11056	-41	-0.4
25.3	10926	10926	0	0.0
26.5	9911	9911	0	0.0
27.7	9692	9687	-5	-0.1
28.9	8505	8518	13	0.2
30.1	7528	7528	0	0.0
31.3	7278	7278	0	0.0
32.5	6125	6125	0	0.0
33.7	6078	6078	0	0.0
34.9	5748	5728	-20	-0.3
36.1	5728	5577	-151	-2.6
37.3	4500	4500	0	0.0
38.6	4500	4500	0	0.0
39.8	4500	4500	0	0.0
41.0	4500	4500	0	0.0
42.2	4500	4500	0	0.0
43.4	4500	4500	0	0.0
44.6	4500	4500	0	0.0
45.8	4500	4500	0	0.0
47.0	4500	4500	0	0.0
48.2	4500	4500	0	0.0
49.4	4500	4500	0	0.0
50.6	4500	4500	0	0.0
51.8	4463	4462	-1	0.0
53.0	4250	4250	0	0.0
54.2	4134	4134	0	0.0
55.4	4048	4048	0	0.0
56.6	3979	3979	0	0.0
57.8	3602	3610	8	0.2
59.0	3510	3602	92	2.6
60.2	3478	3510	32	0.9
61.4	3436	3436	0	0.0
62.7	3422	3422	0	0.0
63.9	3422	3422	0	0.0
65.1	3250	3294	44	1.4
66.3	3250	3250	0	0.0
67.5	3250	3250	0	0.0
68.7	3250	3250	0	0.0
69.9	3250	3250	0	0.0
71.1	3250	3250	0	0.0
72.3	3250	3250	0	0.0
73.5	3250	3250	0	0.0
74.7	3250	3250	0	0.0
75.9	3250	3250	0	0.0
77.1	3250	3250	0	0.0
78.3	3250	3250	0	0.0
79.5	3250	3250	0	0.0
80.7	3250	3250	0	0.0
81.9	3250	3250	0	0.0
83.1	3250	3250	0	0.0
84.3	3250	3250	0	0.0
85.5	3250	3250	0	0.0
86.7	3250	3250	0	0.0
88.0	3250	3250	0	0.0
89.2	3250	3250	0	0.0
90.4	3250	3250	0	0.0
91.6	3250	3250	0	0.0
92.8	3250	3250	0	0.0
94.0	3250	3250	0	0.0
95.2	3250	3250	0	0.0
96.4	3250	3250	0	0.0
97.6	3250	3250	0	0.0
98.8	3250	3250	0	0.0
Min	3250	3250	-151	-2.6
Max	46295	46295	103	2.6
Mean	8466	8466	0	0.0
Median	4500	4500	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	96.3
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	30037	30037	0	0.0
2.4	24797	24797	0	0.0
3.6	20039	20039	0	0.0
4.8	13808	13808	0	0.0
6.0	13739	13739	0	0.0
7.2	12446	12446	0	0.0
8.4	12268	12268	0	0.0
9.6	11770	11770	0	0.0
10.8	11736	11736	0	0.0
12.0	10023	10023	0	0.0
13.3	9987	9987	0	0.0
14.5	9738	9738	0	0.0
15.7	9547	9548	1	0.0
16.9	9000	9000	0	0.0
18.1	8790	8786	-4	0.0
19.3	8491	8489	-2	0.0
20.5	8206	8206	0	0.0
21.7	7871	7874	3	0.0
22.9	7837	7837	0	0.0
24.1	7694	7694	0	0.0
25.3	7691	7692	1	0.0
26.5	7531	7656	125	1.7
27.7	7415	7440	25	0.3
28.9	7388	7408	20	0.3
30.1	7277	7271	-6	-0.1
31.3	7048	7074	26	0.4
32.5	7015	7013	-2	0.0
33.7	6954	6963	9	0.1
34.9	6758	6770	12	0.2
36.1	6680	6680	0	0.0
37.3	6627	6672	45	0.7
38.6	6515	6515	0	0.0
39.8	6368	6298	-70	-1.1
41.0	6298	6145	-153	-2.4
42.2	6127	6113	-14	-0.2
43.4	6114	6108	-6	-0.1
44.6	6058	6082	24	0.4
45.8	5954	6033	79	1.3
47.0	5924	5997	73	1.2
48.2	5846	5953	107	1.8
49.4	5777	5917	140	2.4
50.6	5686	5795	109	1.9
51.8	5675	5675	0	0.0
53.0	5664	5664	0	0.0
54.2	5613	5612	-1	0.0
55.4	5593	5590	-3	-0.1
56.6	5547	5551	4	0.1
57.8	5400	5481	81	1.5
59.0	5391	5400	9	0.2
60.2	5373	5373	0	0.0
61.4	5350	5354	4	0.1
62.7	5252	5251	-1	0.0
63.9	5242	5243	1	0.0
65.1	5046	5078	32	0.6
66.3	4964	5046	82	1.7
67.5	4934	4964	30	0.6
68.7	4571	4933	362	7.9
69.9	4560	4566	6	0.1
71.1	4504	4524	20	0.4
72.3	4500	4500	0	0.0
73.5	4500	4500	0	0.0
74.7	4500	4500	0	0.0
75.9	4500	4500	0	0.0
77.1	4500	4500	0	0.0
78.3	4500	4500	0	0.0
79.5	4500	4500	0	0.0
80.7	4500	4500	0	0.0
81.9	4500	4500	0	0.0
83.1	4500	4500	0	0.0
84.3	4266	4266	0	0.0
85.5	3990	3990	0	0.0
86.7	3830	3830	0	0.0
88.0	3719	3719	0	0.0
89.2	3700	3700	0	0.0
90.4	3552	3250	-302	-8.5
91.6	3250	3250	0	0.0
92.8	3250	3250	0	0.0
94.0	3250	3250	0	0.0
95.2	3250	3250	0	0.0
96.4	3250	3250	0	0.0
97.6	3250	3250	0	0.0
98.8	3250	3250	0	0.0
Min	3250	3250	-302	-8.5
Max	30037	30037	362	7.9
Mean	6980	6991	11	0.2
Median	5732	5856	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		11.0
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	15837	15837	0	0.0
2.4	14124	14124	0	0.0
3.6	13439	13439	0	0.0
4.8	13385	13385	0	0.0
6.0	12281	12281	0	0.0
7.2	12057	12057	0	0.0
8.4	11988	11270	-718	-6.0
9.6	10962	10962	0	0.0
10.8	10855	10855	0	0.0
12.0	10242	10242	0	0.0
13.3	10107	10109	2	0.0
14.5	9603	9570	-33	-0.3
15.7	9395	9428	33	0.4
16.9	9380	9395	15	0.2
18.1	9370	9376	6	0.1
19.3	9324	9324	0	0.0
20.5	9316	9315	-1	0.0
21.7	9288	9213	-75	-0.8
22.9	9225	9200	-25	-0.3
24.1	9200	9193	-7	-0.1
25.3	9169	9172	3	0.0
26.5	9165	9140	-25	-0.3
27.7	9140	9102	-38	-0.4
28.9	9102	9017	-85	-0.9
30.1	9002	9002	0	0.0
31.3	8996	8996	0	0.0
32.5	8966	8966	0	0.0
33.7	8854	8854	0	0.0
34.9	8678	8742	64	0.7
36.1	8628	8615	-13	-0.2
37.3	8546	8589	43	0.5
38.6	8238	8238	0	0.0
39.8	8219	8173	-46	-0.6
41.0	8174	8153	-21	-0.3
42.2	8151	8043	-108	-1.3
43.4	8043	7968	-75	-0.9
44.6	7969	7899	-70	-0.9
45.8	7889	7757	-132	-1.7
47.0	7732	7732	0	0.0
48.2	7684	7686	2	0.0
49.4	7682	7684	2	0.0
50.6	7565	7621	56	0.7
51.8	7510	7506	-4	-0.1
53.0	7467	7472	5	0.1
54.2	7438	7467	29	0.4
55.4	7374	7457	83	1.1
56.6	7342	7383	41	0.6
57.8	7334	7354	20	0.3
59.0	6967	7350	383	5.5
60.2	6938	6963	25	0.4
61.4	6906	6928	22	0.3
62.7	6880	6890	10	0.1
63.9	6856	6878	22	0.3
65.1	6821	6857	36	0.5
66.3	6732	6796	64	1.0
67.5	6715	6737	22	0.3
68.7	6707	6714	7	0.1
69.9	6593	6712	119	1.8
71.1	6553	6596	43	0.7
72.3	6542	6553	11	0.2
73.5	6519	6542	23	0.4
74.7	6453	6519	66	1.0
75.9	6442	6468	26	0.4
77.1	6399	6400	1	0.0
78.3	6356	6399	43	0.7
79.5	6187	6189	2	0.0
80.7	6107	6114	7	0.1
81.9	5726	6094	368	6.4
83.1	5655	5998	343	6.1
84.3	5532	5721	189	3.4
85.5	5518	5712	194	3.5
86.7	5452	5531	79	1.4
88.0	5426	5517	91	1.7
89.2	5426	5430	4	0.1
90.4	5382	5426	44	0.8
91.6	5317	5309	-8	-0.2
92.8	5307	5306	-1	0.0
94.0	5187	5190	3	0.1
95.2	4922	4922	0	0.0
96.4	4444	4448	4	0.1
97.6	4394	4394	0	0.0
98.8	4267	4274	7	0.2
Min	4267	4274	-718	-6.0
Max	15837	15837	383	6.4
Mean	7964	7979	14	0.3
Median	7624	7653	2	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		11.0
X>=5.0		3.7
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		30.0
X>=5.0		10.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	19859	19859	0	0.0
2.4	14846	14846	0	0.0
3.6	14741	14816	75	0.5
4.8	14727	14574	-153	-1.0
6.0	14043	14044	1	0.0
7.2	13827	13825	-2	0.0
8.4	12945	12943	-2	0.0
9.6	12818	12631	-187	-1.5
10.8	12632	12485	-147	-1.2
12.0	12631	12374	-257	-2.0
13.3	12389	12367	-22	-0.2
14.5	12036	12039	3	0.0
15.7	12027	11940	-87	-0.7
16.9	11978	11922	-56	-0.5
18.1	11922	11767	-155	-1.3
19.3	11768	11726	-42	-0.4
20.5	11721	11723	2	0.0
21.7	11708	11657	-51	-0.4
22.9	11678	11606	-72	-0.6
24.1	11658	11514	-144	-1.2
25.3	11515	11493	-22	-0.2
26.5	11493	11491	-2	0.0
27.7	11485	11488	3	0.0
28.9	11485	11426	-59	-0.5
30.1	11397	11369	-28	-0.2
31.3	11318	11330	12	0.1
32.5	11254	11256	2	0.0
33.7	11210	11193	-17	-0.2
34.9	11199	11187	-12	-0.1
36.1	11188	11048	-140	-1.3
37.3	11179	10964	-215	-1.9
38.6	11040	10944	-96	-0.9
39.8	10944	10937	-7	-0.1
41.0	10939	10908	-31	-0.3
42.2	10907	10887	-20	-0.2
43.4	10867	10848	-19	-0.2
44.6	10848	10818	-30	-0.3
45.8	10828	10743	-85	-0.8
47.0	10774	10658	-116	-1.1
48.2	10653	10463	-190	-1.8
49.4	10462	10453	-9	-0.1
50.6	10420	10448	28	0.3
51.8	10343	10350	7	0.1
53.0	10228	10342	114	1.1
54.2	10218	10235	17	0.2
55.4	10212	10200	-12	-0.1
56.6	10180	10194	14	0.1
57.8	10099	10180	81	0.8
59.0	10085	10099	14	0.1
60.2	10040	10084	44	0.4
61.4	10039	10039	0	0.0
62.7	9988	9988	0	0.0
63.9	9960	9919	-41	-0.4
65.1	9919	9833	-86	-0.9
66.3	9908	9783	-125	-1.3
67.5	9821	9770	-51	-0.5
68.7	9759	9757	-2	0.0
69.9	9712	9743	31	0.3
71.1	9672	9713	41	0.4
72.3	9640	9672	32	0.3
73.5	9640	9671	31	0.3
74.7	9597	9633	36	0.4
75.9	9429	9596	167	1.8
77.1	9415	9428	13	0.1
78.3	9333	9415	82	0.9
79.5	9310	9310	0	0.0
80.7	9272	9271	-1	0.0
81.9	9179	9179	0	0.0
83.1	9176	9176	0	0.0
84.3	9118	9123	5	0.1
85.5	9020	9019	-1	0.0
86.7	8863	8881	18	0.2
88.0	8779	8768	-11	-0.1
89.2	8767	8764	-3	0.0
90.4	8686	8690	4	0.0
91.6	8532	8534	2	0.0
92.8	8363	8362	-1	0.0
94.0	8312	8311	-1	0.0
95.2	8274	8278	4	0.0
96.4	7927	7927	0	0.0
97.6	7404	7403	-1	0.0
98.8	7351	7357	6	0.1
Min	7351	7357	-257	-2.0
Max	19859	19859	167	1.8
Mean	10719	10695	-23	-0.2
Median	10441	10451	-1	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		12.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	16206	16078	-128	-0.8
2.4	15775	15775	0	0.0
3.6	15000	15115	115	0.8
4.8	15000	15000	0	0.0
6.0	15000	15000	0	0.0
7.2	15000	15000	0	0.0
8.4	15000	15000	0	0.0
9.6	15000	15000	0	0.0
10.8	15000	15000	0	0.0
12.0	15000	15000	0	0.0
13.3	15000	15000	0	0.0
14.5	15000	15000	0	0.0
15.7	15000	15000	0	0.0
16.9	15000	15000	0	0.0
18.1	15000	15000	0	0.0
19.3	15000	15000	0	0.0
20.5	14993	14986	-7	0.0
21.7	14930	14930	0	0.0
22.9	14927	14927	0	0.0
24.1	14903	14903	0	0.0
25.3	14834	14834	0	0.0
26.5	14756	14756	0	0.0
27.7	14739	14733	-6	0.0
28.9	14737	14677	-60	-0.4
30.1	14631	14565	-66	-0.5
31.3	14543	14454	-89	-0.6
32.5	14480	14241	-239	-1.7
33.7	14447	14236	-211	-1.5
34.9	14409	13966	-443	-3.1
36.1	14220	13926	-294	-2.1
37.3	13915	13906	-9	-0.1
38.6	13885	13883	-2	0.0
39.8	13654	13664	10	0.1
41.0	13641	13641	0	0.0
42.2	13582	13406	-176	-1.3
43.4	13418	13337	-81	-0.6
44.6	13406	13307	-99	-0.7
45.8	13307	13223	-84	-0.6
47.0	13231	13179	-52	-0.4
48.2	13179	13088	-91	-0.7
49.4	12961	13062	101	0.8
50.6	12925	12961	36	0.3
51.8	12911	12880	-31	-0.2
53.0	12861	12842	-19	-0.1
54.2	12843	12710	-133	-1.0
55.4	12711	12622	-89	-0.7
56.6	12623	12534	-89	-0.7
57.8	12617	12509	-108	-0.9
59.0	12519	12474	-45	-0.4
60.2	12510	12468	-42	-0.3
61.4	12417	12417	0	0.0
62.7	12414	12413	-1	0.0
63.9	12372	12358	-14	-0.1
65.1	12252	12261	9	0.1
66.3	12202	12211	9	0.1
67.5	12177	12206	29	0.2
68.7	12176	12185	9	0.1
69.9	12160	12164	4	0.0
71.1	12126	12160	34	0.3
72.3	12098	12119	21	0.2
73.5	12078	12085	7	0.1
74.7	12071	12070	-1	0.0
75.9	11998	11997	-1	0.0
77.1	11993	11936	-57	-0.5
78.3	11862	11862	0	0.0
79.5	11821	11689	-132	-1.1
80.7	11666	11659	-7	-0.1
81.9	11659	11596	-63	-0.5
83.1	11596	11490	-106	-0.9
84.3	11491	11414	-77	-0.7
85.5	11424	11374	-50	-0.4
86.7	11314	11272	-42	-0.4
88.0	10995	10996	1	0.0
89.2	10791	10883	92	0.9
90.4	10777	10777	0	0.0
91.6	10344	9684	-660	-6.4
92.8	10330	9655	-675	-6.5
94.0	9684	9512	-172	-1.8
95.2	9678	9377	-301	-3.1
96.4	9403	9241	-162	-1.7
97.6	8682	8689	7	0.1
98.8	8263	8263	0	0.0
Min	8263	8263	-675	-6.5
Max	16206	16078	115	0.9
Mean	13080	13022	-58	-0.5
Median	12943	13012	-1	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		13.4
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		10.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	14298	14298	0	0.0
2.4	14207	14207	0	0.0
3.6	13238	13238	0	0.0
4.8	13212	13212	0	0.0
6.0	13133	13133	0	0.0
7.2	12876	12876	0	0.0
8.4	12356	12543	187	1.5
9.6	12207	12356	149	1.2
10.8	12188	12208	20	0.2
12.0	11947	11936	-11	-0.1
13.3	11909	11893	-16	-0.1
14.5	11893	11879	-14	-0.1
15.7	11831	11831	0	0.0
16.9	11675	11699	24	0.2
18.1	11470	11449	-21	-0.2
19.3	11449	11416	-33	-0.3
20.5	11236	11240	4	0.0
21.7	11190	11170	-20	-0.2
22.9	11129	11154	25	0.2
24.1	11112	11130	18	0.2
25.3	11106	11103	-3	0.0
26.5	11080	10932	-148	-1.3
27.7	10932	10890	-42	-0.4
28.9	10867	10833	-34	-0.3
30.1	10815	10822	7	0.1
31.3	10814	10814	0	0.0
32.5	10808	10805	-3	0.0
33.7	10801	10781	-20	-0.2
34.9	10783	10728	-55	-0.5
36.1	10702	10726	24	0.2
37.3	10673	10716	43	0.4
38.6	10640	10669	29	0.3
39.8	10440	10639	199	1.9
41.0	10384	10441	57	0.5
42.2	10349	10410	61	0.6
43.4	10327	10355	28	0.3
44.6	10304	10329	25	0.2
45.8	10282	10308	26	0.3
47.0	10263	10283	20	0.2
48.2	10259	10281	22	0.2
49.4	10255	10258	3	0.0
50.6	10248	10227	-21	-0.2
51.8	10187	10163	-24	-0.2
53.0	10137	10112	-25	-0.2
54.2	10119	10027	-92	-0.9
55.4	10033	9965	-68	-0.7
56.6	10028	9961	-67	-0.7
57.8	10019	9903	-116	-1.2
59.0	9873	9851	-22	-0.2
60.2	9866	9833	-33	-0.3
61.4	9852	9783	-69	-0.7
62.7	9814	9765	-49	-0.5
63.9	9789	9640	-149	-1.5
65.1	9740	9593	-147	-1.5
66.3	9615	9493	-122	-1.3
67.5	9579	9492	-87	-0.9
68.7	9494	9491	-3	0.0
69.9	9491	9437	-54	-0.6
71.1	9491	9390	-101	-1.1
72.3	9413	9386	-27	-0.3
73.5	9331	9223	-108	-1.2
74.7	9223	9209	-14	-0.2
75.9	9196	9148	-48	-0.5
77.1	9144	9142	-2	0.0
78.3	9142	9135	-7	-0.1
79.5	9135	9111	-24	-0.3
80.7	9120	9081	-39	-0.4
81.9	9078	9067	-11	-0.1
83.1	9047	9059	12	0.1
84.3	9026	9056	30	0.3
85.5	8981	9052	71	0.8
86.7	8973	9040	67	0.7
88.0	8972	9026	54	0.6
89.2	8603	8989	386	4.5
90.4	8446	8900	454	5.4
91.6	8428	8445	17	0.2
92.8	8395	8387	-8	-0.1
94.0	7983	7988	5	0.1
95.2	7822	7801	-21	-0.3
96.4	7533	7539	6	0.1
97.6	7106	7116	10	0.1
98.8	6465	6463	-2	0.0
Min	6465	6463	-149	-1.5
Max	14298	14298	454	5.4
Mean	10285	10286	1	0.0
Median	10252	10243	-3	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		6.1
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		10.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	16372	16372	0	0.0
2.4	15607	15607	0	0.0
3.6	15381	15381	0	0.0
4.8	15134	15134	0	0.0
6.0	15000	15060	60	0.4
7.2	15000	15000	0	0.0
8.4	15000	15000	0	0.0
9.6	14900	14900	0	0.0
10.8	14820	14820	0	0.0
12.0	14017	14027	10	0.1
13.3	13146	12954	-192	-1.5
14.5	12954	12843	-111	-0.9
15.7	12563	12578	15	0.1
16.9	12542	12577	35	0.3
18.1	12522	12565	43	0.3
19.3	12444	12542	98	0.8
20.5	12431	12445	14	0.1
21.7	12407	12431	24	0.2
22.9	12324	12324	0	0.0
24.1	12179	12178	-1	0.0
25.3	12137	12136	-1	0.0
26.5	12083	12060	-23	-0.2
27.7	11711	11711	0	0.0
28.9	11342	11342	0	0.0
30.1	11002	11193	191	1.7
31.3	10052	9807	-245	-2.4
32.5	9801	9567	-234	-2.4
33.7	9455	9454	-1	0.0
34.9	9400	9400	0	0.0
36.1	9310	9311	1	0.0
37.3	8442	8470	28	0.3
38.6	7585	7576	-9	-0.1
39.8	7484	7393	-91	-1.2
41.0	7401	7314	-87	-1.2
42.2	6777	6747	-30	-0.4
43.4	6744	6710	-34	-0.5
44.6	6423	6492	69	1.1
45.8	6302	6414	112	1.8
47.0	6043	6264	221	3.7
48.2	5946	6035	89	1.5
49.4	5942	5949	7	0.1
50.6	5919	5925	6	0.1
51.8	5901	5923	22	0.4
53.0	5855	5881	26	0.4
54.2	5821	5854	33	0.6
55.4	5820	5822	2	0.0
56.6	5721	5734	13	0.2
57.8	5605	5601	-4	-0.1
59.0	5593	5596	3	0.1
60.2	5562	5586	24	0.4
61.4	5542	5546	4	0.1
62.7	5438	5534	96	1.8
63.9	5436	5437	1	0.0
65.1	5368	5380	12	0.2
66.3	5256	5299	43	0.8
67.5	5252	5243	-9	-0.2
68.7	5246	5228	-18	-0.3
69.9	5222	5223	1	0.0
71.1	5179	5150	-29	-0.6
72.3	5150	4921	-229	-4.4
73.5	4922	4891	-31	-0.6
74.7	4890	4846	-44	-0.9
75.9	4852	4833	-19	-0.4
77.1	4846	4817	-29	-0.6
78.3	4729	4791	62	1.3
79.5	4724	4729	5	0.1
80.7	4694	4723	29	0.6
81.9	4675	4675	0	0.0
83.1	4621	4632	11	0.2
84.3	4618	4626	8	0.2
85.5	4475	4618	143	3.2
86.7	4402	4478	76	1.7
88.0	4352	4404	52	1.2
89.2	4322	4389	67	1.6
90.4	4313	4352	39	0.9
91.6	4238	4241	3	0.1
92.8	4238	4239	1	0.0
94.0	4220	4200	-20	-0.5
95.2	4188	4034	-154	-3.7
96.4	4034	4033	-1	0.0
97.6	3898	3897	-1	0.0
98.8	3402	3400	-2	-0.1
Min	3402	3400	-245	-4.4
Max	16372	16372	221	3.7
Mean	8057	8059	2	0.1
Median	5931	5937	1	0.0

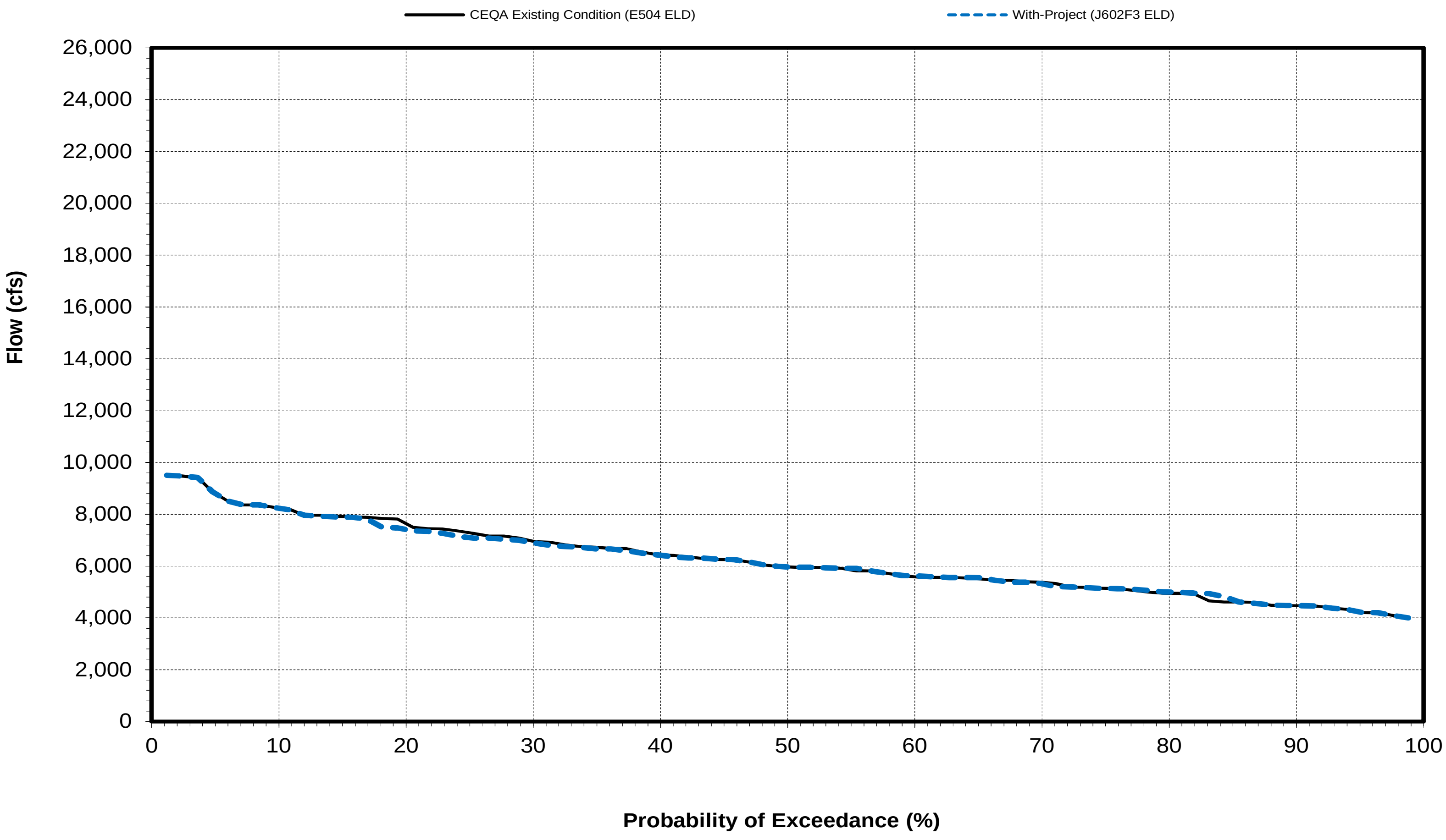
Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	78.0
1.1<=X<10.0		13.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

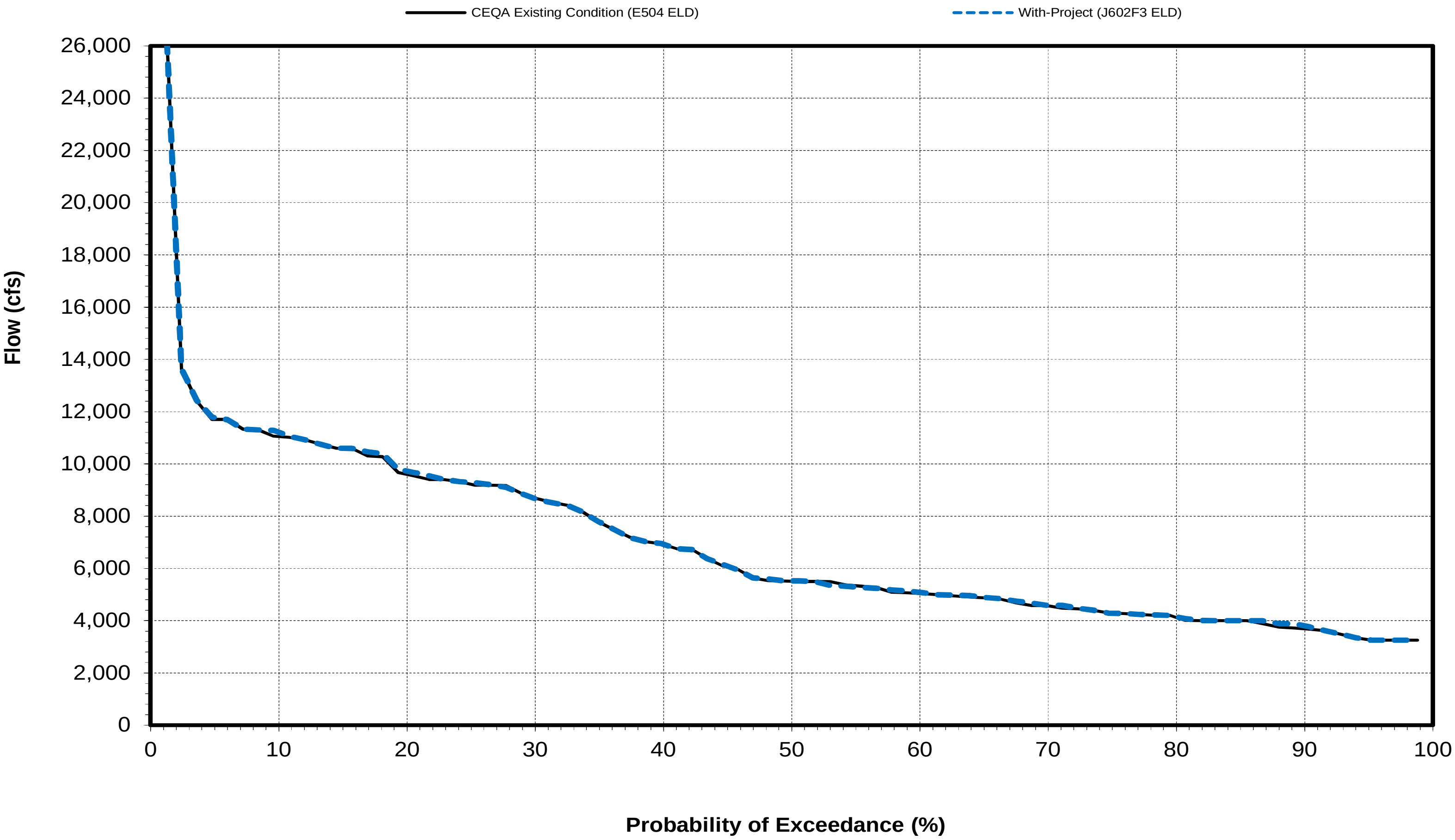
(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		25.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Keswick Dam **October**



Sacramento River Flow below Keswick Dam

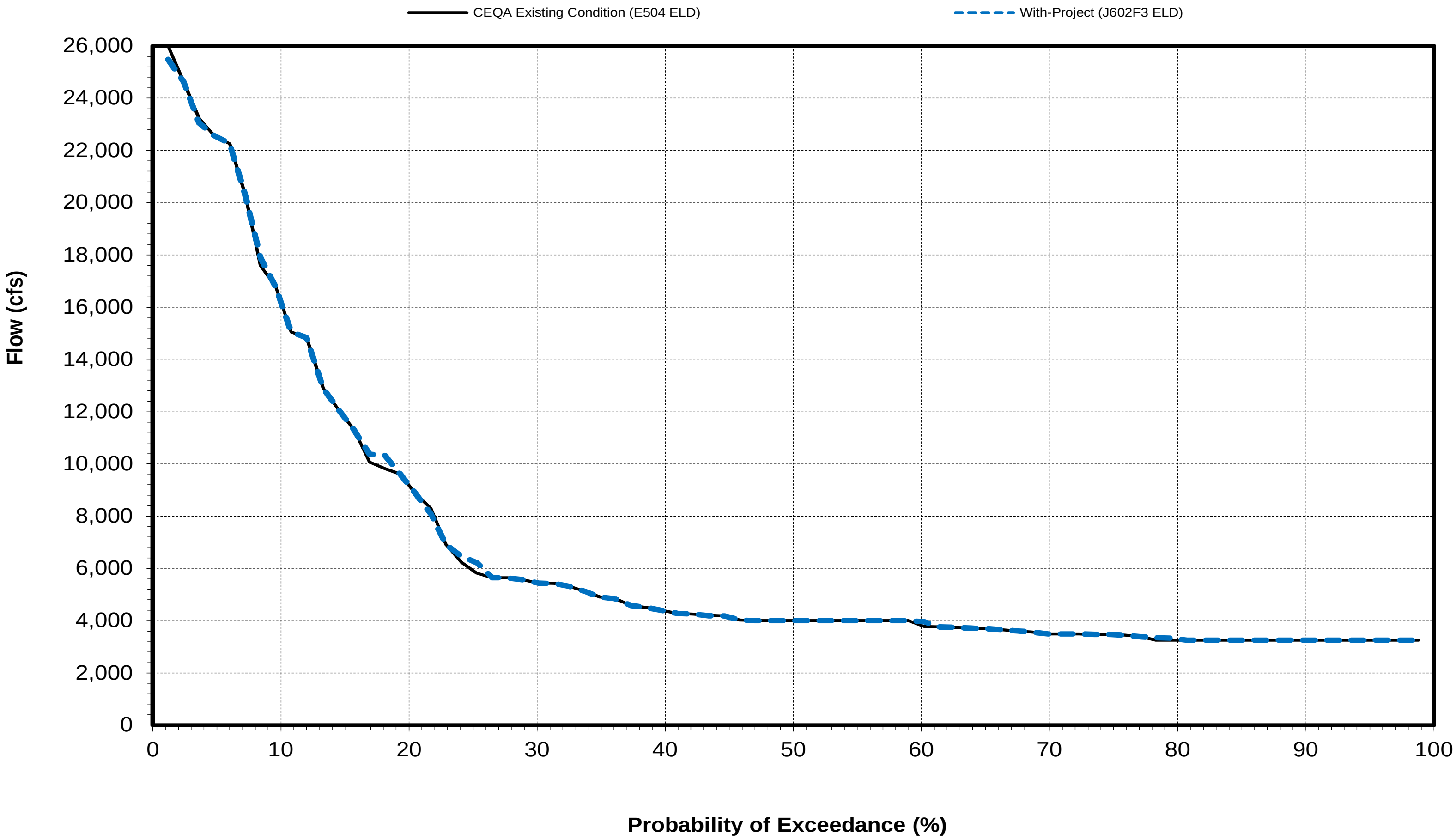
November



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

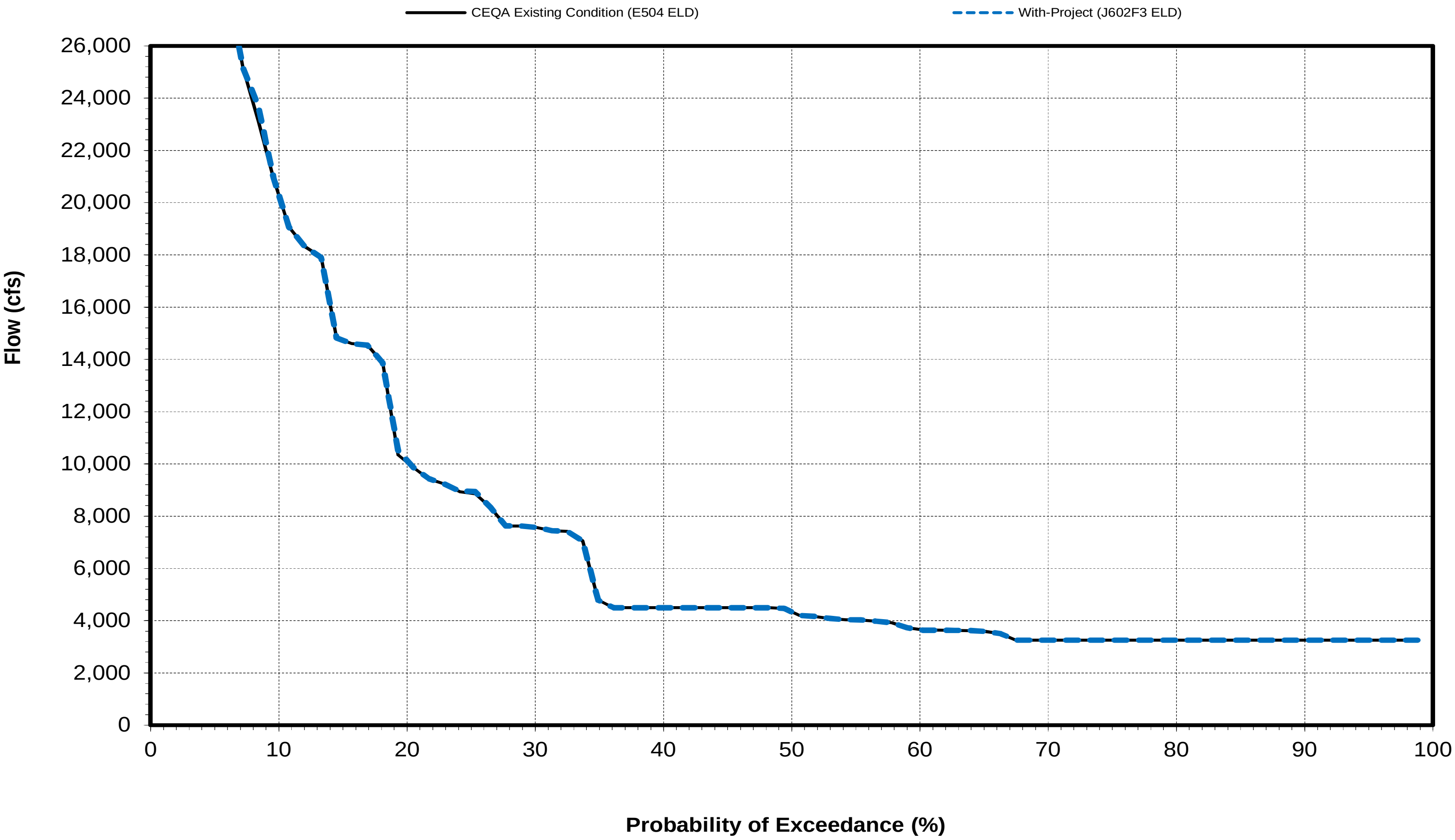
Sacramento River Flow below Keswick Dam **December**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow below Keswick Dam

January

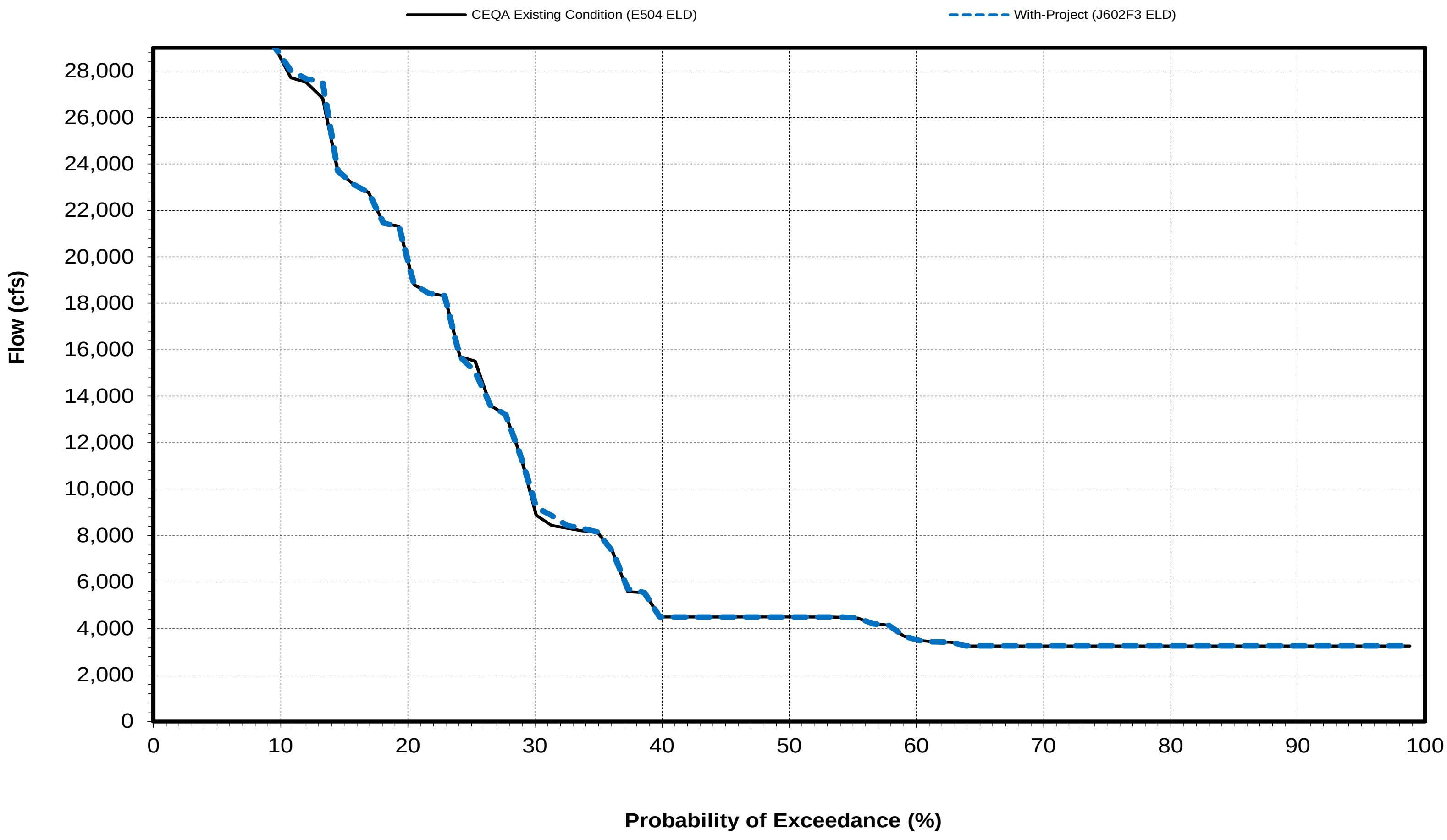


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

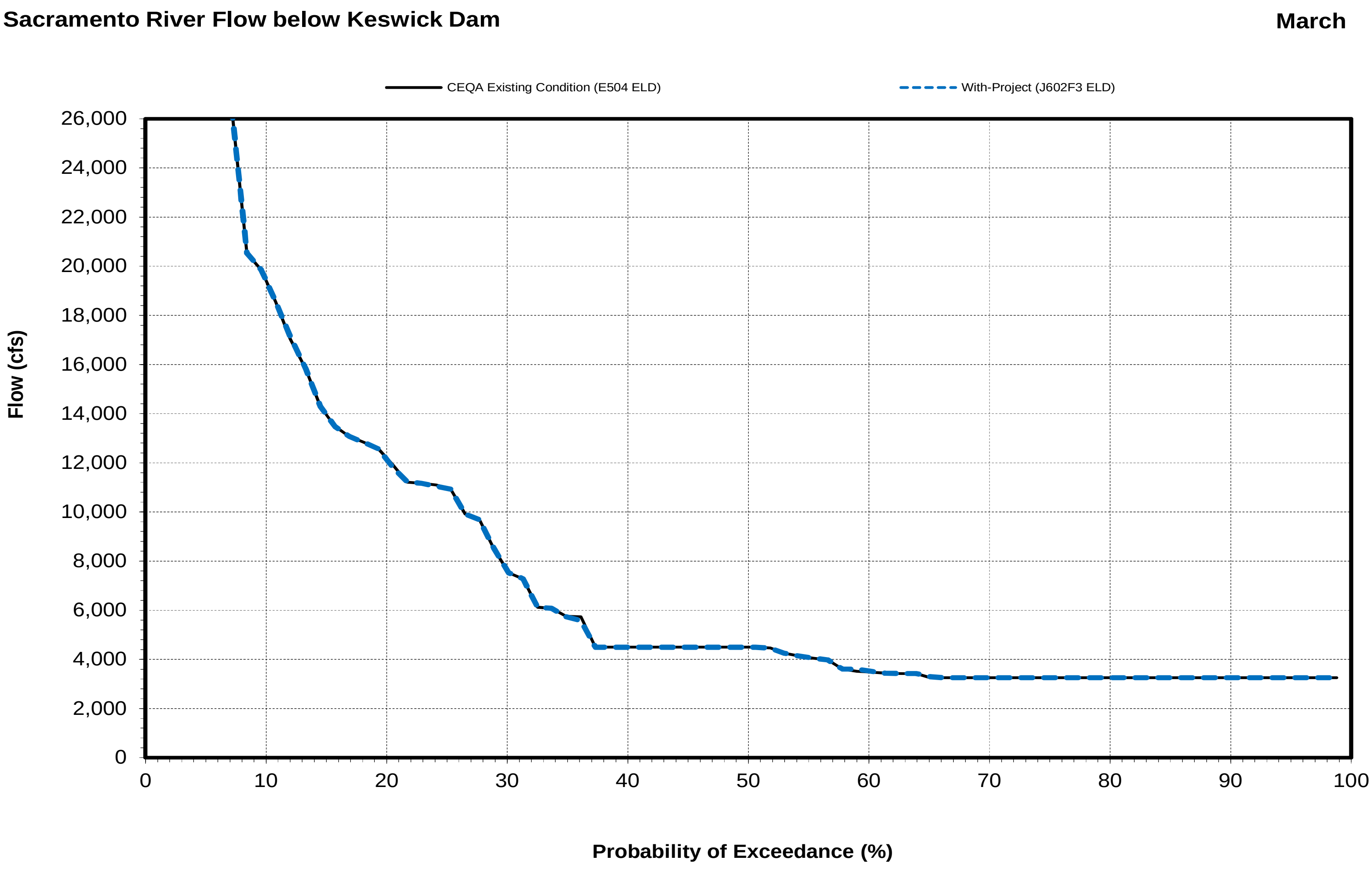
Sacramento River Flow below Keswick Dam

February



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

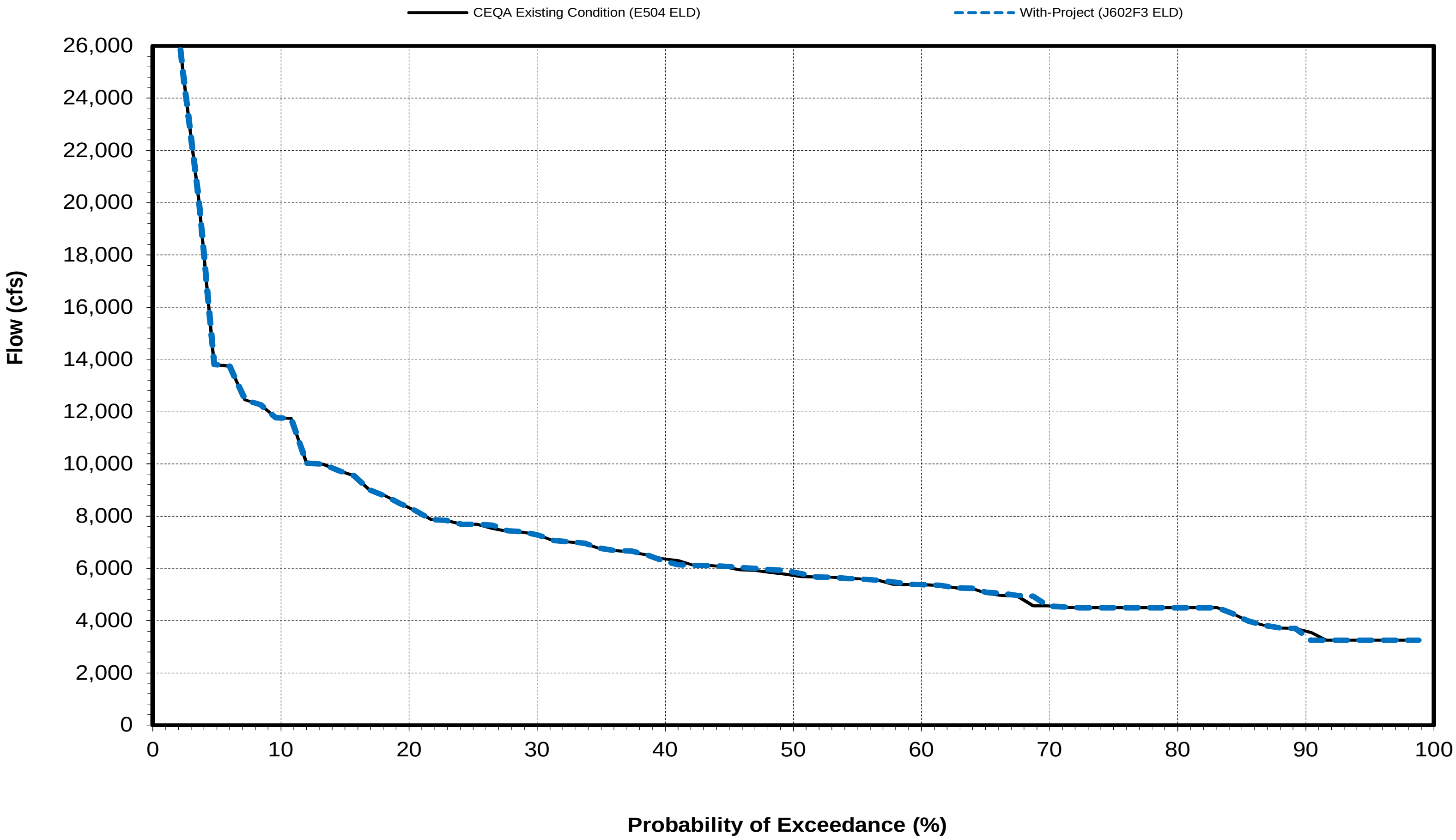
Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow below Keswick Dam

April

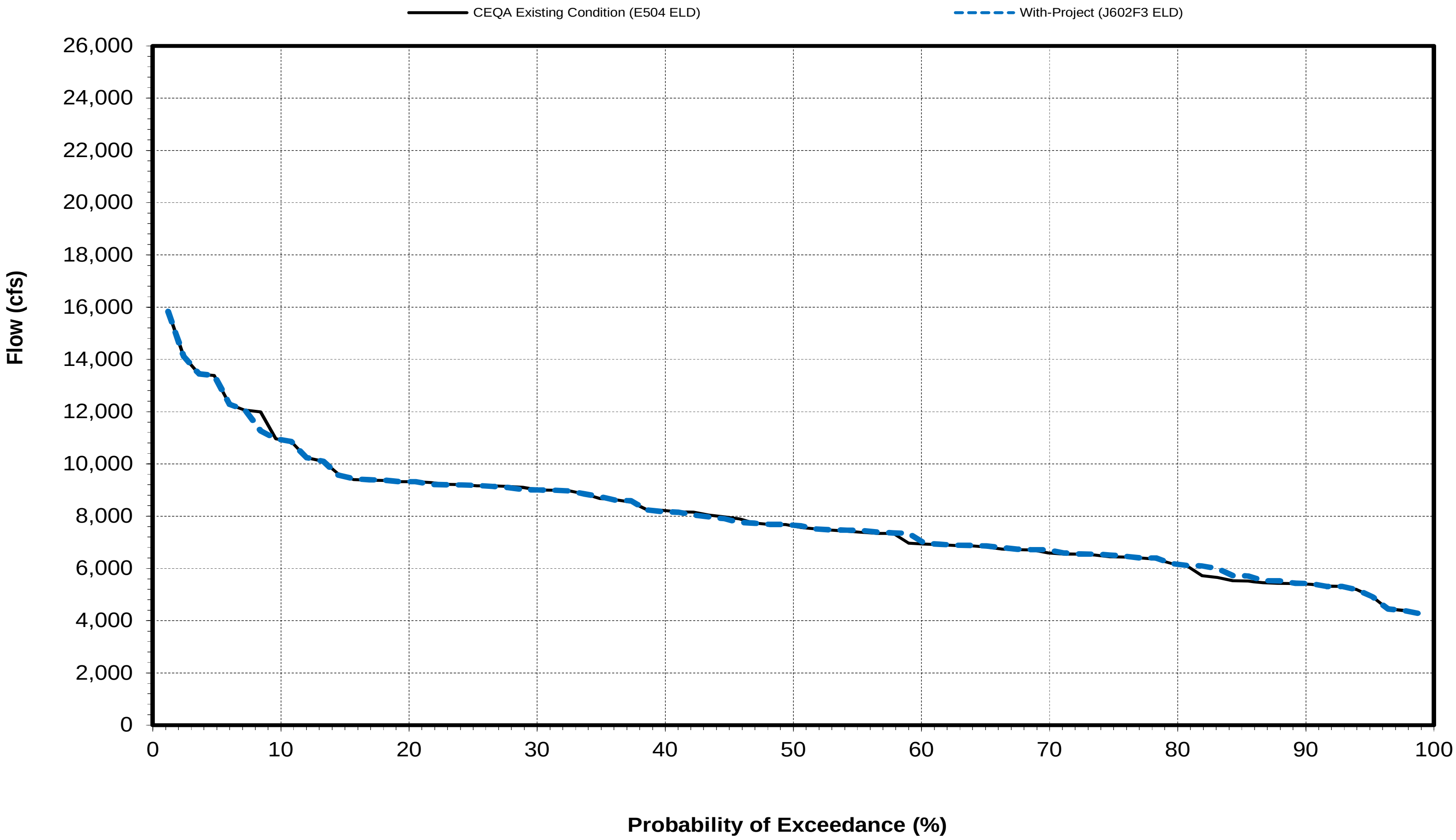


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow below Keswick Dam

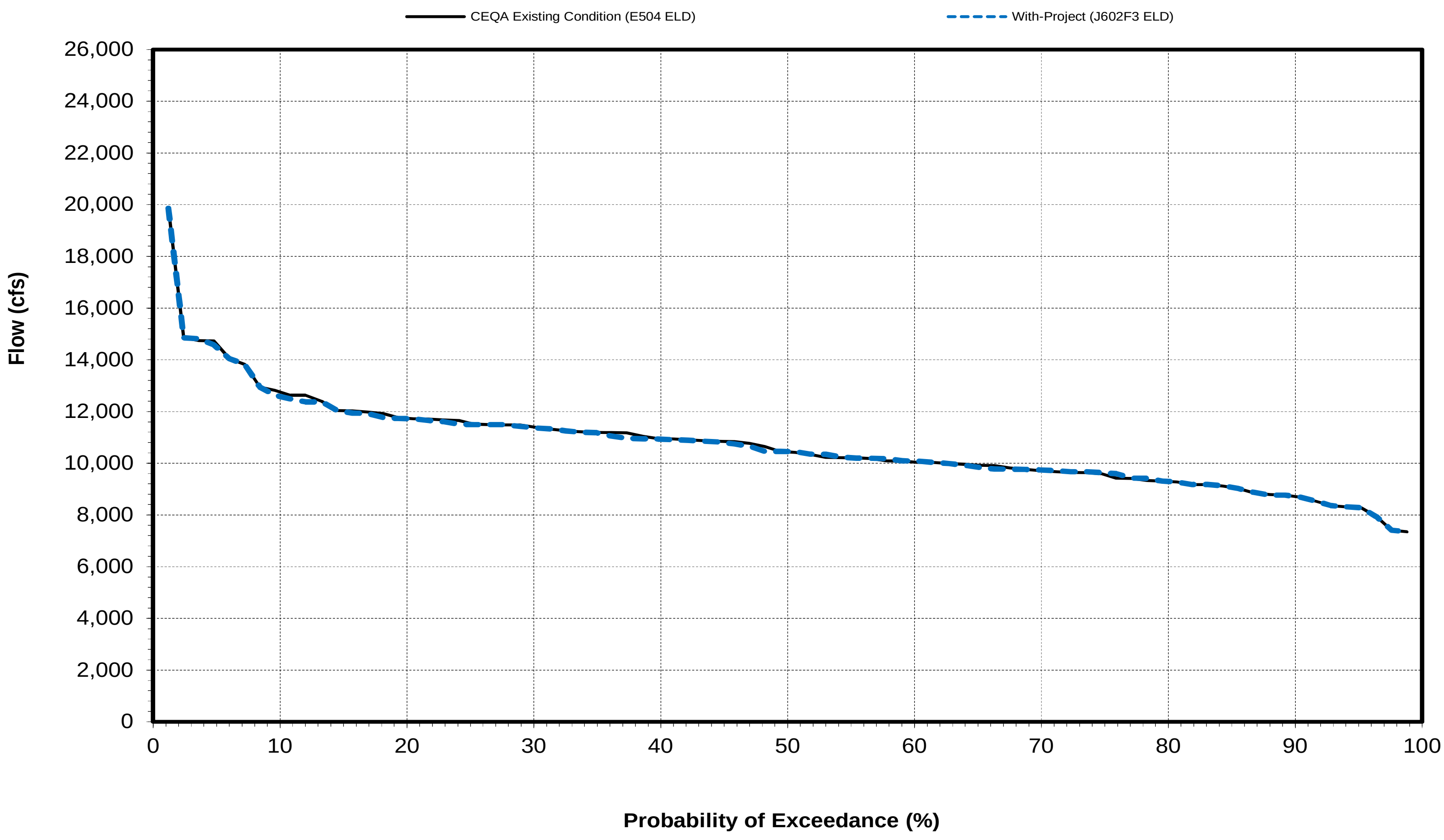
May



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

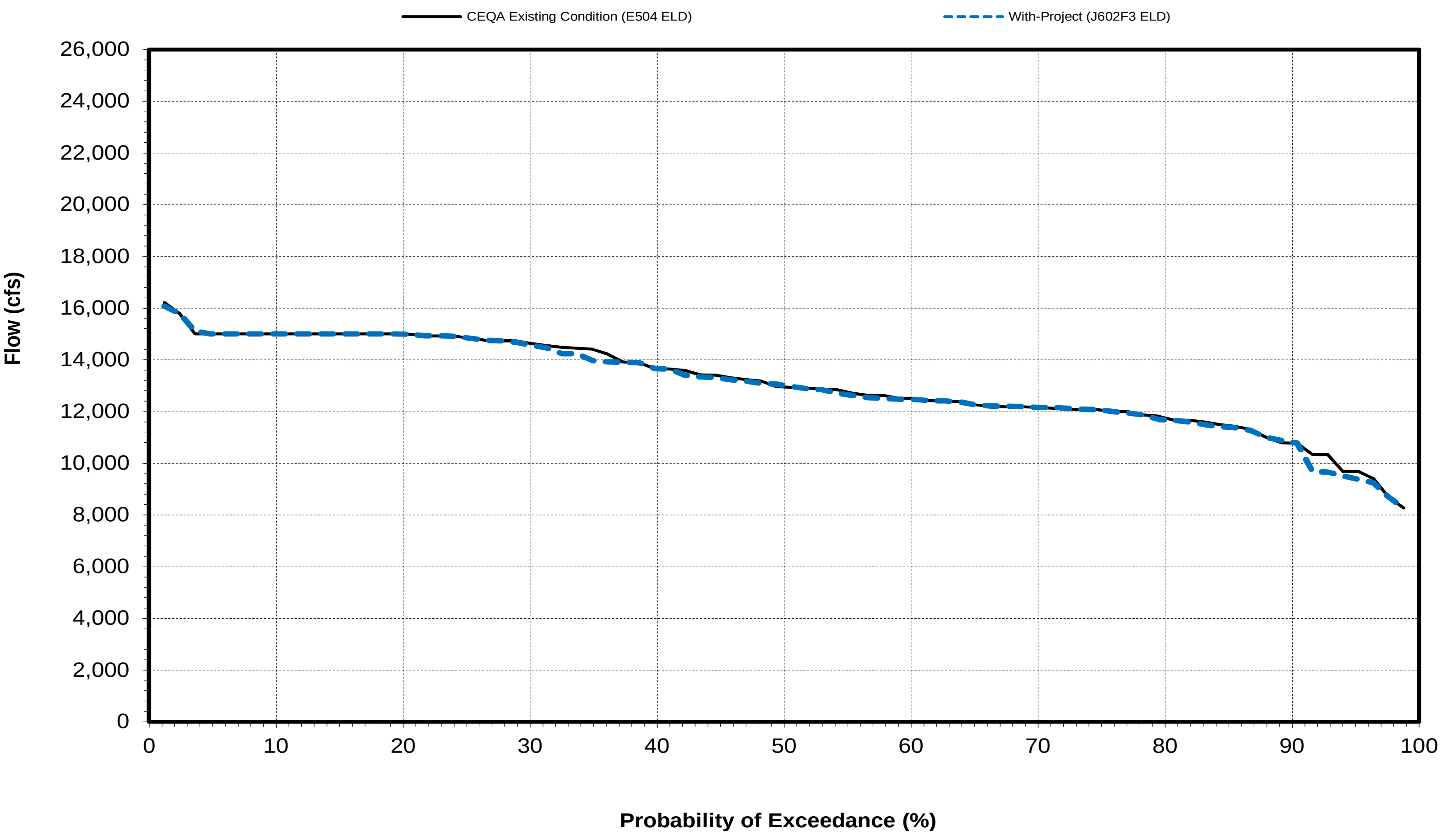
Created: 7/26/2016

Sacramento River Flow below Keswick Dam **June**



Sacramento River Flow below Keswick Dam

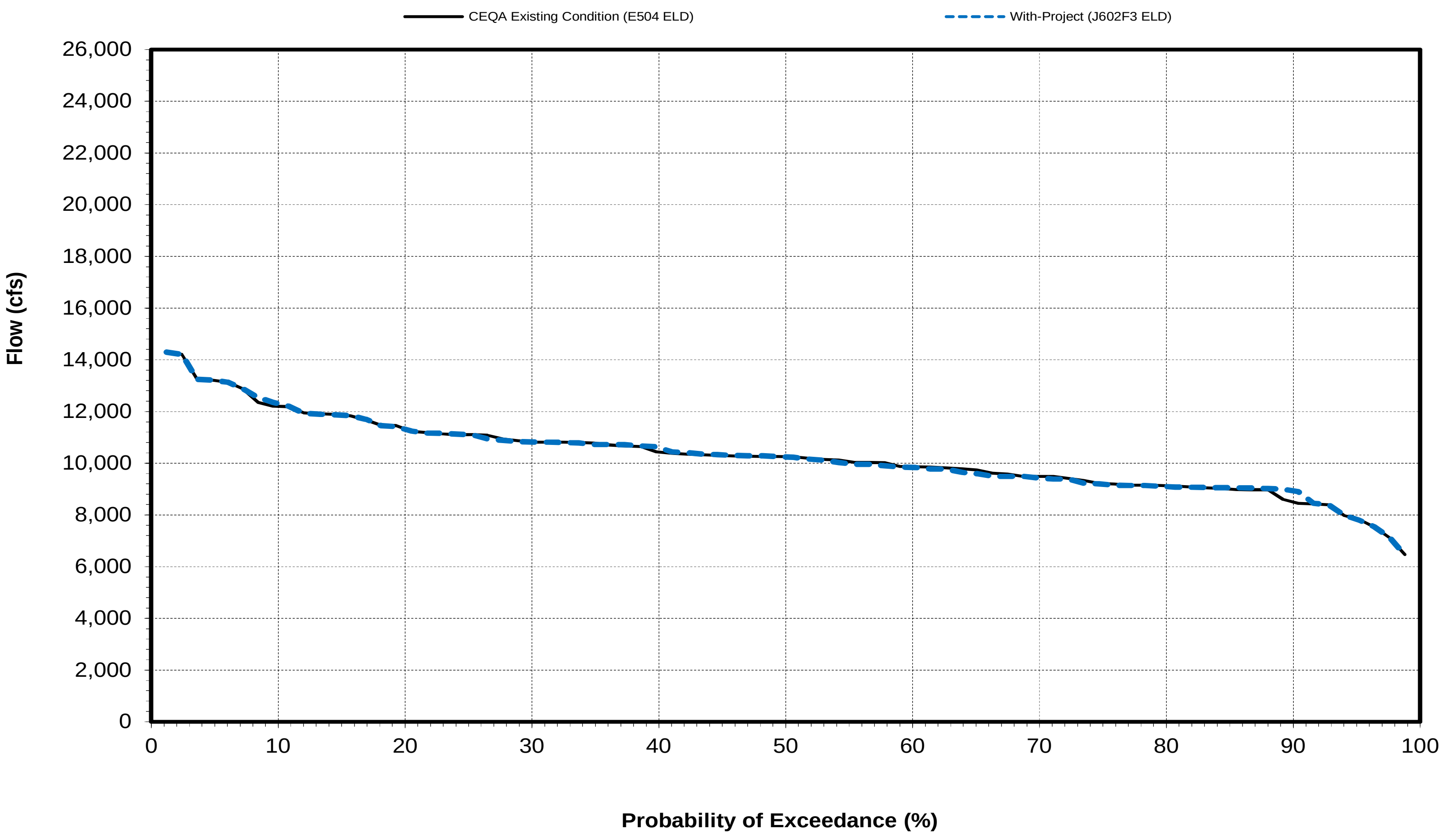
July



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

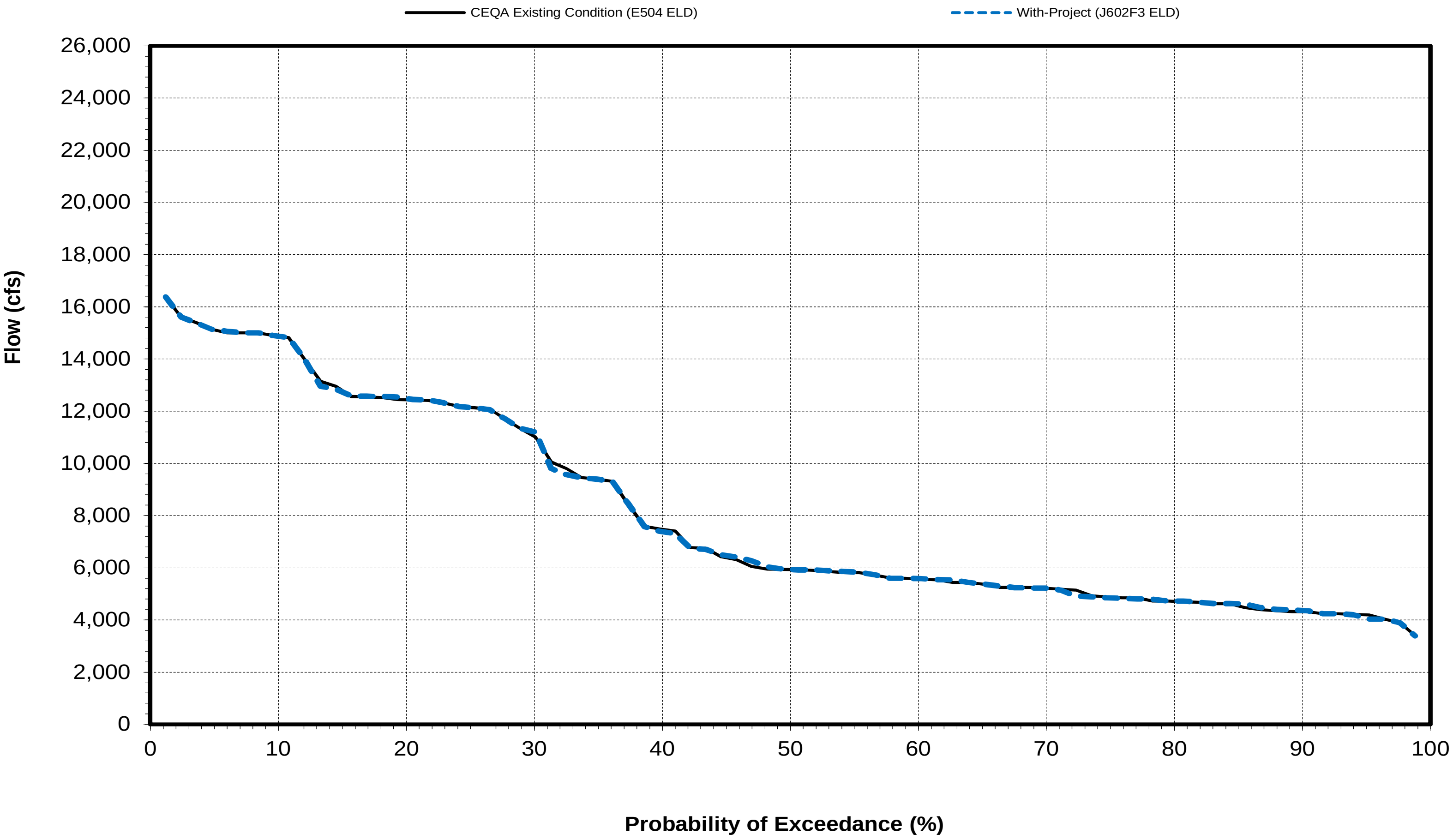
Sacramento River Flow below Keswick Dam **August**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow below Keswick Dam **September**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Long-term and Water Year Type Average Sacramento River Flow at Bend Bridge Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	7,163	9,105	11,272	14,898	17,715	14,357	10,633	10,004	11,679	13,318	10,470	8,493
With-Project (J602F3 ELD)	7,141	9,131	11,286	14,908	17,738	14,356	10,643	10,017	11,655	13,259	10,471	8,494
Difference	-22	26	14	10	23	-1	10	13	-24	-59	1	1
Percent Difference[3]	-0.3	0.3	0.1	0.1	0.1	0.0	0.1	0.1	-0.2	-0.4	0.0	0.0
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	8,032	11,488	18,982	27,021	29,762	24,911	15,188	12,530	12,088	13,298	11,348	13,511
With-Project (J602F3 ELD)	7,918	11,489	18,993	27,052	29,810	24,913	15,198	12,515	12,102	13,300	11,360	13,509
Difference	-114	1	11	31	48	2	10	-15	14	2	12	-2
Percent Difference[3]	-1.4	0.0	0.1	0.1	0.2	0.0	0.1	-0.1	0.1	0.0	0.1	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	6,950	9,119	10,183	15,728	23,149	15,515	10,366	10,256	12,145	14,467	10,600	8,452
With-Project (J602F3 ELD)	6,927	9,178	10,224	15,726	23,144	15,502	10,371	10,349	12,108	14,464	10,586	8,511
Difference	-23	59	41	-2	-5	-13	5	93	-37	-3	-14	59
Percent Difference[3]	-0.3	0.6	0.4	0.0	0.0	-0.1	0.0	0.9	-0.3	0.0	-0.1	0.7
Below Normal												
CEQA Existing Condition (E504 ELD)	7,139	8,226	8,267	8,867	11,745	8,821	8,553	8,723	11,426	13,032	10,066	5,940
With-Project (J602F3 ELD)	7,135	8,217	8,267	8,867	11,713	8,813	8,556	8,732	11,342	13,041	10,052	5,948
Difference	-4	-9	0	0	-32	-8	3	9	-84	9	-14	8
Percent Difference[3]	-0.1	-0.1	0.0	0.0	-0.3	-0.1	0.0	0.1	-0.7	0.1	-0.1	0.1
Dry												
CEQA Existing Condition (E504 ELD)	6,657	8,032	7,039	7,015	8,787	8,240	7,862	8,640	11,734	13,641	10,009	5,613
With-Project (J602F3 ELD)	6,690	8,084	7,039	7,015	8,843	8,241	7,890	8,658	11,698	13,486	10,095	5,583
Difference	33	52	0	0	56	1	28	18	-36	-155	86	-30
Percent Difference[3]	0.5	0.6	0.0	0.0	0.6	0.0	0.4	0.2	-0.3	-1.1	0.9	-0.5
Critical												
CEQA Existing Condition (E504 ELD)	6,282	6,567	5,515	6,662	6,533	5,966	7,611	7,819	10,541	12,060	9,602	4,961
With-Project (J602F3 ELD)	6,356	6,614	5,544	6,663	6,545	5,981	7,611	7,813	10,534	11,881	9,482	4,950
Difference	74	47	29	1	12	15	0	-6	-7	-179	-120	-11
Percent Difference[3]	1.2	0.7	0.5	0.0	0.2	0.3	0.0	-0.1	-0.1	-1.5	-1.2	-0.2

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

Sacramento River Flow at Bend Bridge - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	11012	11012	0	0.0
2.4	10900	10814	-86	-0.8
3.6	10814	10640	-174	-1.6
4.8	10465	10465	0	0.0
6.0	9758	9758	0	0.0
7.2	9745	9744	-1	0.0
8.4	9734	9734	0	0.0
9.6	9338	9338	0	0.0
10.8	9151	9123	-28	-0.3
12.0	9091	9090	-1	0.0
13.3	9006	8983	-23	-0.3
14.5	8977	8956	-21	-0.2
15.7	8956	8780	-176	-2.0
16.9	8907	8699	-208	-2.3
18.1	8780	8494	-286	-3.3
19.3	8700	8434	-266	-3.1
20.5	8494	8314	-180	-2.1
21.7	8434	8084	-350	-4.1
22.9	8314	8063	-251	-3.0
24.1	8127	8044	-83	-1.0
25.3	8086	7938	-148	-1.8
26.5	7939	7935	-4	-0.1
27.7	7830	7831	1	0.0
28.9	7824	7824	0	0.0
30.1	7795	7779	-16	-0.2
31.3	7792	7763	-29	-0.4
32.5	7791	7721	-70	-0.9
33.7	7680	7674	-6	-0.1
34.9	7672	7670	-2	0.0
36.1	7612	7464	-148	-1.9
37.3	7464	7449	-15	-0.2
38.6	7430	7430	0	0.0
39.8	7374	7340	-34	-0.5
41.0	7350	7339	-11	-0.1
42.2	7312	7289	-23	-0.3
43.4	7294	7280	-14	-0.2
44.6	7011	7186	175	2.5
45.8	6968	7057	89	1.3
47.0	6960	6966	6	0.1
48.2	6821	6821	0	0.0
49.4	6818	6818	0	0.0
50.6	6792	6793	1	0.0
51.8	6756	6758	2	0.0
53.0	6713	6713	0	0.0
54.2	6604	6713	109	1.7
55.4	6556	6647	91	1.4
56.6	6542	6603	61	0.9
57.8	6524	6564	40	0.6
59.0	6522	6561	39	0.6
60.2	6463	6524	61	0.9
61.4	6381	6522	141	2.2
62.7	6381	6381	0	0.0
63.9	6333	6333	0	0.0
65.1	6240	6253	13	0.2
66.3	6231	6231	0	0.0
67.5	6222	6107	-115	-1.8
68.7	6105	6105	0	0.0
69.9	6095	6073	-22	-0.4
71.1	6070	6066	-4	-0.1
72.3	6065	6028	-37	-0.6
73.5	6028	5974	-54	-0.9
74.7	5967	5930	-37	-0.6
75.9	5927	5918	-9	-0.2
77.1	5824	5839	15	0.3
78.3	5822	5825	3	0.1
79.5	5820	5819	-1	0.0
80.7	5819	5818	-1	0.0
81.9	5813	5712	-101	-1.7
83.1	5711	5696	-15	-0.3
84.3	5710	5694	-16	-0.3
85.5	5694	5624	-70	-1.2
86.7	5624	5610	-14	-0.2
88.0	5515	5583	68	1.2
89.2	5491	5494	3	0.1
90.4	5462	5479	17	0.3
91.6	5364	5462	98	1.8
92.8	5262	5407	145	2.8
94.0	5250	5364	114	2.2
95.2	5199	5250	51	1.0
96.4	5106	5105	-1	0.0
97.6	5014	5015	1	0.0
98.8	4834	4835	1	0.0
Min	4834	4835	-350	-4.1
Max	11012	11012	175	2.8
Mean	7163	7141	-22	-0.2
Median	6805	6806	-1	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	73.2
1.1<=X<10.0		11.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	35526	35527	1	0.0
2.4	20223	20223	0	0.0
3.6	14485	14485	0	0.0
4.8	14417	14480	63	0.4
6.0	14177	14191	14	0.1
7.2	13155	13155	0	0.0
8.4	12817	12901	84	0.7
9.6	12816	12809	-7	-0.1
10.8	12760	12759	-1	0.0
12.0	12716	12716	0	0.0
13.3	12605	12611	6	0.0
14.5	12362	12355	-7	-0.1
15.7	12263	12301	38	0.3
16.9	12209	12263	54	0.4
18.1	12042	12231	189	1.6
19.3	11963	12190	227	1.9
20.5	11926	11964	38	0.3
21.7	11876	11876	0	0.0
22.9	11835	11835	0	0.0
24.1	11824	11823	-1	0.0
25.3	11764	11764	0	0.0
26.5	11376	11351	-25	-0.2
27.7	11168	11175	7	0.1
28.9	11083	11106	23	0.2
30.1	11026	11056	30	0.3
31.3	10797	10836	39	0.4
32.5	10752	10797	45	0.4
33.7	10739	10752	13	0.1
34.9	10577	10673	96	0.9
36.1	10483	10483	0	0.0
37.3	10053	10385	332	3.3
38.6	9954	9966	12	0.1
39.8	9577	9572	-5	-0.1
41.0	9519	9545	26	0.3
42.2	9362	9362	0	0.0
43.4	9334	9334	0	0.0
44.6	8936	9202	266	3.0
45.8	8587	8936	349	4.1
47.0	8346	8327	-19	-0.2
48.2	8237	8237	0	0.0
49.4	8233	7954	-279	-3.4
50.6	7899	7891	-8	-0.1
51.8	7815	7748	-67	-0.9
53.0	7748	7737	-11	-0.1
54.2	7740	7695	-45	-0.6
55.4	7668	7668	0	0.0
56.6	7659	7639	-20	-0.3
57.8	7593	7593	0	0.0
59.0	7291	7291	0	0.0
60.2	7289	7289	0	0.0
61.4	7225	7227	2	0.0
62.7	7192	7192	0	0.0
63.9	7130	7128	-2	0.0
65.1	6799	6799	0	0.0
66.3	6781	6783	2	0.0
67.5	6669	6597	-72	-1.1
68.7	6483	6570	87	1.3
69.9	6466	6483	17	0.3
71.1	6337	6337	0	0.0
72.3	6282	6287	5	0.1
73.5	6228	6212	-16	-0.3
74.7	6199	6201	2	0.0
75.9	6089	6089	0	0.0
77.1	5960	5961	1	0.0
78.3	5895	5894	-1	0.0
79.5	5776	5842	66	1.1
80.7	5770	5775	5	0.1
81.9	5667	5667	0	0.0
83.1	5664	5664	0	0.0
84.3	5655	5655	0	0.0
85.5	5620	5620	0	0.0
86.7	5269	5268	-1	0.0
88.0	5234	5234	0	0.0
89.2	5129	5130	1	0.0
90.4	4950	4952	2	0.0
91.6	4935	4934	-1	0.0
92.8	4738	4825	87	1.8
94.0	4613	4747	134	2.9
95.2	4515	4740	225	5.0
96.4	4397	4525	128	2.9
97.6	4268	4266	-2	0.0
98.8	4105	4105	0	0.0
Min	4105	4105	-279	-3.4
Max	35526	35527	349	5.0
Mean	9105	9131	26	0.3
Median	8066	7923	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		13.4
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		25.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	42288	42288	0	0.0
2.4	40586	40070	-516	-1.3
3.6	34576	34575	-1	0.0
4.8	34562	34563	1	0.0
6.0	31201	31019	-182	-0.6
7.2	30405	30394	-11	0.0
8.4	29570	29571	1	0.0
9.6	28876	29168	292	1.0
10.8	23991	23991	0	0.0
12.0	23565	23565	0	0.0
13.3	21838	22338	500	2.3
14.5	21070	21070	0	0.0
15.7	21053	21053	0	0.0
16.9	18845	18633	-212	-1.1
18.1	17813	17806	-7	0.0
19.3	16743	17384	641	3.8
20.5	15501	15794	293	1.9
21.7	14754	14754	0	0.0
22.9	14217	14217	0	0.0
24.1	13894	13894	0	0.0
25.3	13829	13829	0	0.0
26.5	13433	13434	1	0.0
27.7	11877	11875	-2	0.0
28.9	11778	11772	-6	-0.1
30.1	11272	11272	0	0.0
31.3	10096	10095	-1	0.0
32.5	9168	9168	0	0.0
33.7	8989	8990	1	0.0
34.9	8926	8925	-1	0.0
36.1	8891	8892	1	0.0
37.3	8887	8888	1	0.0
38.6	8798	8798	0	0.0
39.8	8641	8641	0	0.0
41.0	8611	8611	0	0.0
42.2	8253	8253	0	0.0
43.4	7563	7563	0	0.0
44.6	7342	7342	0	0.0
45.8	7308	7308	0	0.0
47.0	7272	7272	0	0.0
48.2	7267	7267	0	0.0
49.4	7120	7120	0	0.0
50.6	7005	7004	-1	0.0
51.8	6894	6897	3	0.0
53.0	6846	6844	-2	0.0
54.2	6834	6832	-2	0.0
55.4	6734	6734	0	0.0
56.6	6725	6725	0	0.0
57.8	6582	6585	3	0.0
59.0	6525	6526	1	0.0
60.2	6392	6388	-4	-0.1
61.4	6378	6377	-1	0.0
62.7	6280	6280	0	0.0
63.9	6214	6214	0	0.0
65.1	6191	6191	0	0.0
66.3	6179	6180	1	0.0
67.5	6153	6153	0	0.0
68.7	6135	6134	-1	0.0
69.9	5964	5964	0	0.0
71.1	5945	5945	0	0.0
72.3	5889	5889	0	0.0
73.5	5801	5801	0	0.0
74.7	5716	5715	-1	0.0
75.9	5629	5628	-1	0.0
77.1	5548	5548	0	0.0
78.3	5525	5524	-1	0.0
79.5	5462	5462	0	0.0
80.7	5409	5409	0	0.0
81.9	5321	5327	6	0.1
83.1	5229	5321	92	1.8
84.3	5189	5189	0	0.0
85.5	5188	5188	0	0.0
86.7	5147	5142	-5	-0.1
88.0	5119	5119	0	0.0
89.2	5089	5089	0	0.0
90.4	4912	4912	0	0.0
91.6	4785	4833	48	1.0
92.8	4721	4785	64	1.4
94.0	4687	4720	33	0.7
95.2	4652	4686	34	0.7
96.4	4590	4590	0	0.0
97.6	4125	4200	75	1.8
98.8	3960	3960	0	0.0
Min	3960	3960	-516	-1.3
Max	42288	42288	641	3.8
Mean	11272	11286	14	0.2
Median	7063	7062	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	90.2
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	76621	76621	0	0.0
2.4	56585	56585	0	0.0
3.6	51190	51191	1	0.0
4.8	49946	49947	1	0.0
6.0	43743	43743	0	0.0
7.2	40149	40386	237	0.6
8.4	39814	40149	335	0.8
9.6	33233	33323	90	0.3
10.8	31575	31575	0	0.0
12.0	30178	30178	0	0.0
13.3	26897	26877	-20	-0.1
14.5	26346	26346	0	0.0
15.7	26137	26138	1	0.0
16.9	26084	26104	20	0.1
18.1	25934	26081	147	0.6
19.3	23329	23324	-5	0.0
20.5	22421	22421	0	0.0
21.7	19737	19736	-1	0.0
22.9	19495	19495	0	0.0
24.1	19059	19059	0	0.0
25.3	18297	18298	1	0.0
26.5	17759	17762	3	0.0
27.7	17672	17673	1	0.0
28.9	15124	15124	0	0.0
30.1	15051	15051	0	0.0
31.3	14852	14852	0	0.0
32.5	14232	14232	0	0.0
33.7	13397	13397	0	0.0
34.9	13376	13376	0	0.0
36.1	12256	12254	-2	0.0
37.3	12125	12125	0	0.0
38.6	12030	12030	0	0.0
39.8	11467	11467	0	0.0
41.0	11139	11139	0	0.0
42.2	11063	11063	0	0.0
43.4	10446	10446	0	0.0
44.6	10301	10321	20	0.2
45.8	10080	10081	1	0.0
47.0	10069	10067	-2	0.0
48.2	10060	10063	3	0.0
49.4	9837	9837	0	0.0
50.6	9150	9158	8	0.1
51.8	9109	9109	0	0.0
53.0	8774	8774	0	0.0
54.2	8369	8369	0	0.0
55.4	8238	8238	0	0.0
56.6	8129	8129	0	0.0
57.8	7761	7761	0	0.0
59.0	7664	7664	0	0.0
60.2	7590	7590	0	0.0
61.4	7442	7442	0	0.0
62.7	7410	7409	-1	0.0
63.9	7330	7330	0	0.0
65.1	7255	7256	1	0.0
66.3	7025	7025	0	0.0
67.5	6749	6751	2	0.0
68.7	6660	6660	0	0.0
69.9	6564	6564	0	0.0
71.1	6486	6486	0	0.0
72.3	6439	6439	0	0.0
73.5	6266	6267	1	0.0
74.7	6189	6189	0	0.0
75.9	6125	6125	0	0.0
77.1	6080	6080	0	0.0
78.3	6073	6073	0	0.0
79.5	5971	5965	-6	-0.1
80.7	5953	5953	0	0.0
81.9	5935	5935	0	0.0
83.1	5849	5849	0	0.0
84.3	5484	5480	-4	-0.1
85.5	5419	5419	0	0.0
86.7	5267	5268	1	0.0
88.0	5012	5013	1	0.0
89.2	4978	4978	0	0.0
90.4	4976	4976	0	0.0
91.6	4973	4973	0	0.0
92.8	4820	4820	0	0.0
94.0	4722	4722	0	0.0
95.2	4663	4663	0	0.0
96.4	4620	4620	0	0.0
97.6	4576	4576	0	0.0
98.8	4414	4414	0	0.0
Min	4414	4414	-20	-0.1
Max	76621	76621	335	0.8
Mean	14898	14908	10	0.0
Median	9494	9498	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	73269	73267	-2	0.0
2.4	63149	63235	86	0.1
3.6	62332	62332	0	0.0
4.8	54794	54794	0	0.0
6.0	47464	47464	0	0.0
7.2	46337	47150	813	1.8
8.4	45980	46322	342	0.7
9.6	43393	43393	0	0.0
10.8	42843	42843	0	0.0
12.0	40460	40410	-50	-0.1
13.3	40286	40285	-1	0.0
14.5	39162	39162	0	0.0
15.7	37322	37319	-3	0.0
16.9	32661	32661	0	0.0
18.1	32553	32554	1	0.0
19.3	30704	30703	-1	0.0
20.5	29501	29502	1	0.0
21.7	27615	27614	-1	0.0
22.9	26922	26922	0	0.0
24.1	24966	24514	-452	-1.8
25.3	24037	24037	0	0.0
26.5	23062	23062	0	0.0
27.7	21302	21311	9	0.0
28.9	20536	20536	0	0.0
30.1	20503	20503	0	0.0
31.3	17895	17893	-2	0.0
32.5	16424	16695	271	1.7
33.7	15682	16424	742	4.7
34.9	15660	15660	0	0.0
36.1	15118	15118	0	0.0
37.3	14633	14633	0	0.0
38.6	13770	13770	0	0.0
39.8	13230	13230	0	0.0
41.0	12954	12955	1	0.0
42.2	12614	12614	0	0.0
43.4	12530	12530	0	0.0
44.6	12121	12121	0	0.0
45.8	10903	10903	0	0.0
47.0	10861	10861	0	0.0
48.2	10806	10807	1	0.0
49.4	10641	10641	0	0.0
50.6	10528	10528	0	0.0
51.8	10343	10344	1	0.0
53.0	9671	9671	0	0.0
54.2	9580	9580	0	0.0
55.4	9079	9079	0	0.0
56.6	8864	8866	2	0.0
57.8	8853	8853	0	0.0
59.0	8516	8516	0	0.0
60.2	8504	8505	1	0.0
61.4	8400	8400	0	0.0
62.7	8364	8364	0	0.0
63.9	8127	8127	0	0.0
65.1	8010	8010	0	0.0
66.3	7824	7825	1	0.0
67.5	7767	7767	0	0.0
68.7	7650	7650	0	0.0
69.9	7573	7574	1	0.0
71.1	7449	7450	1	0.0
72.3	7299	7299	0	0.0
73.5	7081	7217	136	1.9
74.7	7045	7045	0	0.0
75.9	6784	6784	0	0.0
77.1	6724	6725	1	0.0
78.3	6585	6585	0	0.0
79.5	6554	6555	1	0.0
80.7	6479	6479	0	0.0
81.9	6389	6389	0	0.0
83.1	5772	5772	0	0.0
84.3	5346	5347	1	0.0
85.5	5334	5334	0	0.0
86.7	5183	5183	0	0.0
88.0	5126	5126	0	0.0
89.2	5090	5090	0	0.0
90.4	5002	5002	0	0.0
91.6	4981	4981	0	0.0
92.8	4931	4931	0	0.0
94.0	4894	4895	1	0.0
95.2	4632	4632	0	0.0
96.4	4476	4476	0	0.0
97.6	4426	4426	0	0.0
98.8	4354	4354	0	0.0
Min	4354	4354	-452	-1.8
Max	73269	73267	813	4.7
Mean	17714	17738	23	0.1
Median	10585	10585	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	69050	69051	1	0.0
2.4	68710	68710	0	0.0
3.6	53273	53274	1	0.0
4.8	49832	49832	0	0.0
6.0	46477	46477	0	0.0
7.2	38869	38870	1	0.0
8.4	32967	32967	0	0.0
9.6	31762	31762	0	0.0
10.8	29294	29293	-1	0.0
12.0	26578	26578	0	0.0
13.3	25009	25010	1	0.0
14.5	23740	23842	102	0.4
15.7	21259	21259	0	0.0
16.9	20402	20403	1	0.0
18.1	19848	19848	0	0.0
19.3	19688	19700	12	0.1
20.5	19233	19240	7	0.0
21.7	19018	19018	0	0.0
22.9	18329	18329	0	0.0
24.1	18098	18057	-41	-0.2
25.3	17611	17611	0	0.0
26.5	17292	17293	1	0.0
27.7	16122	16012	-110	-0.7
28.9	14686	14686	0	0.0
30.1	14124	14124	0	0.0
31.3	13625	13620	-5	0.0
32.5	13589	13589	0	0.0
33.7	12475	12476	1	0.0
34.9	12218	12212	-6	0.0
36.1	12212	12048	-164	-1.3
37.3	11615	11615	0	0.0
38.6	11544	11544	0	0.0
39.8	10843	10837	-6	-0.1
41.0	10490	10485	-5	0.0
42.2	10098	10100	2	0.0
43.4	9772	9771	-1	0.0
44.6	9732	9732	0	0.0
45.8	9662	9662	0	0.0
47.0	9629	9629	0	0.0
48.2	9357	9357	0	0.0
49.4	8999	8999	0	0.0
50.6	8926	8928	2	0.0
51.8	8718	8718	0	0.0
53.0	8592	8592	0	0.0
54.2	8547	8546	-1	0.0
55.4	8449	8449	0	0.0
56.6	8427	8428	1	0.0
57.8	8107	8107	0	0.0
59.0	8005	8005	0	0.0
60.2	7933	7933	0	0.0
61.4	7784	7782	-2	0.0
62.7	7724	7724	0	0.0
63.9	7724	7724	0	0.0
65.1	7688	7688	0	0.0
66.3	7583	7583	0	0.0
67.5	7433	7433	0	0.0
68.7	7397	7397	0	0.0
69.9	7155	7155	0	0.0
71.1	7051	7051	0	0.0
72.3	6871	6871	0	0.0
73.5	6867	6867	0	0.0
74.7	6773	6773	0	0.0
75.9	6770	6770	0	0.0
77.1	6699	6698	-1	0.0
78.3	6365	6365	0	0.0
79.5	5821	5822	1	0.0
80.7	5808	5808	0	0.0
81.9	5774	5774	0	0.0
83.1	5661	5661	0	0.0
84.3	5645	5645	0	0.0
85.5	5615	5615	0	0.0
86.7	5508	5508	0	0.0
88.0	5445	5446	1	0.0
89.2	4998	4998	0	0.0
90.4	4905	4904	-1	0.0
91.6	4846	4846	0	0.0
92.8	4765	4765	0	0.0
94.0	4626	4757	131	2.8
95.2	4609	4608	-1	0.0
96.4	4369	4370	1	0.0
97.6	4191	4191	0	0.0
98.8	3953	3997	44	1.1
Min	3953	3997	-164	-1.3
Max	69050	69051	131	2.8
Mean	14357	14356	0	0.0
Median	8963	8964	0	0.0
Entire 82-Year Simulation Period				
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)			96.3
1.1<=X<10.0				2.4
X>=5.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				1.2
X<=-5.0				0.0
X<=-10.0				0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more			**0.0**
Low Flow Conditions (Upper 25% of Distribution)				
(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)			90.0
1.1<=X<10.0				10.0
X>=5.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				0.0
X<=-5.0				0.0
X<=-10.0				0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more			**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	40881	40881	0	0.0
2.4	33418	33418	0	0.0
3.6	24516	24516	0	0.0
4.8	23629	23629	0	0.0
6.0	22099	22099	0	0.0
7.2	21967	21968	1	0.0
8.4	17843	17843	0	0.0
9.6	17450	17450	0	0.0
10.8	17450	17450	0	0.0
12.0	16833	16833	0	0.0
13.3	16809	16810	1	0.0
14.5	15982	15983	1	0.0
15.7	15593	15593	0	0.0
16.9	14489	14489	0	0.0
18.1	14205	14205	0	0.0
19.3	14056	14056	0	0.0
20.5	13221	13221	0	0.0
21.7	13008	13008	0	0.0
22.9	11881	11881	0	0.0
24.1	11612	11612	0	0.0
25.3	11168	11168	0	0.0
26.5	10802	10802	0	0.0
27.7	10447	10448	1	0.0
28.9	10316	10316	0	0.0
30.1	10148	10148	0	0.0
31.3	9781	9896	115	1.2
32.5	9465	9462	-3	0.0
33.7	9385	9385	0	0.0
34.9	9373	9370	-3	0.0
36.1	9278	9277	-1	0.0
37.3	9203	9206	3	0.0
38.6	9201	9202	1	0.0
39.8	9183	9196	13	0.1
41.0	9042	9043	1	0.0
42.2	8949	8992	43	0.5
43.4	8864	8864	0	0.0
44.6	8811	8819	8	0.1
45.8	8753	8802	49	0.6
47.0	8641	8642	1	0.0
48.2	8521	8521	0	0.0
49.4	8511	8517	6	0.1
50.6	8499	8511	12	0.1
51.8	8495	8500	5	0.1
53.0	8462	8490	28	0.3
54.2	8439	8462	23	0.3
55.4	8428	8450	22	0.3
56.6	8339	8428	89	1.1
57.8	8207	8341	134	1.6
59.0	8138	8177	39	0.5
60.2	8044	8160	116	1.4
61.4	8034	8060	26	0.3
62.7	7991	8006	15	0.2
63.9	7987	7827	-160	-2.0
65.1	7830	7779	-51	-0.7
66.3	7671	7670	-1	0.0
67.5	7638	7637	-1	0.0
68.7	7615	7614	-1	0.0
69.9	7574	7568	-6	-0.1
71.1	7438	7439	1	0.0
72.3	7336	7342	6	0.1
73.5	7295	7295	0	0.0
74.7	7241	7273	32	0.4
75.9	7233	7242	9	0.1
77.1	7217	7234	17	0.2
78.3	7188	7212	24	0.3
79.5	7128	7127	-1	0.0
80.7	7019	7035	16	0.2
81.9	6985	6989	4	0.1
83.1	6868	6868	0	0.0
84.3	6808	6866	58	0.9
85.5	6770	6812	42	0.6
86.7	6685	6770	85	1.3
88.0	6660	6685	25	0.4
89.2	6638	6659	21	0.3
90.4	6537	6637	100	1.5
91.6	6360	6535	175	2.8
92.8	6301	6300	-1	0.0
94.0	6280	6280	0	0.0
95.2	5749	5621	-128	-2.2
96.4	5621	5453	-168	-3.0
97.6	5361	5361	0	0.0
98.8	4996	4996	0	0.0
Min	4996	4996	-168	-3.0
Max	40881	40881	175	2.8
Mean	10633	10643	10	0.1
Median	8505	8514	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	22564	22564	0	0.0
2.4	19325	19325	0	0.0
3.6	18432	18432	0	0.0
4.8	18115	18115	0	0.0
6.0	17577	17577	0	0.0
7.2	17347	17347	0	0.0
8.4	14822	14821	-1	0.0
9.6	14801	14326	-475	-3.2
10.8	14326	14084	-242	-1.7
12.0	13806	13813	7	0.1
13.3	13156	13156	0	0.0
14.5	12526	12526	0	0.0
15.7	12258	12258	0	0.0
16.9	12235	12238	3	0.0
18.1	12107	12107	0	0.0
19.3	12014	12014	0	0.0
20.5	11589	11650	61	0.5
21.7	11476	11477	1	0.0
22.9	11371	11371	0	0.0
24.1	11359	11359	0	0.0
25.3	11309	11310	1	0.0
26.5	10650	10680	30	0.3
27.7	10556	10405	-151	-1.4
28.9	10386	10387	1	0.0
30.1	10309	10349	40	0.4
31.3	10290	10290	0	0.0
32.5	10276	10285	9	0.1
33.7	10258	10248	-10	-0.1
34.9	10133	10243	110	1.1
36.1	9964	10133	169	1.7
37.3	9958	9645	-313	-3.1
38.6	9645	9609	-36	-0.4
39.8	9621	9587	-34	-0.4
41.0	9562	9496	-66	-0.7
42.2	9498	9493	-5	-0.1
43.4	9475	9370	-105	-1.1
44.6	9181	9252	71	0.8
45.8	9081	9081	0	0.0
47.0	9069	9079	10	0.1
48.2	9041	9040	-1	0.0
49.4	9038	9015	-23	-0.3
50.6	8990	8990	0	0.0
51.8	8898	8956	58	0.7
53.0	8866	8889	23	0.3
54.2	8848	8866	18	0.2
55.4	8834	8835	1	0.0
56.6	8780	8782	2	0.0
57.8	8666	8717	51	0.6
59.0	8639	8687	48	0.6
60.2	8625	8674	49	0.6
61.4	8492	8666	174	2.0
62.7	8464	8489	25	0.3
63.9	8426	8482	56	0.7
65.1	8273	8426	153	1.8
66.3	8268	8273	5	0.1
67.5	8244	8264	20	0.2
68.7	8184	8247	63	0.8
69.9	8172	8185	13	0.2
71.1	8159	8160	1	0.0
72.3	8155	8129	-26	-0.3
73.5	8007	8020	13	0.2
74.7	7974	7974	0	0.0
75.9	7960	7970	10	0.1
77.1	7782	7957	175	2.2
78.3	7747	7928	181	2.3
79.5	7638	7778	140	1.8
80.7	7605	7753	148	1.9
81.9	7570	7643	73	1.0
83.1	7538	7622	84	1.1
84.3	7466	7604	138	1.8
85.5	7435	7541	106	1.4
86.7	7430	7465	35	0.5
88.0	7237	7436	199	2.7
89.2	7221	7240	19	0.3
90.4	6907	6910	3	0.0
91.6	6876	6882	6	0.1
92.8	6865	6865	0	0.0
94.0	6784	6784	0	0.0
95.2	6714	6714	0	0.0
96.4	6659	6660	1	0.0
97.6	6272	6265	-7	-0.1
98.8	6140	6144	4	0.1
Min	6140	6144	-475	-3.2
Max	22564	22564	199	2.7
Mean	10004	10017	14	0.2
Median	9014	9003	2	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	79.3
1.1<=X<10.0		14.6
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		40.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	25085	25085	0	0.0
2.4	17358	17358	0	0.0
3.6	15357	15337	-20	-0.1
4.8	15242	15206	-36	-0.2
6.0	14221	14219	-2	0.0
7.2	14210	14211	1	0.0
8.4	13268	13266	-2	0.0
9.6	13258	13256	-2	0.0
10.8	13132	13074	-58	-0.4
12.0	13037	12921	-116	-0.9
13.3	13019	12851	-168	-1.3
14.5	13007	12800	-207	-1.6
15.7	12864	12770	-94	-0.7
16.9	12703	12703	0	0.0
18.1	12695	12695	0	0.0
19.3	12499	12494	-5	0.0
20.5	12411	12300	-111	-0.9
21.7	12300	12252	-48	-0.4
22.9	12271	12238	-33	-0.3
24.1	12238	12196	-42	-0.3
25.3	12171	12170	-1	0.0
26.5	12171	12120	-51	-0.4
27.7	12114	12115	1	0.0
28.9	12107	11947	-160	-1.3
30.1	12106	11895	-211	-1.7
31.3	11941	11873	-68	-0.6
32.5	11865	11865	0	0.0
33.7	11836	11819	-17	-0.1
34.9	11814	11819	5	0.0
36.1	11807	11808	1	0.0
37.3	11793	11793	0	0.0
38.6	11780	11752	-28	-0.2
39.8	11752	11742	-10	-0.1
41.0	11742	11734	-8	-0.1
42.2	11734	11711	-23	-0.2
43.4	11711	11706	-5	0.0
44.6	11707	11678	-29	-0.2
45.8	11669	11589	-80	-0.7
47.0	11558	11562	4	0.0
48.2	11556	11544	-12	-0.1
49.4	11553	11495	-58	-0.5
50.6	11537	11475	-62	-0.5
51.8	11484	11471	-13	-0.1
53.0	11474	11426	-48	-0.4
54.2	11445	11406	-39	-0.3
55.4	11426	11337	-89	-0.8
56.6	11378	11336	-42	-0.4
57.8	11330	11275	-55	-0.5
59.0	11275	11263	-12	-0.1
60.2	11264	11256	-8	-0.1
61.4	11257	11243	-14	-0.1
62.7	11254	11213	-41	-0.4
63.9	11228	11208	-20	-0.2
65.1	11212	11178	-34	-0.3
66.3	11171	11174	3	0.0
67.5	11166	11112	-54	-0.5
68.7	11112	11082	-30	-0.3
69.9	11083	11013	-70	-0.6
71.1	11025	10867	-158	-1.4
72.3	10867	10821	-46	-0.4
73.5	10653	10739	86	0.8
74.7	10584	10663	79	0.7
75.9	10501	10584	83	0.8
77.1	10475	10500	25	0.2
78.3	10422	10432	10	0.1
79.5	10371	10387	16	0.2
80.7	10369	10365	-4	0.0
81.9	10209	10215	6	0.1
83.1	10144	10191	47	0.5
84.3	10106	10161	55	0.5
85.5	10096	10106	10	0.1
86.7	10045	10095	50	0.5
88.0	9985	10048	63	0.6
89.2	9849	9849	0	0.0
90.4	9467	9458	-9	-0.1
91.6	9426	9425	-1	0.0
92.8	9341	9340	-1	0.0
94.0	9240	9237	-3	0.0
95.2	9028	9030	2	0.0
96.4	8562	8565	3	0.0
97.6	8090	8092	2	0.0
98.8	8087	8089	2	0.0
Min	8087	8089	-211	-1.7
Max	25085	25085	86	0.8
Mean	11679	11655	-24	-0.2
Median	11545	11485	-9	-0.1
Entire 82-Year Simulation Period				
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)			93.9
1.1<=X<10.0				0.0
X>=5.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				6.1
X<=-5.0				0.0
X<=-10.0				0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more			**0.0**
Low Flow Conditions (Upper 25% of Distribution)				
(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)			100.0
1.1<=X<10.0				0.0
X>=5.0				0.0
X>=10.0				0.0
-10.0<X<=-1.1				0.0
X<=-5.0				0.0
X<=-10.0				0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more			**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	17091	17091	0	0.0
2.4	16556	16428	-128	-0.8
3.6	15798	15798	0	0.0
4.8	15501	15618	117	0.8
6.0	15425	15409	-16	-0.1
7.2	15381	15381	0	0.0
8.4	15334	15334	0	0.0
9.6	15324	15330	6	0.0
10.8	15322	15318	-4	0.0
12.0	15300	15293	-7	0.0
13.3	15272	15269	-3	0.0
14.5	15262	15255	-7	0.0
15.7	15205	15207	2	0.0
16.9	15113	15112	-1	0.0
18.1	15082	15076	-6	0.0
19.3	15031	15036	5	0.0
20.5	14994	14994	0	0.0
21.7	14990	14991	1	0.0
22.9	14968	14967	-1	0.0
24.1	14939	14939	0	0.0
25.3	14894	14884	-10	-0.1
26.5	14863	14863	0	0.0
27.7	14716	14730	14	0.1
28.9	14684	14700	16	0.1
30.1	14658	14493	-165	-1.1
31.3	14637	14467	-170	-1.2
32.5	14605	14427	-178	-1.2
33.7	14493	14259	-234	-1.6
34.9	14467	14160	-307	-2.1
36.1	14251	14083	-168	-1.2
37.3	14130	14050	-80	-0.6
38.6	13965	13975	10	0.1
39.8	13940	13925	-15	-0.1
41.0	13917	13683	-234	-1.7
42.2	13749	13623	-126	-0.9
43.4	13625	13401	-224	-1.6
44.6	13409	13379	-30	-0.2
45.8	13380	13301	-79	-0.6
47.0	13301	13251	-50	-0.4
48.2	13208	13208	0	0.0
49.4	13162	13162	0	0.0
50.6	13074	13078	4	0.0
51.8	13072	13052	-20	-0.2
53.0	13053	12995	-58	-0.4
54.2	12995	12989	-6	0.0
55.4	12848	12847	-1	0.0
56.6	12840	12836	-4	0.0
57.8	12836	12791	-45	-0.4
59.0	12791	12766	-25	-0.2
60.2	12766	12747	-19	-0.1
61.4	12759	12709	-50	-0.4
62.7	12754	12685	-69	-0.5
63.9	12710	12650	-60	-0.5
65.1	12632	12604	-28	-0.2
66.3	12574	12582	8	0.1
67.5	12495	12558	63	0.5
68.7	12404	12504	100	0.8
69.9	12401	12498	97	0.8
71.1	12400	12411	11	0.1
72.3	12394	12400	6	0.0
73.5	12379	12314	-65	-0.5
74.7	12357	12306	-51	-0.4
75.9	12306	12246	-60	-0.5
77.1	12132	12091	-41	-0.3
78.3	12092	12037	-55	-0.5
79.5	12038	11986	-52	-0.4
80.7	11967	11885	-82	-0.7
81.9	11890	11819	-71	-0.6
83.1	11820	11691	-129	-1.1
84.3	11701	11624	-77	-0.7
85.5	11624	11470	-154	-1.3
86.7	11407	11454	47	0.4
88.0	11395	11408	13	0.1
89.2	11336	11336	0	0.0
90.4	10993	11084	91	0.8
91.6	10977	10978	1	0.0
92.8	10525	9798	-727	-6.9
94.0	10472	9686	-786	-7.5
95.2	9821	9506	-315	-3.2
96.4	9577	9436	-141	-1.5
97.6	8964	8970	6	0.1
98.8	8551	8550	-1	0.0
Min	8551	8550	-786	-7.5
Max	17091	17091	117	0.8
Mean	13318	13259	-59	-0.5
Median	13118	13120	-9	-0.1

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	82.9
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		17.1
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		10.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	15099	15099	0	0.0
2.4	14801	14801	0	0.0
3.6	13745	13745	0	0.0
4.8	13590	13590	0	0.0
6.0	13246	13246	0	0.0
7.2	13127	13127	0	0.0
8.4	12699	12699	0	0.0
9.6	12173	12326	153	1.3
10.8	12011	12164	153	1.3
12.0	11974	12011	37	0.3
13.3	11955	11955	0	0.0
14.5	11918	11918	0	0.0
15.7	11862	11886	24	0.2
16.9	11774	11744	-30	-0.3
18.1	11572	11475	-97	-0.8
19.3	11474	11473	-1	0.0
20.5	11435	11364	-71	-0.6
21.7	11419	11255	-164	-1.4
22.9	11275	11254	-21	-0.2
24.1	11263	11216	-47	-0.4
25.3	11215	11208	-7	-0.1
26.5	11197	11197	0	0.0
27.7	11174	11179	5	0.0
28.9	11006	11068	62	0.6
30.1	10986	10983	-3	0.0
31.3	10931	10976	45	0.4
32.5	10915	10935	20	0.2
33.7	10907	10930	23	0.2
34.9	10886	10915	29	0.3
36.1	10863	10907	44	0.4
37.3	10728	10856	128	1.2
38.6	10685	10728	43	0.4
39.8	10648	10671	23	0.2
41.0	10599	10611	12	0.1
42.2	10526	10526	0	0.0
43.4	10467	10491	24	0.2
44.6	10444	10478	34	0.3
45.8	10434	10407	-27	-0.3
47.0	10412	10390	-22	-0.2
48.2	10385	10382	-3	0.0
49.4	10378	10351	-27	-0.3
50.6	10373	10282	-91	-0.9
51.8	10351	10266	-85	-0.8
53.0	10244	10228	-16	-0.2
54.2	10211	10199	-12	-0.1
55.4	10200	10186	-14	-0.1
56.6	10185	10186	1	0.0
57.8	10164	10124	-40	-0.4
59.0	10089	10090	1	0.0
60.2	10045	10011	-34	-0.3
61.4	10035	10003	-32	-0.3
62.7	10009	9978	-31	-0.3
63.9	9977	9946	-31	-0.3
65.1	9935	9886	-49	-0.5
66.3	9864	9845	-19	-0.2
67.5	9847	9782	-65	-0.7
68.7	9792	9707	-85	-0.9
69.9	9791	9651	-140	-1.4
71.1	9707	9607	-100	-1.0
72.3	9626	9589	-37	-0.4
73.5	9607	9577	-30	-0.3
74.7	9606	9567	-39	-0.4
75.9	9576	9504	-72	-0.8
77.1	9554	9471	-83	-0.9
78.3	9472	9287	-185	-2.0
79.5	9287	9286	-1	0.0
80.7	9286	9279	-7	-0.1
81.9	9178	9233	55	0.6
83.1	9158	9225	67	0.7
84.3	9154	9207	53	0.6
85.5	9128	9207	79	0.9
86.7	9118	9190	72	0.8
88.0	8919	9164	245	2.7
89.2	8754	9125	371	4.2
90.4	8728	8840	112	1.3
91.6	8710	8709	-1	0.0
92.8	8460	8419	-41	-0.5
94.0	8307	8311	4	0.0
95.2	8012	7991	-21	-0.3
96.4	7736	7741	5	0.1
97.6	7227	7236	9	0.1
98.8	6932	6931	-1	0.0
Min	6932	6931	-185	-2.0
Max	15099	15099	371	4.2
Mean	10470	10471	1	0.0
Median	10376	10317	-1	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	16731	16731	0	0.0
2.4	16008	16008	0	0.0
3.6	15779	15779	0	0.0
4.8	15555	15555	0	0.0
6.0	15518	15518	0	0.0
7.2	15424	15473	49	0.3
8.4	15334	15334	0	0.0
9.6	15184	15184	0	0.0
10.8	14937	14937	0	0.0
12.0	14070	14077	7	0.0
13.3	13588	13455	-133	-1.0
14.5	13455	13440	-15	-0.1
15.7	13440	13326	-114	-0.8
16.9	13326	13320	-6	0.0
18.1	13318	13281	-37	-0.3
19.3	13063	13063	0	0.0
20.5	12828	12883	55	0.4
21.7	12724	12870	146	1.1
22.9	12711	12724	13	0.1
24.1	12690	12690	0	0.0
25.3	12563	12540	-23	-0.2
26.5	12532	12532	0	0.0
27.7	12187	12187	0	0.0
28.9	12034	12034	0	0.0
30.1	11489	11673	184	1.6
31.3	10522	10132	-390	-3.7
32.5	10131	10073	-58	-0.6
33.7	10073	10068	-5	0.0
34.9	10062	10038	-24	-0.2
36.1	9218	9218	0	0.0
37.3	9118	9146	28	0.3
38.6	8505	8496	-9	-0.1
39.8	7984	7816	-168	-2.1
41.0	7769	7760	-9	-0.1
42.2	7430	7433	3	0.0
43.4	7002	6994	-8	-0.1
44.6	6859	6854	-5	-0.1
45.8	6786	6784	-2	0.0
47.0	6622	6749	127	1.9
48.2	6441	6626	185	2.9
49.4	6331	6460	129	2.0
50.6	6259	6341	82	1.3
51.8	6257	6251	-6	-0.1
53.0	6246	6248	2	0.0
54.2	6227	6241	14	0.2
55.4	6183	6172	-11	-0.2
56.6	6167	6156	-11	-0.2
57.8	6093	6094	1	0.0
59.0	6035	6034	-1	0.0
60.2	6019	6020	1	0.0
61.4	5929	5941	12	0.2
62.7	5835	5851	16	0.3
63.9	5807	5838	31	0.5
65.1	5784	5787	3	0.1
66.3	5572	5544	-28	-0.5
67.5	5519	5516	-3	-0.1
68.7	5511	5510	-1	0.0
69.9	5497	5486	-11	-0.2
71.1	5496	5451	-45	-0.8
72.3	5349	5357	8	0.1
73.5	5310	5349	39	0.7
74.7	5304	5313	9	0.2
75.9	5209	5217	8	0.2
77.1	5206	5207	1	0.0
78.3	5163	5206	43	0.8
79.5	5117	5201	84	1.6
80.7	5084	5117	33	0.6
81.9	5047	5018	-29	-0.6
83.1	5013	4993	-20	-0.4
84.3	4940	4940	0	0.0
85.5	4928	4931	3	0.1
86.7	4906	4928	22	0.4
88.0	4886	4905	19	0.4
89.2	4842	4865	23	0.5
90.4	4725	4726	1	0.0
91.6	4696	4696	0	0.0
92.8	4545	4547	2	0.0
94.0	4529	4531	2	0.0
95.2	4514	4487	-27	-0.6
96.4	4493	4482	-11	-0.2
97.6	4487	4392	-95	-2.1
98.8	4376	4375	-1	0.0
Min	4376	4375	-390	-3.7
Max	16731	16731	185	2.9
Mean	8493	8494	1	0.0
Median	6295	6401	0	0.0

Entire 82-Year Simulation Period

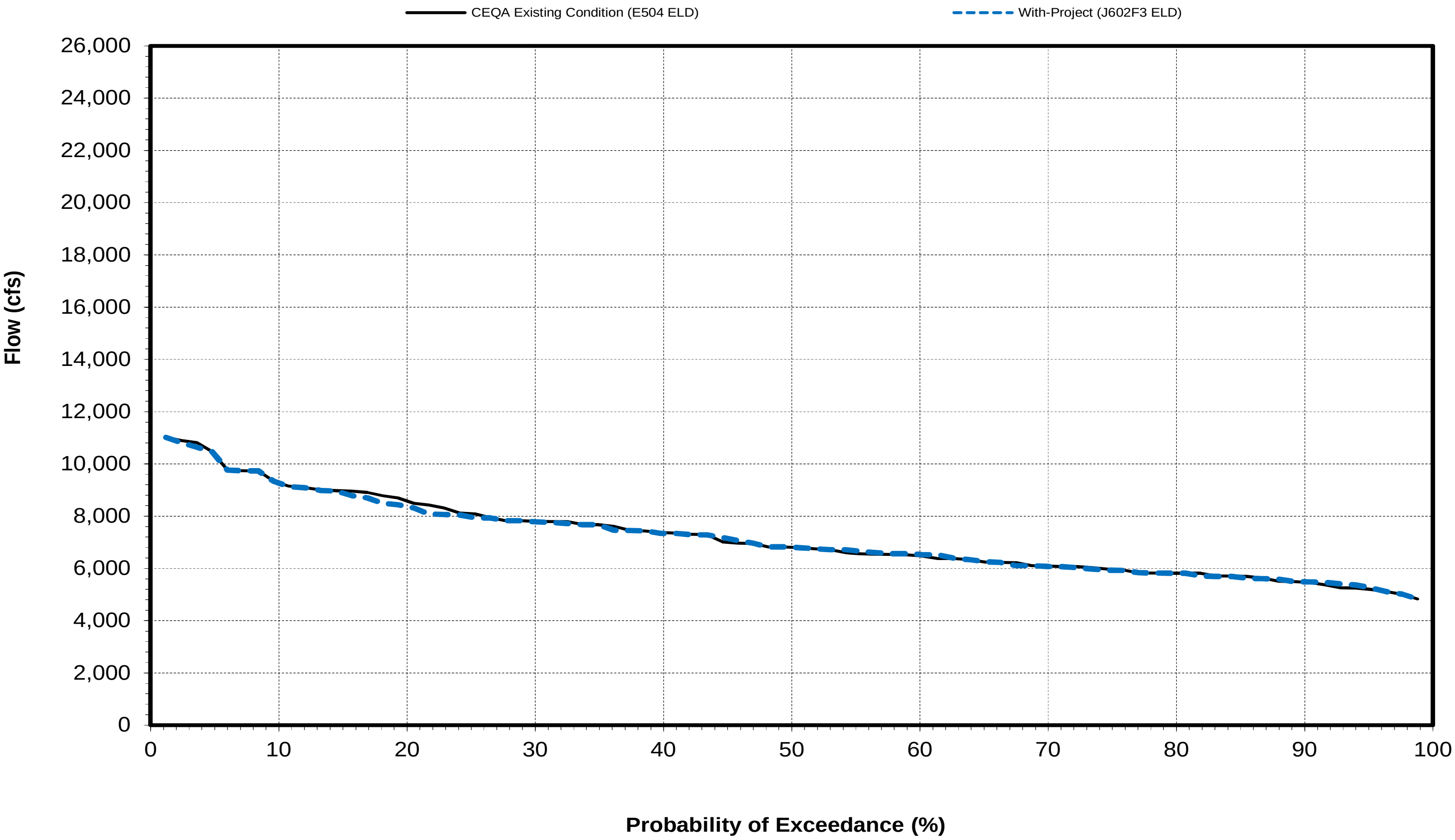
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Bend Bridge

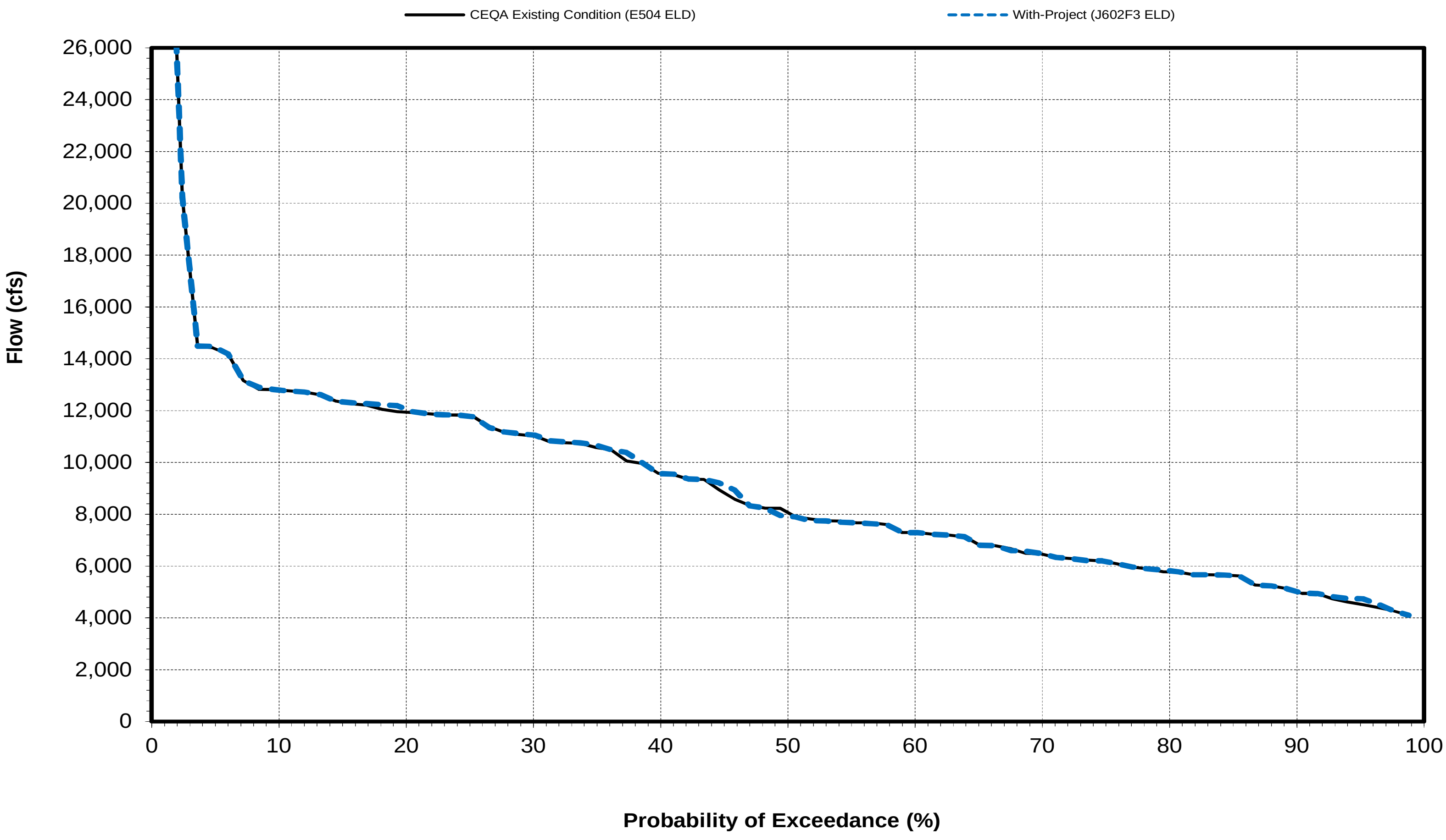
October



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

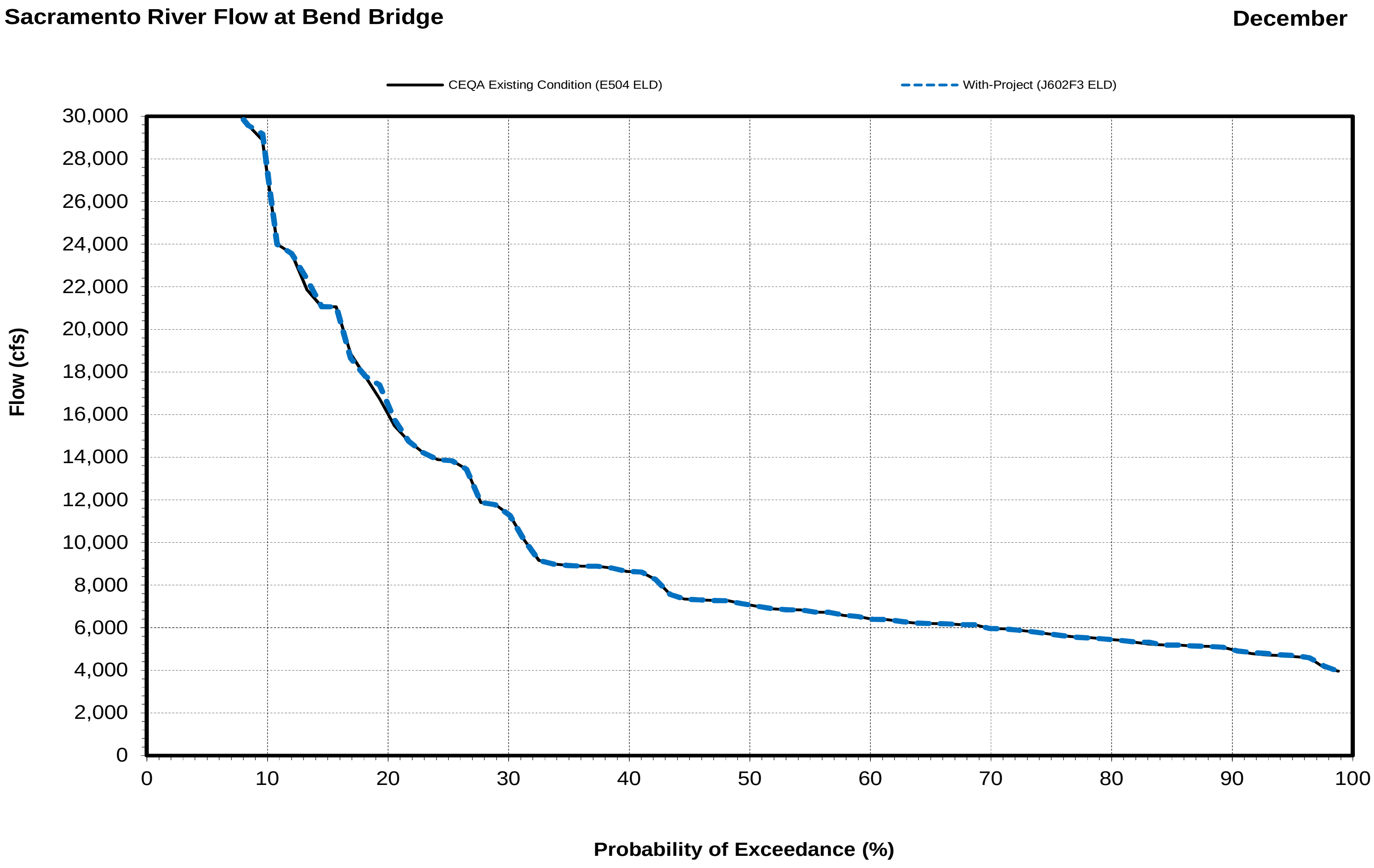
Created: 7/26/2016

Sacramento River Flow at Bend Bridge **November**



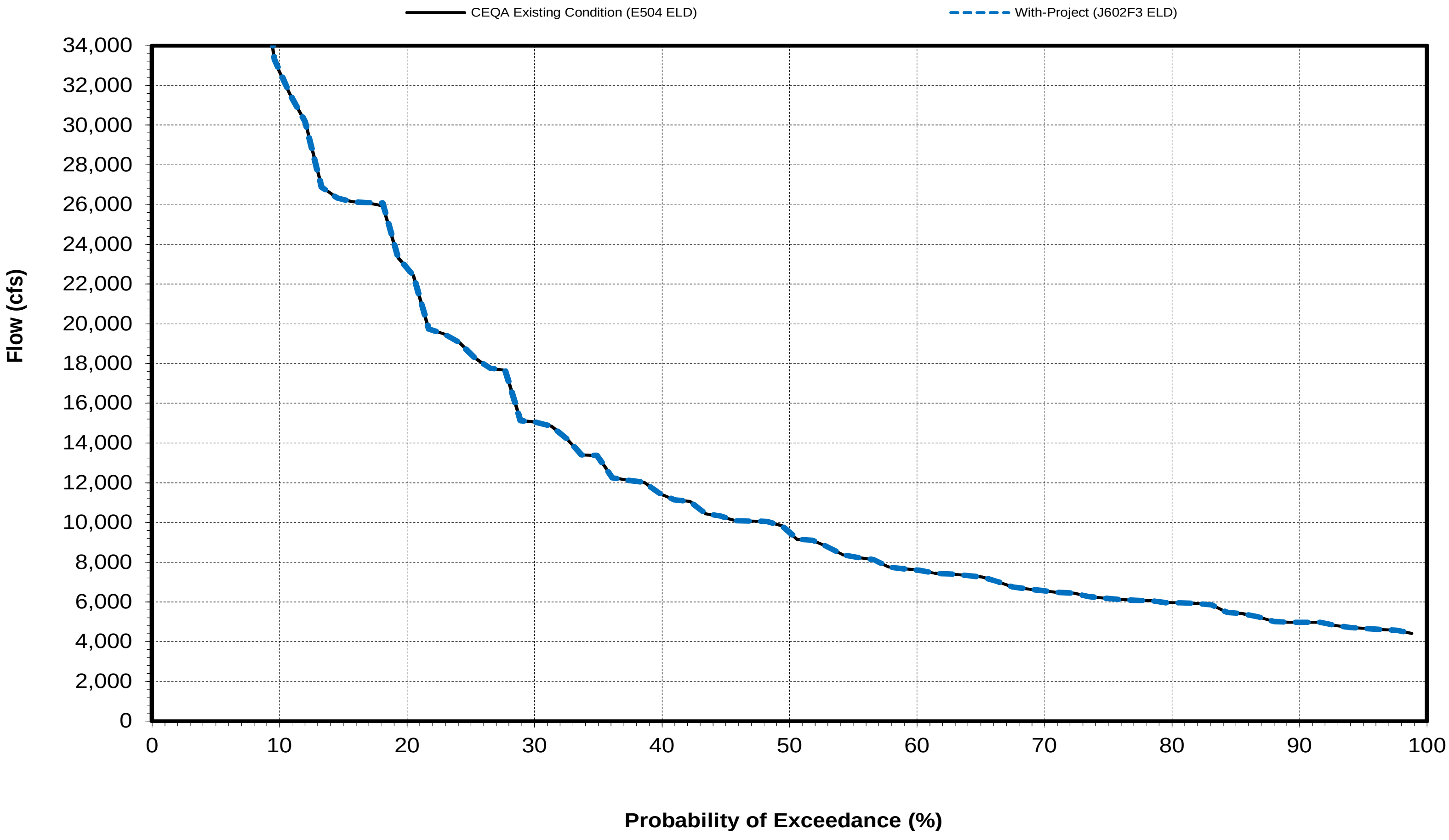
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

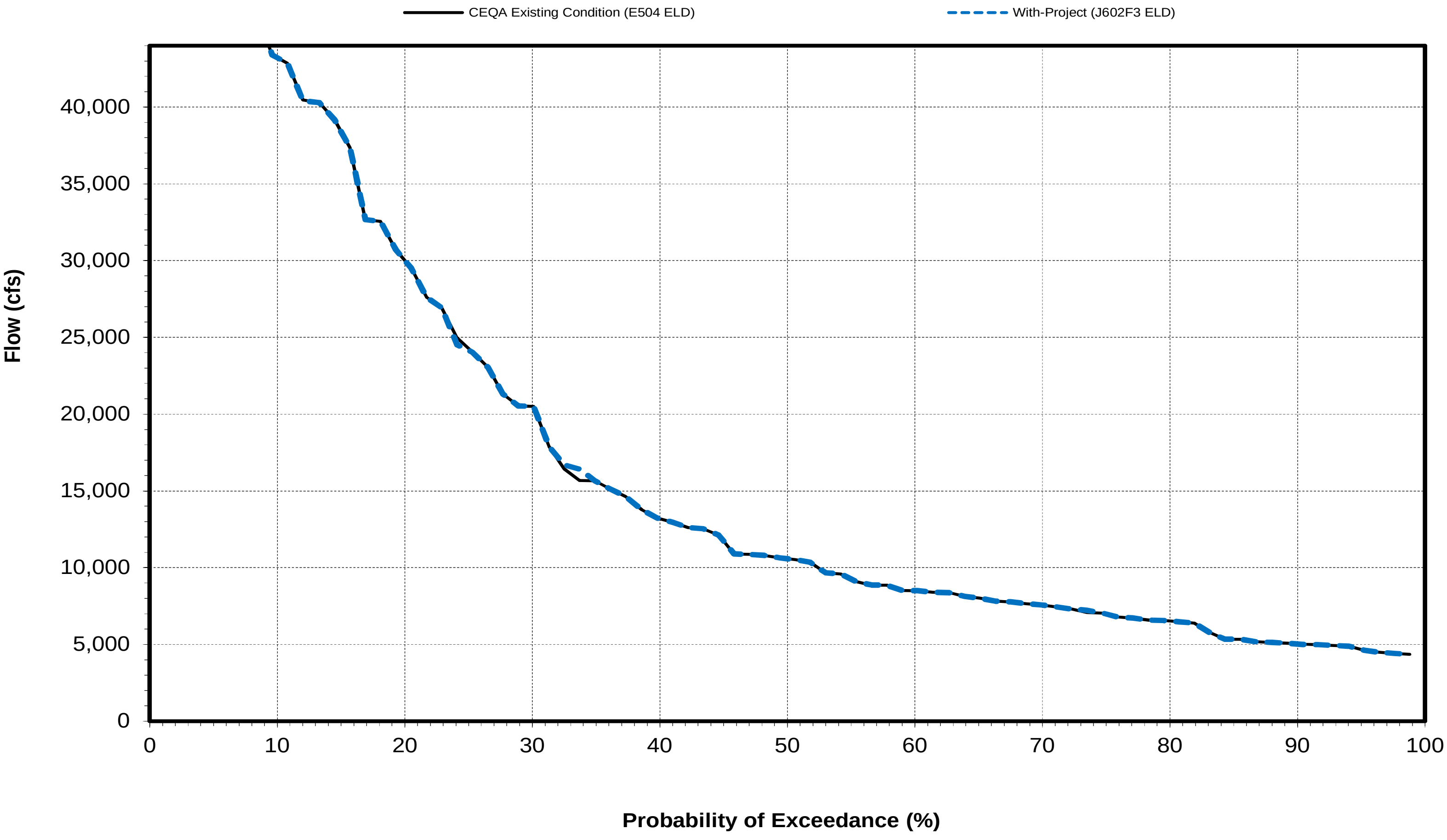
Sacramento River Flow at Bend Bridge **January**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Bend Bridge

February

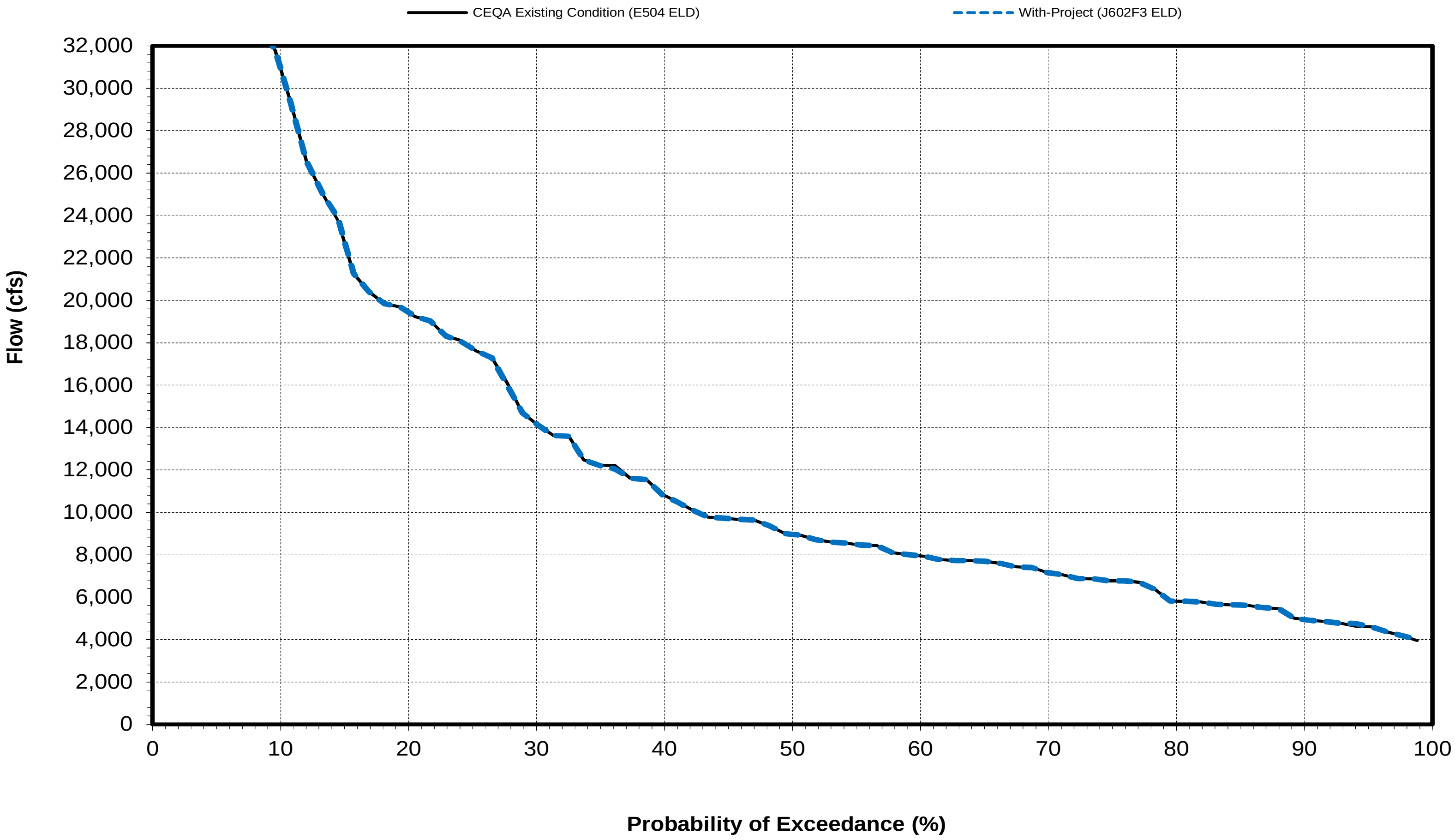


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Bend Bridge

March

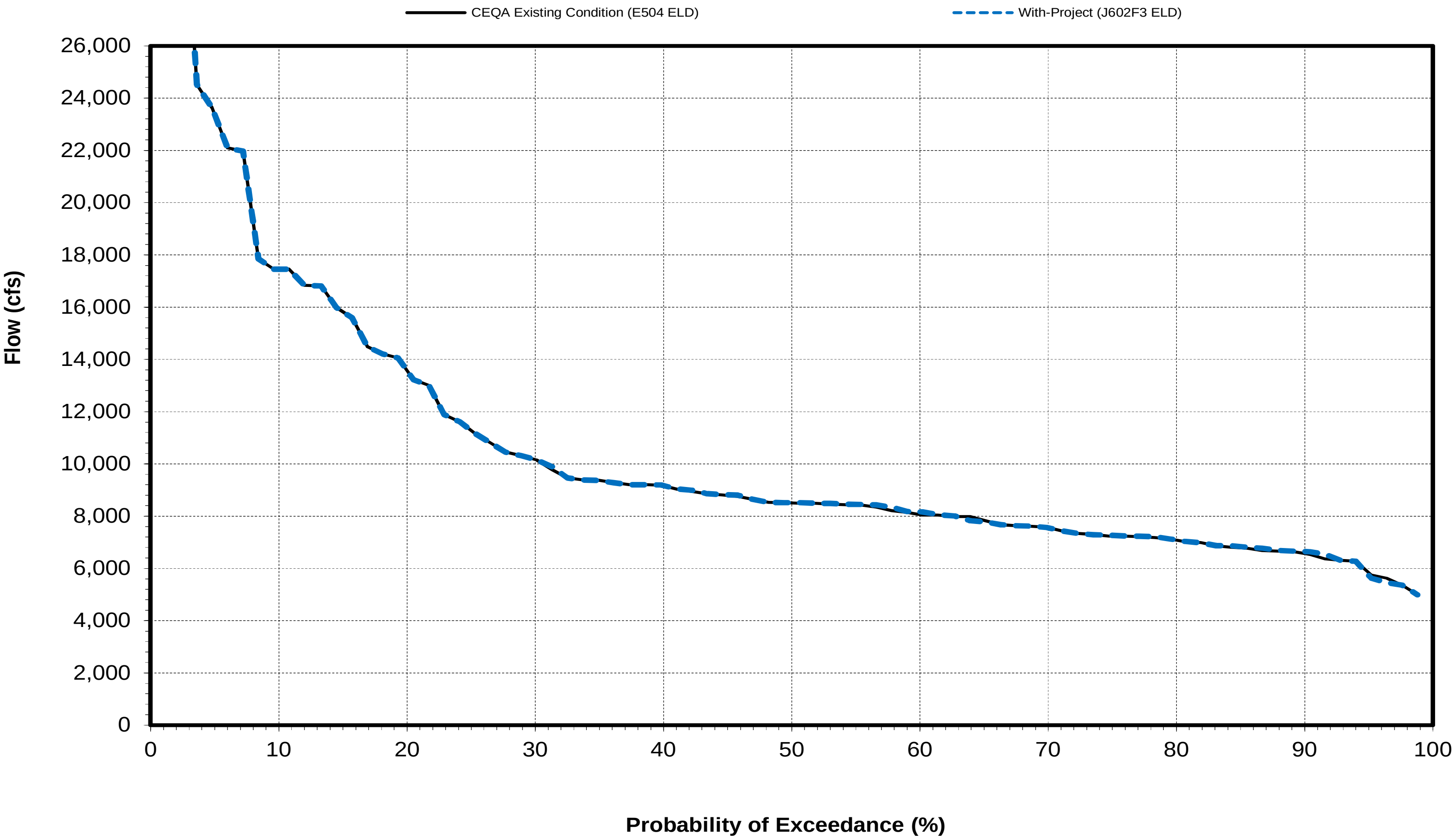


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Bend Bridge

April

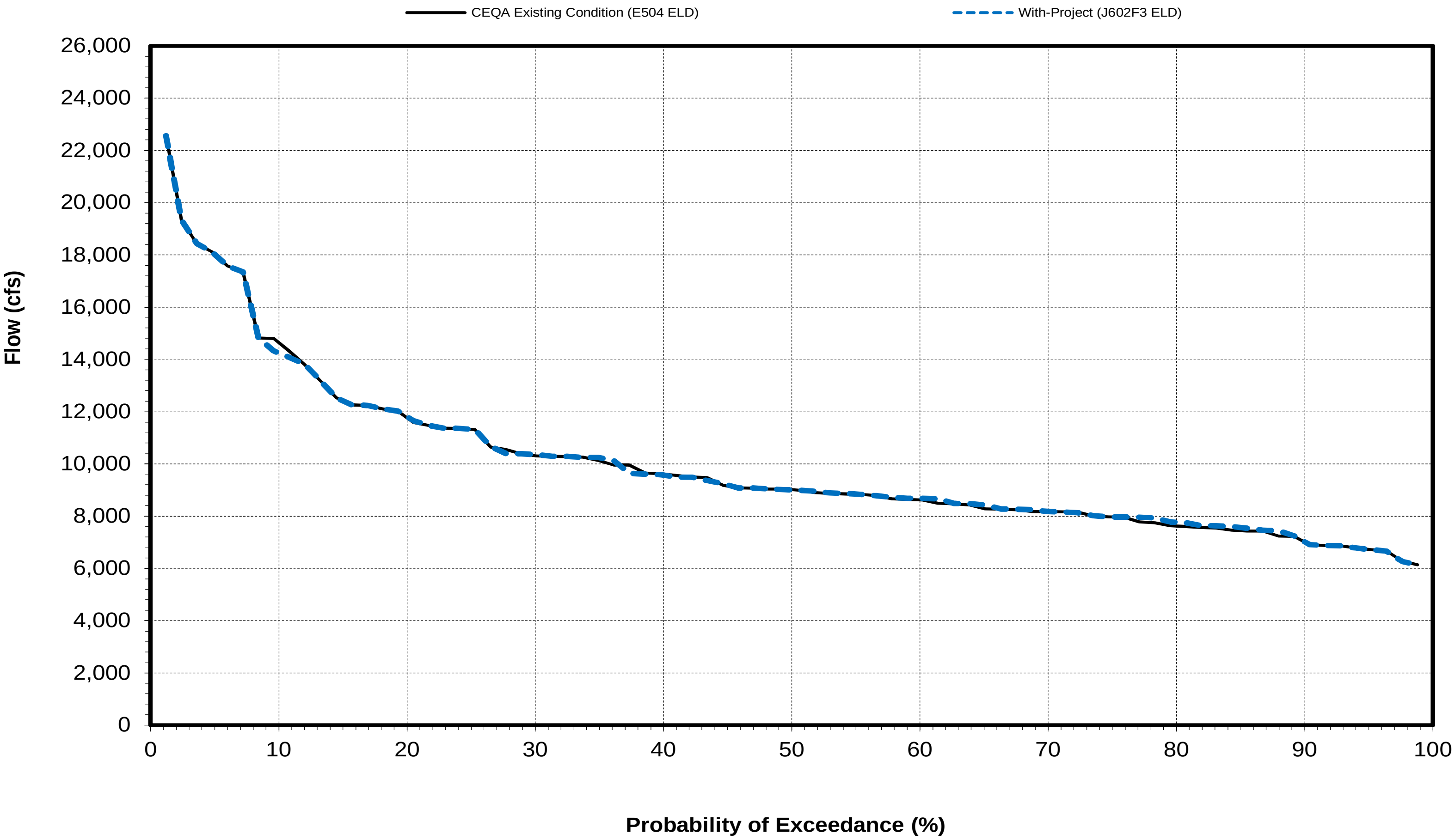


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Bend Bridge

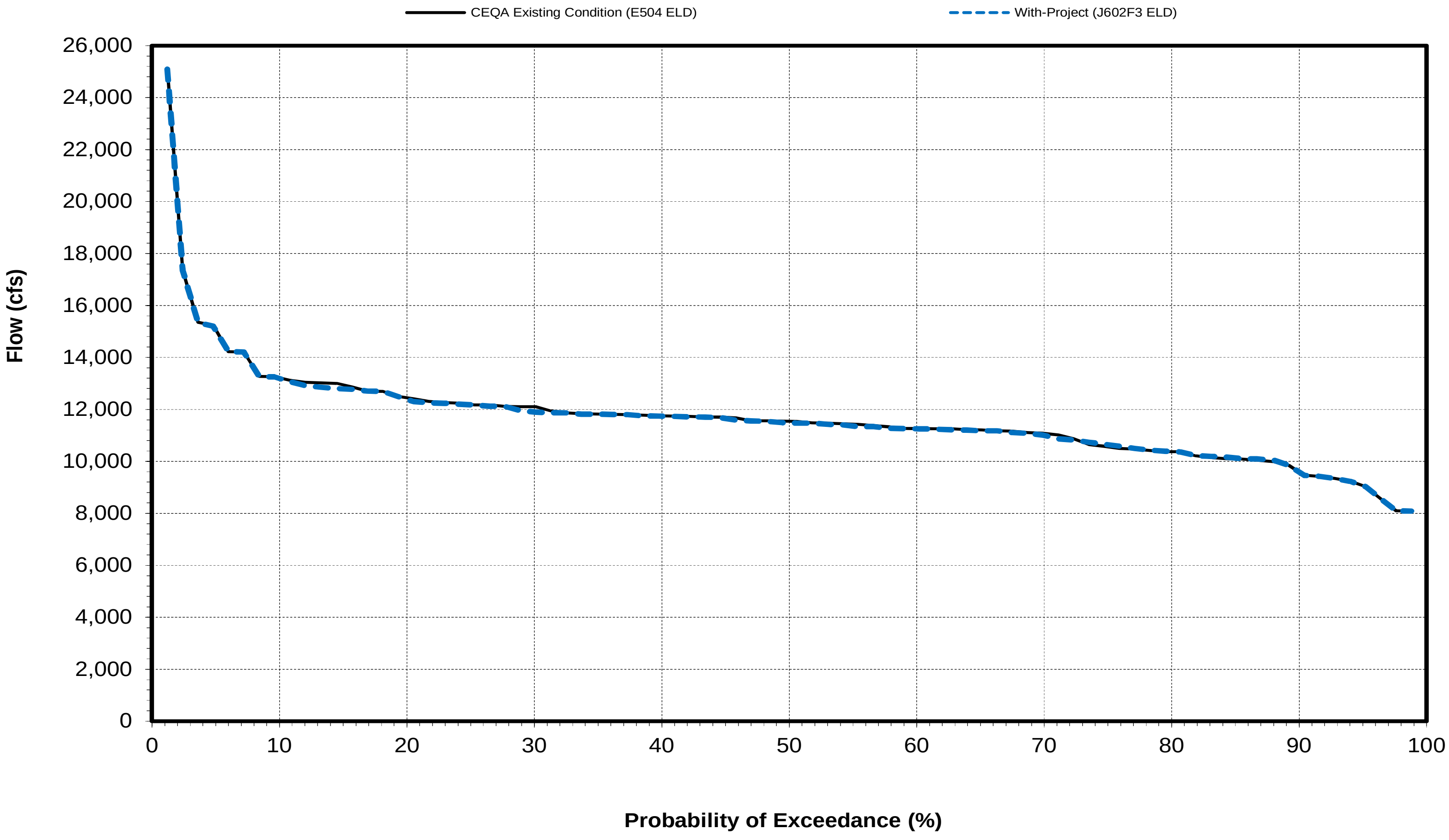
May



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Bend Bridge

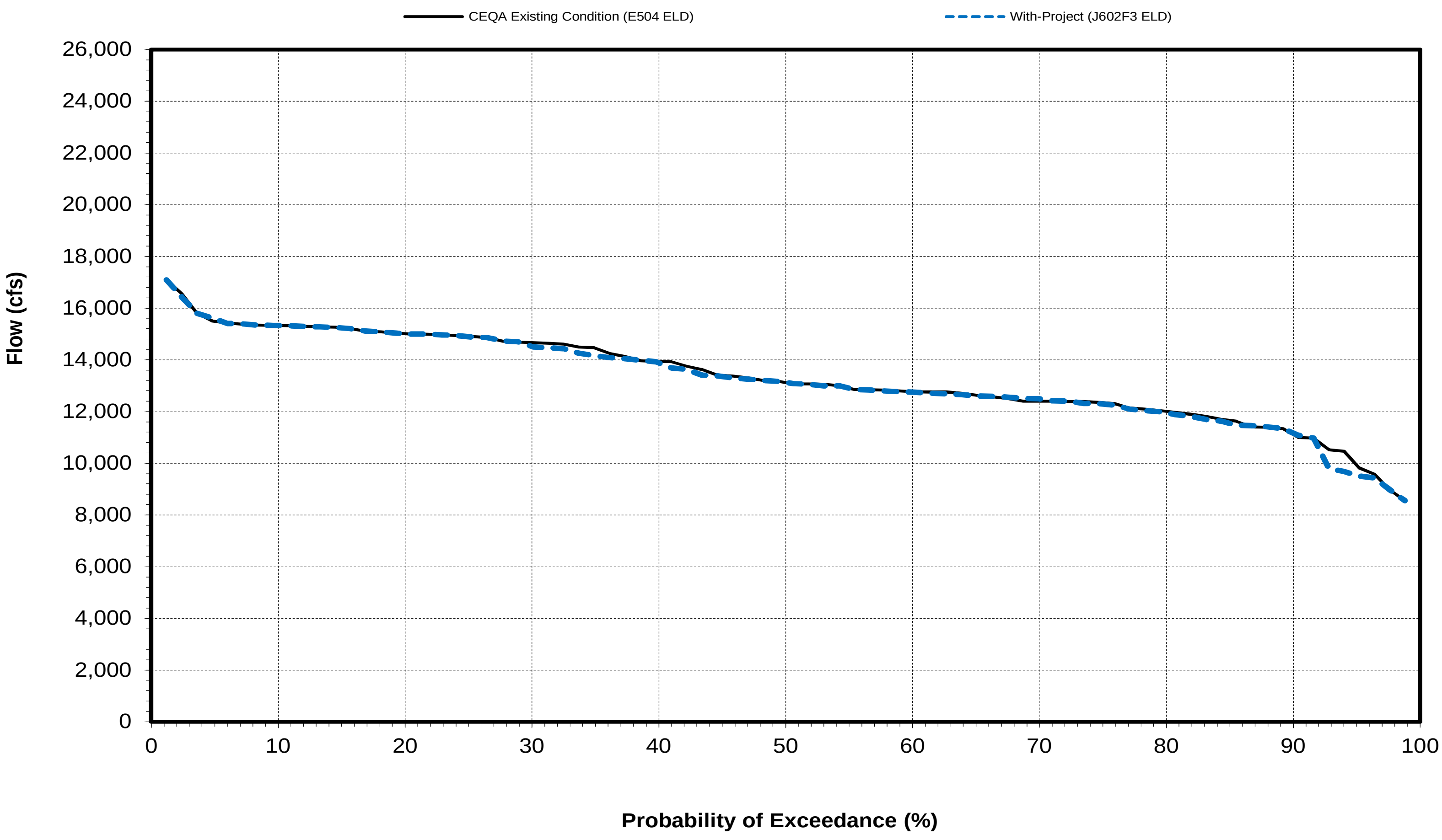
June



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Bend Bridge

July

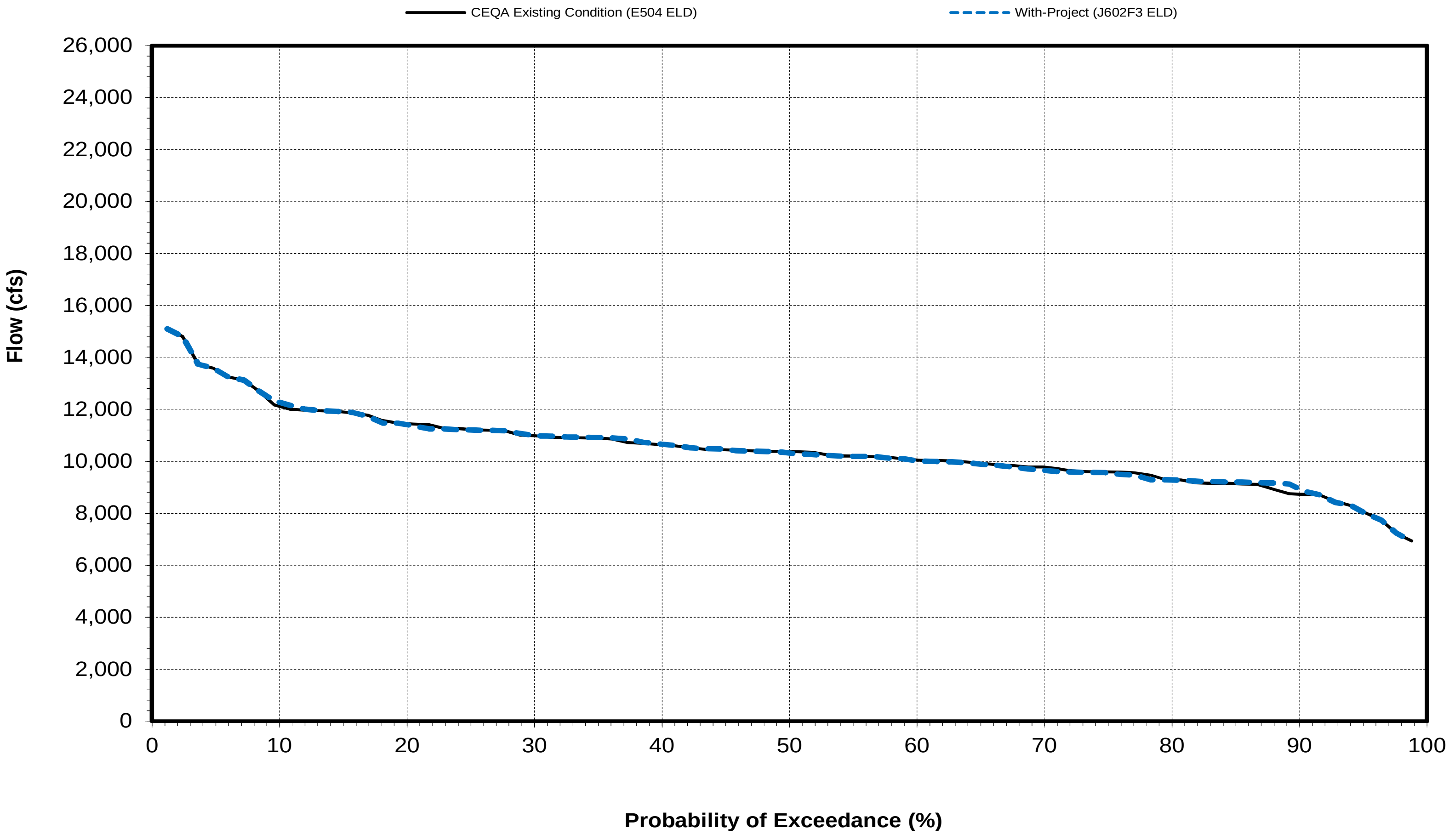


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Bend Bridge

August

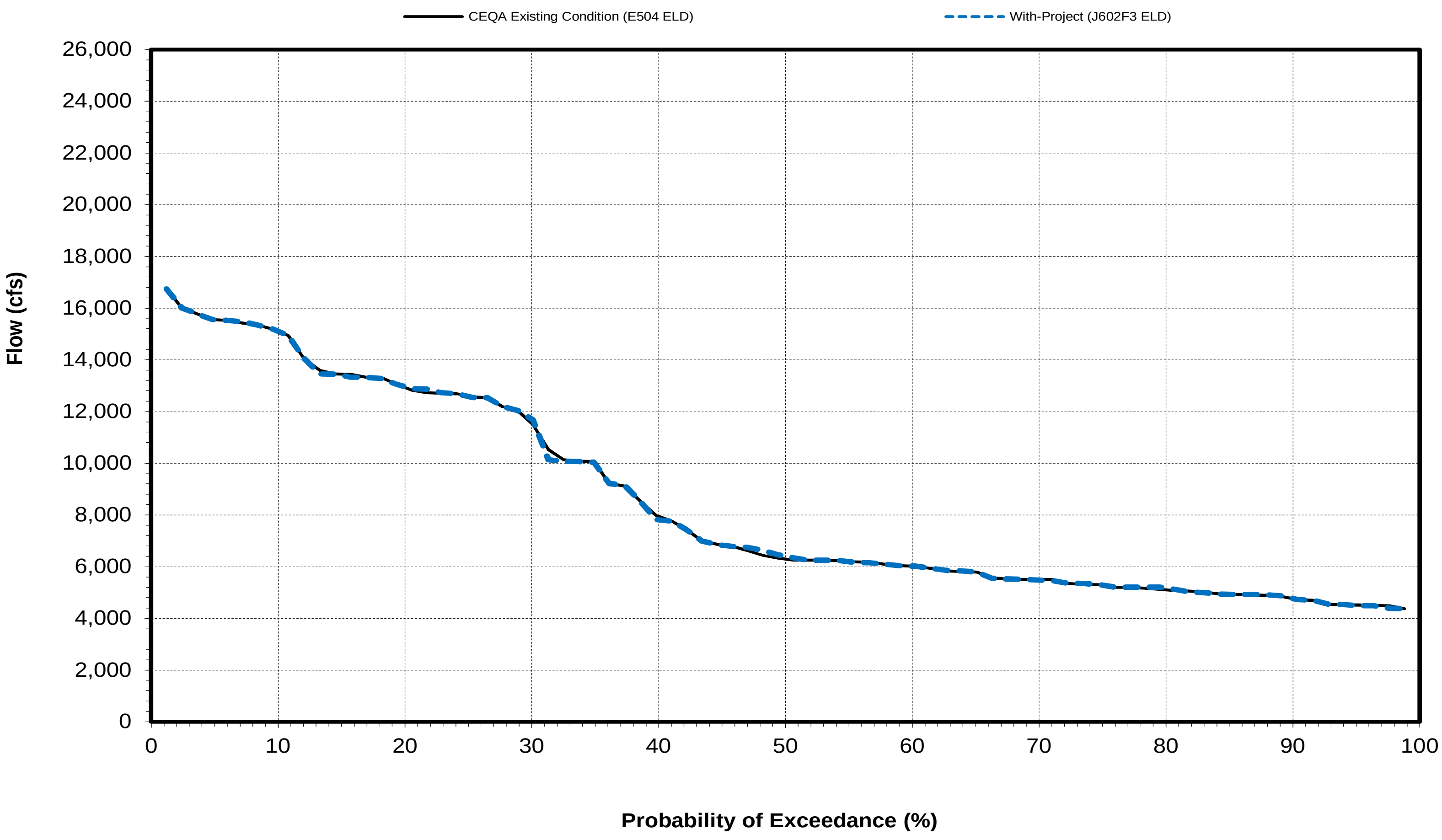


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Bend Bridge

September



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Long-term and Water Year Type Average Sacramento River Flow below Confluence with the Feather River Under CEQA Existing Condition (E504 ELD) anc With-Project (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
						Long-term						
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	9,234	12,530	18,779	26,725	32,547	27,950	19,683	15,704	13,060	15,500	11,886	15,637
With-Project (J602F3 ELD)	9,207	12,547	18,792	26,730	32,558	27,947	19,686	15,739	13,031	15,427	11,873	15,626
Difference	-27	17	13	5	11	-3	3	35	-29	-73	-13	-11
Percent Difference[3]	-0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.2	-0.2	-0.5	-0.1	-0.1
						Water Year Types[1]						
Wet												
CEQA Existing Condition (E504 ELD)	10,967	16,690	30,611	43,653	49,786	43,016	32,233	26,089	18,337	16,114	12,795	24,558
With-Project (J602F3 ELD)	10,848	16,695	30,629	43,667	49,775	43,016	32,231	26,061	18,340	16,107	12,796	24,552
Difference	-119	5	18	14	-11	0	-2	-28	3	-7	1	-6
Percent Difference[3]	-1.1	0.0	0.1	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	8,539	12,927	18,200	32,107	39,127	37,124	22,094	16,961	13,445	17,812	14,246	18,245
With-Project (J602F3 ELD)	8,516	12,986	18,221	32,108	39,126	37,111	22,091	17,038	13,361	17,788	14,216	18,299
Difference	-23	59	21	1	-1	-13	-3	77	-84	-24	-30	54
Percent Difference[3]	-0.3	0.5	0.1	0.0	0.0	0.0	0.0	0.5	-0.6	-0.1	-0.2	0.3
Below Normal												
CEQA Existing Condition (E504 ELD)	9,398	11,157	13,401	18,782	26,513	19,587	14,251	11,201	11,026	16,636	14,176	12,051
With-Project (J602F3 ELD)	9,395	11,091	13,400	18,781	26,554	19,568	14,251	11,378	10,919	16,639	14,129	11,933
Difference	-3	-66	-1	-1	41	-19	0	177	-107	3	-47	-118
Percent Difference[3]	0.0	-0.6	0.0	0.0	0.2	-0.1	0.0	1.6	-1.0	0.0	-0.3	-1.0
Dry												
CEQA Existing Condition (E504 ELD)	8,294	10,522	12,831	14,405	19,984	17,397	11,072	9,138	10,165	15,510	9,774	9,838
With-Project (J602F3 ELD)	8,316	10,574	12,828	14,406	20,010	17,397	11,090	9,153	10,176	15,324	9,845	9,857
Difference	22	52	-3	1	26	0	18	15	11	-186	71	19
Percent Difference[3]	0.3	0.5	0.0	0.0	0.1	0.0	0.2	0.2	0.1	-1.2	0.7	0.2
Critical												
CEQA Existing Condition (E504 ELD)	7,390	7,736	8,917	12,413	14,502	11,719	9,335	7,045	7,956	10,518	8,054	6,583
With-Project (J602F3 ELD)	7,461	7,779	8,948	12,417	14,514	11,733	9,334	7,039	7,947	10,335	7,940	6,574
Difference	71	43	31	4	12	14	-1	-6	-9	-183	-114	-9
Percent Difference[3]	1.0	0.6	0.3	0.0	0.1	0.1	0.0	-0.1	-0.1	-1.7	-1.4	-0.1

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

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	26493	26270	-223	-0.8
2.4	15762	15762	0	0.0
3.6	14381	14381	0	0.0
4.8	14345	14346	1	0.0
6.0	13437	13437	0	0.0
7.2	13410	13379	-31	-0.2
8.4	13195	13195	0	0.0
9.6	12865	12865	0	0.0
10.8	12587	12587	0	0.0
12.0	12435	12078	-357	-2.9
13.3	12080	12075	-5	0.0
14.5	12074	11596	-478	-4.0
15.7	11627	11588	-39	-0.3
16.9	11600	11578	-22	-0.2
18.1	11526	11524	-2	0.0
19.3	11492	11521	29	0.3
20.5	11459	11492	33	0.3
21.7	11289	11299	10	0.1
22.9	11059	11029	-30	-0.3
24.1	10885	10884	-1	0.0
25.3	10870	10870	0	0.0
26.5	10794	10794	0	0.0
27.7	10784	10661	-123	-1.1
28.9	10449	10449	0	0.0
30.1	10233	10398	165	1.6
31.3	10233	10233	0	0.0
32.5	10226	10144	-82	-0.8
33.7	10144	9921	-223	-2.2
34.9	9929	9860	-69	-0.7
36.1	9888	9850	-38	-0.4
37.3	9855	9774	-81	-0.8
38.6	9849	9697	-152	-1.5
39.8	9691	9689	-2	0.0
41.0	9569	9634	65	0.7
42.2	9479	9569	90	0.9
43.4	9478	9479	1	0.0
44.6	9443	9443	0	0.0
45.8	9321	9410	89	1.0
47.0	9316	9316	0	0.0
48.2	9199	9195	-4	0.0
49.4	9189	9189	0	0.0
50.6	9156	9156	0	0.0
51.8	9147	9126	-21	-0.2
53.0	8951	9085	134	1.5
54.2	8912	8957	45	0.5
55.4	8836	8940	104	1.2
56.6	8760	8774	14	0.2
57.8	8605	8605	0	0.0
59.0	8600	8565	-35	-0.4
60.2	8528	8390	-138	-1.6
61.4	8357	8355	-2	0.0
62.7	8182	8120	-62	-0.8
63.9	8152	8110	-42	-0.5
65.1	8065	7986	-79	-1.0
66.3	7762	7762	0	0.0
67.5	7543	7544	1	0.0
68.7	7384	7326	-58	-0.8
69.9	7318	6980	-338	-4.6
71.1	6980	6929	-51	-0.7
72.3	6930	6640	-290	-4.2
73.5	6639	6634	-5	-0.1
74.7	6623	6616	-7	-0.1
75.9	6616	6530	-86	-1.3
77.1	6528	6489	-39	-0.6
78.3	6491	6371	-120	-1.8
79.5	6358	6312	-46	-0.7
80.7	6305	6262	-43	-0.7
81.9	6264	6209	-55	-0.9
83.1	6209	6194	-15	-0.2
84.3	6189	6103	-86	-1.4
85.5	6044	6044	0	0.0
86.7	5966	5966	0	0.0
88.0	5738	5762	24	0.4
89.2	5601	5653	52	0.9
90.4	5551	5648	97	1.7
91.6	5486	5601	115	2.1
92.8	5472	5486	14	0.3
94.0	5324	5308	-16	-0.3
95.2	5127	5232	105	2.0
96.4	4934	5130	196	4.0
97.6	4909	4936	27	0.6
98.8	4676	4677	1	0.0
Min	4676	4677	-478	-4.6
Max	26493	26270	196	4.0
Mean	9234	9207	-27	-0.2
Median	9173	9173	-1	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	78.0
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		13.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	65.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	42085	42085	0	0.0
2.4	40669	40669	0	0.0
3.6	27460	27466	6	0.0
4.8	26119	26163	44	0.2
6.0	23383	23386	3	0.0
7.2	20667	20661	-6	0.0
8.4	20010	20010	0	0.0
9.6	19016	19016	0	0.0
10.8	18695	18669	-26	-0.1
12.0	17317	17294	-23	-0.1
13.3	17063	17064	1	0.0
14.5	16752	16931	179	1.1
15.7	16713	16777	64	0.4
16.9	16327	16706	379	2.3
18.1	16094	16173	79	0.5
19.3	15810	15997	187	1.2
20.5	15551	15551	0	0.0
21.7	15469	15465	-4	0.0
22.9	15460	15431	-29	-0.2
24.1	15399	15408	9	0.1
25.3	15394	15399	5	0.0
26.5	15354	15353	-1	0.0
27.7	15349	15342	-7	0.0
28.9	15161	15161	0	0.0
30.1	14420	14675	255	1.8
31.3	14113	14282	169	1.2
32.5	14110	14112	2	0.0
33.7	14093	14111	18	0.1
34.9	14023	14023	0	0.0
36.1	13692	13692	0	0.0
37.3	13269	13348	79	0.6
38.6	13246	13344	98	0.7
39.8	13216	13211	-5	0.0
41.0	13203	13203	0	0.0
42.2	12949	12950	1	0.0
43.4	12915	12914	-1	0.0
44.6	12785	12792	7	0.1
45.8	12500	12558	58	0.5
47.0	12379	12501	122	1.0
48.2	11938	12184	246	2.1
49.4	11634	11644	10	0.1
50.6	11630	11635	5	0.0
51.8	11530	11529	-1	0.0
53.0	11411	11408	-3	0.0
54.2	11349	11341	-8	-0.1
55.4	11332	11332	0	0.0
56.6	11201	11181	-20	-0.2
57.8	10892	10774	-118	-1.1
59.0	10082	10074	-8	-0.1
60.2	10074	9870	-204	-2.0
61.4	9699	9704	5	0.1
62.7	9619	9619	0	0.0
63.9	9343	9337	-6	-0.1
65.1	9270	9270	0	0.0
66.3	9262	9254	-8	-0.1
67.5	8360	8360	0	0.0
68.7	8207	8208	1	0.0
69.9	8088	8090	2	0.0
71.1	8037	8037	0	0.0
72.3	7748	7750	2	0.0
73.5	7419	7416	-3	0.0
74.7	7372	7304	-68	-0.9
75.9	7252	7233	-19	-0.3
77.1	7249	7119	-130	-1.8
78.3	7114	7036	-78	-1.1
79.5	7036	6961	-75	-1.1
80.7	6961	6888	-73	-1.0
81.9	6888	6871	-17	-0.2
83.1	6820	6632	-188	-2.8
84.3	6632	6466	-166	-2.5
85.5	6465	6452	-13	-0.2
86.7	6375	6374	-1	0.0
88.0	6320	6319	-1	0.0
89.2	6156	6159	3	0.0
90.4	6054	6155	101	1.7
91.6	6036	6035	-1	0.0
92.8	5440	5705	265	4.9
94.0	5386	5657	271	5.0
95.2	5236	5238	2	0.0
96.4	5180	5167	-13	-0.3
97.6	4780	4786	6	0.1
98.8	4369	4370	1	0.0
Min	4369	4370	-204	-2.8
Max	42085	42085	379	5.0
Mean	12530	12547	17	0.1
Median	11632	11640	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	80.5
1.1<=X<10.0		11.0
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		15.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	62220	62220	0	0.0
2.4	54256	54189	-67	-0.1
3.6	51827	51827	0	0.0
4.8	50732	50733	1	0.0
6.0	49326	49473	147	0.3
7.2	46004	46004	0	0.0
8.4	45976	45911	-65	-0.1
9.6	40563	41180	617	1.5
10.8	39850	39852	2	0.0
12.0	38598	38404	-194	-0.5
13.3	35092	35092	0	0.0
14.5	33571	33566	-5	0.0
15.7	32721	32722	1	0.0
16.9	31985	32261	276	0.9
18.1	30602	30895	293	1.0
19.3	29670	29663	-7	0.0
20.5	28576	28576	0	0.0
21.7	26669	26456	-213	-0.8
22.9	25099	25099	0	0.0
24.1	24627	24627	0	0.0
25.3	24052	24051	-1	0.0
26.5	21534	21507	-27	-0.1
27.7	19794	19797	3	0.0
28.9	19404	19404	0	0.0
30.1	18242	18242	0	0.0
31.3	17989	17981	-8	0.0
32.5	17679	17680	1	0.0
33.7	16500	16500	0	0.0
34.9	16388	16379	-9	-0.1
36.1	16200	16194	-6	0.0
37.3	16192	16193	1	0.0
38.6	15937	15912	-25	-0.2
39.8	15868	15868	0	0.0
41.0	15172	15173	1	0.0
42.2	14675	14677	2	0.0
43.4	14629	14630	1	0.0
44.6	14314	14313	-1	0.0
45.8	14313	14313	0	0.0
47.0	14135	14133	-2	0.0
48.2	13963	13963	0	0.0
49.4	13608	13609	1	0.0
50.6	13045	13044	-1	0.0
51.8	13002	13002	0	0.0
53.0	12944	12944	0	0.0
54.2	12845	12845	0	0.0
55.4	12805	12805	0	0.0
56.6	12768	12768	0	0.0
57.8	12742	12741	-1	0.0
59.0	12648	12648	0	0.0
60.2	12638	12642	4	0.0
61.4	12519	12519	0	0.0
62.7	12133	12147	14	0.1
63.9	12123	12133	10	0.1
65.1	12092	12118	26	0.2
66.3	11949	11964	15	0.1
67.5	11934	11935	1	0.0
68.7	11835	11835	0	0.0
69.9	11658	11615	-43	-0.4
71.1	11503	11503	0	0.0
72.3	11366	11348	-18	-0.2
73.5	11260	11261	1	0.0
74.7	10851	10851	0	0.0
75.9	9922	9922	0	0.0
77.1	9880	9879	-1	0.0
78.3	9856	9855	-1	0.0
79.5	9536	9531	-5	-0.1
80.7	8585	8685	100	1.2
81.9	8425	8425	0	0.0
83.1	8289	8291	2	0.0
84.3	8014	8018	4	0.0
85.5	7952	7947	-5	-0.1
86.7	7804	7803	-1	0.0
88.0	7715	7716	1	0.0
89.2	7094	7095	1	0.0
90.4	6873	6874	1	0.0
91.6	6834	6834	0	0.0
92.8	6725	6725	0	0.0
94.0	6674	6714	40	0.6
95.2	6538	6670	132	2.0
96.4	6433	6427	-6	-0.1
97.6	5950	6026	76	1.3
98.8	5528	5526	-2	0.0
Min	5528	5526	-213	-0.8
Max	62220	62220	617	2.0
Mean	18779	18791	13	0.1
Median	13327	13327	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	95.1
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	71170	71170	0	0.0
2.4	70078	70078	0	0.0
3.6	62593	62593	0	0.0
4.8	61799	61886	87	0.1
6.0	58350	58351	1	0.0
7.2	58086	58086	0	0.0
8.4	56785	56786	1	0.0
9.6	52693	52855	162	0.3
10.8	52397	52416	19	0.0
12.0	51707	51700	-7	0.0
13.3	50877	50871	-6	0.0
14.5	50111	50177	66	0.1
15.7	49122	49122	0	0.0
16.9	47974	47974	0	0.0
18.1	47515	47516	1	0.0
19.3	47097	47098	1	0.0
20.5	45873	45919	46	0.1
21.7	45848	45849	1	0.0
22.9	44256	44256	0	0.0
24.1	42293	42296	3	0.0
25.3	42274	42294	20	0.0
26.5	40741	40724	-17	0.0
27.7	40346	40347	1	0.0
28.9	39561	39560	-1	0.0
30.1	37234	37237	3	0.0
31.3	34159	34160	1	0.0
32.5	33266	33266	0	0.0
33.7	31812	31812	0	0.0
34.9	29975	29974	-1	0.0
36.1	29577	29575	-2	0.0
37.3	27185	27176	-9	0.0
38.6	25483	25483	0	0.0
39.8	25000	25000	0	0.0
41.0	24548	24548	0	0.0
42.2	23012	23013	1	0.0
43.4	22563	22564	1	0.0
44.6	21216	21217	1	0.0
45.8	20359	20359	0	0.0
47.0	20005	20006	1	0.0
48.2	19848	19848	0	0.0
49.4	19690	19690	0	0.0
50.6	19123	19120	-3	0.0
51.8	18109	18109	0	0.0
53.0	17970	17970	0	0.0
54.2	17826	17820	-6	0.0
55.4	17731	17731	0	0.0
56.6	17430	17430	0	0.0
57.8	16391	16400	9	0.1
59.0	16275	16283	8	0.0
60.2	15971	15961	-10	-0.1
61.4	15879	15875	-4	0.0
62.7	15509	15493	-16	-0.1
63.9	14610	14610	0	0.0
65.1	14552	14553	1	0.0
66.3	13869	13871	2	0.0
67.5	13469	13489	20	0.1
68.7	12173	12173	0	0.0
69.9	12046	12051	5	0.0
71.1	11706	11722	16	0.1
72.3	11609	11609	0	0.0
73.5	11596	11597	1	0.0
74.7	11412	11411	-1	0.0
75.9	11409	11411	2	0.0
77.1	11327	11328	1	0.0
78.3	11094	11094	0	0.0
79.5	11063	11064	1	0.0
80.7	11027	11027	0	0.0
81.9	10984	10974	-10	-0.1
83.1	10916	10916	0	0.0
84.3	10781	10781	0	0.0
85.5	10570	10565	-5	0.0
86.7	10435	10433	-2	0.0
88.0	10258	10263	5	0.0
89.2	10243	10249	6	0.1
90.4	10210	10243	33	0.3
91.6	9824	9824	0	0.0
92.8	9485	9485	0	0.0
94.0	9042	9034	-8	-0.1
95.2	8516	8516	0	0.0
96.4	8334	8334	0	0.0
97.6	8279	8279	0	0.0
98.8	7941	7935	-6	-0.1
Min	7941	7935	-17	-0.1
Max	71170	71170	162	0.3
Mean	26725	26730	5	0.0
Median	19407	19405	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	72517	72506	-11	0.0
2.4	65954	65954	0	0.0
3.6	64202	64201	-1	0.0
4.8	63255	63255	0	0.0
6.0	61039	61039	0	0.0
7.2	60287	60287	0	0.0
8.4	60045	60206	161	0.3
9.6	59070	59069	-1	0.0
10.8	58626	58642	16	0.0
12.0	58542	58539	-3	0.0
13.3	57397	57397	0	0.0
14.5	56931	56930	-1	0.0
15.7	56380	56381	1	0.0
16.9	55962	55962	0	0.0
18.1	55639	55616	-23	0.0
19.3	55066	55093	27	0.0
20.5	53237	53233	-4	0.0
21.7	49621	49621	0	0.0
22.9	47999	47956	-43	-0.1
24.1	46647	46250	-397	-0.9
25.3	45282	45247	-35	-0.1
26.5	45161	45162	1	0.0
27.7	44929	44929	0	0.0
28.9	43629	43629	0	0.0
30.1	43350	43349	-1	0.0
31.3	42552	42553	1	0.0
32.5	41841	41841	0	0.0
33.7	41329	41329	0	0.0
34.9	40956	40956	0	0.0
36.1	40180	40162	-18	0.0
37.3	39968	39974	6	0.0
38.6	39656	39657	1	0.0
39.8	38299	38299	0	0.0
41.0	37284	37283	-1	0.0
42.2	35137	35137	0	0.0
43.4	34920	34920	0	0.0
44.6	34061	34061	0	0.0
45.8	32499	33517	1018	3.1
47.0	31608	31609	1	0.0
48.2	31575	31575	0	0.0
49.4	29089	29089	0	0.0
50.6	28711	28713	2	0.0
51.8	27007	27007	0	0.0
53.0	26818	26801	-17	-0.1
54.2	26658	26658	0	0.0
55.4	24837	24837	0	0.0
56.6	24399	24418	19	0.1
57.8	23422	23423	1	0.0
59.0	23396	23398	2	0.0
60.2	23223	23223	0	0.0
61.4	23113	23113	0	0.0
62.7	22799	22802	3	0.0
63.9	20887	20887	0	0.0
65.1	20804	20804	0	0.0
66.3	20417	20416	-1	0.0
67.5	19830	19837	7	0.0
68.7	16589	16590	1	0.0
69.9	16486	16484	-2	0.0
71.1	16431	16435	4	0.0
72.3	16306	16307	1	0.0
73.5	15973	15974	1	0.0
74.7	15878	15878	0	0.0
75.9	15854	15855	1	0.0
77.1	15256	15256	0	0.0
78.3	14087	14087	0	0.0
79.5	14009	14015	6	0.0
80.7	13879	13883	4	0.0
81.9	13033	13033	0	0.0
83.1	12852	13001	149	1.2
84.3	12705	12852	147	1.2
85.5	12677	12677	0	0.0
86.7	12476	12476	0	0.0
88.0	12395	12172	-223	-1.8
89.2	12172	12117	-55	-0.5
90.4	11879	11901	22	0.2
91.6	11803	11877	74	0.6
92.8	11765	11798	33	0.3
94.0	11438	11438	0	0.0
95.2	9133	9134	1	0.0
96.4	8891	8891	0	0.0
97.6	8462	8461	-1	0.0
98.8	8406	8406	0	0.0
Min	8406	8406	-397	-1.8
Max	72517	72506	1018	3.1
Mean	32547	32558	11	0.0
Median	28900	28901	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	95.1
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	69018	69018	0	0.0
2.4	67783	67783	0	0.0
3.6	62855	62855	0	0.0
4.8	60505	60505	0	0.0
6.0	59941	59942	1	0.0
7.2	58885	58885	0	0.0
8.4	58078	58072	-6	0.0
9.6	56289	56289	0	0.0
10.8	55204	55204	0	0.0
12.0	52642	52643	1	0.0
13.3	52585	52585	0	0.0
14.5	50898	50896	-2	0.0
15.7	49962	49967	5	0.0
16.9	48610	48610	0	0.0
18.1	47761	47761	0	0.0
19.3	47682	47682	0	0.0
20.5	46427	46445	18	0.0
21.7	43576	43537	-39	-0.1
22.9	42499	42499	0	0.0
24.1	41367	41368	1	0.0
25.3	39133	39136	3	0.0
26.5	37132	37135	3	0.0
27.7	36438	36440	2	0.0
28.9	35628	35638	10	0.0
30.1	34210	34211	1	0.0
31.3	33228	33208	-20	-0.1
32.5	32505	32501	-4	0.0
33.7	31407	31403	-4	0.0
34.9	31028	31106	78	0.3
36.1	30701	30701	0	0.0
37.3	30610	30610	0	0.0
38.6	30279	30279	0	0.0
39.8	30195	30026	-169	-0.6
41.0	28616	28618	2	0.0
42.2	26716	26716	0	0.0
43.4	25057	25057	0	0.0
44.6	24826	24825	-1	0.0
45.8	24080	23972	-108	-0.4
47.0	23628	23625	-3	0.0
48.2	23446	23446	0	0.0
49.4	23297	23300	3	0.0
50.6	21112	21116	4	0.0
51.8	21102	21102	0	0.0
53.0	20311	20312	1	0.0
54.2	20089	20089	0	0.0
55.4	19937	19937	0	0.0
56.6	19704	19569	-135	-0.7
57.8	19516	19517	1	0.0
59.0	19280	19284	4	0.0
60.2	19246	19236	-10	-0.1
61.4	19188	19183	-5	0.0
62.7	18770	18771	1	0.0
63.9	18565	18565	0	0.0
65.1	18197	18197	0	0.0
66.3	17830	17821	-9	-0.1
67.5	17073	17056	-17	-0.1
68.7	16637	16640	3	0.0
69.9	16047	16048	1	0.0
71.1	15688	15689	1	0.0
72.3	15144	15144	0	0.0
73.5	14609	14610	1	0.0
74.7	14448	14448	0	0.0
75.9	14120	14106	-14	-0.1
77.1	13610	13610	0	0.0
78.3	13291	13290	-1	0.0
79.5	12464	12464	0	0.0
80.7	11974	11974	0	0.0
81.9	11875	11876	1	0.0
83.1	11197	11197	0	0.0
84.3	11190	11192	2	0.0
85.5	10604	10606	2	0.0
86.7	10415	10415	0	0.0
88.0	10262	10264	2	0.0
89.2	9704	9703	-1	0.0
90.4	9375	9375	0	0.0
91.6	8749	8744	-5	-0.1
92.8	8709	8709	0	0.0
94.0	8484	8484	0	0.0
95.2	8283	8283	0	0.0
96.4	7330	7318	-12	-0.2
97.6	6647	6691	44	0.7
98.8	6390	6515	125	2.0
Min	6390	6515	-169	-0.7
Max	69018	69018	125	2.0
Mean	27950	27947	-3	0.0
Median	22205	22208	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	59682	59682	0	0.0
2.4	57092	57092	0	0.0
3.6	54050	54050	0	0.0
4.8	49574	49573	-1	0.0
6.0	49226	49227	1	0.0
7.2	48994	48995	1	0.0
8.4	48707	48707	0	0.0
9.6	46653	46653	0	0.0
10.8	45746	45747	1	0.0
12.0	42871	42872	1	0.0
13.3	38334	38335	1	0.0
14.5	35801	35800	-1	0.0
15.7	34423	34428	5	0.0
16.9	33842	33842	0	0.0
18.1	33229	33227	-2	0.0
19.3	33005	33007	2	0.0
20.5	32778	32736	-42	-0.1
21.7	30170	30161	-9	0.0
22.9	29118	29119	1	0.0
24.1	28614	28614	0	0.0
25.3	26760	26760	0	0.0
26.5	22679	22679	0	0.0
27.7	22264	22256	-8	0.0
28.9	21612	21613	1	0.0
30.1	19577	19551	-26	-0.1
31.3	18575	18576	1	0.0
32.5	18508	18505	-3	0.0
33.7	17888	17888	0	0.0
34.9	17549	17549	0	0.0
36.1	17132	17129	-3	0.0
37.3	17129	17118	-11	-0.1
38.6	16696	16696	0	0.0
39.8	16592	16590	-2	0.0
41.0	16450	16450	0	0.0
42.2	15794	15794	0	0.0
43.4	15664	15665	1	0.0
44.6	15321	15319	-2	0.0
45.8	15042	15034	-8	-0.1
47.0	14419	14420	1	0.0
48.2	14213	14213	0	0.0
49.4	13872	13872	0	0.0
50.6	13786	13786	0	0.0
51.8	13553	13554	1	0.0
53.0	12632	12630	-2	0.0
54.2	12054	11881	-173	-1.4
55.4	11881	11803	-78	-0.7
56.6	11803	11570	-233	-2.0
57.8	11350	11350	0	0.0
59.0	11204	11238	34	0.3
60.2	10949	11204	255	2.3
61.4	10894	10949	55	0.5
62.7	10738	10893	155	1.4
63.9	10660	10660	0	0.0
65.1	10647	10647	0	0.0
66.3	10623	10622	-1	0.0
67.5	10370	10370	0	0.0
68.7	10247	10247	0	0.0
69.9	10186	10186	0	0.0
71.1	10137	10137	0	0.0
72.3	10101	10101	0	0.0
73.5	9984	9984	0	0.0
74.7	9787	9787	0	0.0
75.9	9466	9466	0	0.0
77.1	9440	9385	-55	-0.6
78.3	9387	9358	-29	-0.3
79.5	9353	9353	0	0.0
80.7	9339	9339	0	0.0
81.9	9310	9311	1	0.0
83.1	9164	9266	102	1.1
84.3	8994	9164	170	1.9
85.5	8877	8994	117	1.3
86.7	8864	8877	13	0.1
88.0	8858	8870	12	0.1
89.2	8852	8852	0	0.0
90.4	8646	8646	0	0.0
91.6	8626	8626	0	0.0
92.8	8175	8175	0	0.0
94.0	8142	8142	0	0.0
95.2	7916	7916	0	0.0
96.4	7898	7898	0	0.0
97.6	7752	7752	0	0.0
98.8	7725	7725	0	0.0
Min	7725	7725	-233	-2.0
Max	59682	59682	255	2.3
Mean	19683	19686	3	0.0
Median	13829	13829	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	91.5
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	49823	49823	0	0.0
2.4	47472	47471	-1	0.0
3.6	44619	44619	0	0.0
4.8	42287	42288	1	0.0
6.0	39221	39221	0	0.0
7.2	36829	36828	-1	0.0
8.4	35448	34732	-716	-2.0
9.6	34673	34673	0	0.0
10.8	34129	34130	1	0.0
12.0	32310	32309	-1	0.0
13.3	32268	32268	0	0.0
14.5	32177	32178	1	0.0
15.7	30916	30917	1	0.0
16.9	27683	27684	1	0.0
18.1	25125	25132	7	0.0
19.3	23723	23724	1	0.0
20.5	23206	23213	7	0.0
21.7	22341	22341	0	0.0
22.9	21325	21753	428	2.0
24.1	20625	20626	1	0.0
25.3	19767	19767	0	0.0
26.5	19217	19221	4	0.0
27.7	16298	16298	0	0.0
28.9	15503	15501	-2	0.0
30.1	14745	14745	0	0.0
31.3	14505	14505	0	0.0
32.5	14258	14258	0	0.0
33.7	13736	13736	0	0.0
34.9	13643	13622	-21	-0.2
36.1	13242	13242	0	0.0
37.3	13189	13190	1	0.0
38.6	12067	12067	0	0.0
39.8	11806	11883	77	0.7
41.0	11625	11806	181	1.6
42.2	11096	11625	529	4.8
43.4	11086	11096	10	0.1
44.6	11031	11030	-1	0.0
45.8	10943	10943	0	0.0
47.0	10728	10722	-6	-0.1
48.2	10643	10682	39	0.4
49.4	10576	10643	67	0.6
50.6	10465	10576	111	1.1
51.8	10272	10465	193	1.9
53.0	10092	10398	306	3.0
54.2	10058	10099	41	0.4
55.4	10050	10092	42	0.4
56.6	10014	10058	44	0.4
57.8	9855	10014	159	1.6
59.0	9779	9854	75	0.8
60.2	9612	9779	167	1.7
61.4	9543	9695	152	1.6
62.7	9494	9609	115	1.2
63.9	9416	9608	192	2.0
65.1	9293	9543	250	2.7
66.3	9244	9494	250	2.7
67.5	9209	9419	210	2.3
68.7	9195	9283	88	1.0
69.9	9109	9244	135	1.5
71.1	8985	9209	224	2.5
72.3	8919	8985	66	0.7
73.5	8915	8909	-6	-0.1
74.7	8910	8833	-77	-0.9
75.9	8832	8703	-129	-1.5
77.1	8703	8654	-49	-0.6
78.3	8655	8630	-25	-0.3
79.5	8630	8620	-10	-0.1
80.7	8620	8415	-205	-2.4
81.9	8408	8408	0	0.0
83.1	8373	8373	0	0.0
84.3	8038	7997	-41	-0.5
85.5	7858	7873	15	0.2
86.7	7707	7672	-35	-0.5
88.0	7397	7397	0	0.0
89.2	7360	7360	0	0.0
90.4	7265	7270	5	0.1
91.6	7051	7051	0	0.0
92.8	7037	7038	1	0.0
94.0	6922	6922	0	0.0
95.2	6737	6736	-1	0.0
96.4	6504	6504	0	0.0
97.6	5681	5681	0	0.0
98.8	5579	5579	0	0.0
Min	5579	5579	-716	-2.4
Max	49823	49823	529	4.8
Mean	15704	15739	35	0.4
Median	10521	10610	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	76.8
1.1<=X<10.0		19.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	50349	50349	0	0.0
2.4	37841	37841	0	0.0
3.6	27735	27736	1	0.0
4.8	27616	27617	1	0.0
6.0	26439	26439	0	0.0
7.2	26313	26313	0	0.0
8.4	24572	24572	0	0.0
9.6	21650	21650	0	0.0
10.8	19920	19875	-45	-0.2
12.0	19275	19275	0	0.0
13.3	18580	18581	1	0.0
14.5	18445	18445	0	0.0
15.7	16692	16692	0	0.0
16.9	15618	15618	0	0.0
18.1	15397	15397	0	0.0
19.3	15248	15248	0	0.0
20.5	14905	14905	0	0.0
21.7	14490	14490	0	0.0
22.9	14086	14179	93	0.7
24.1	13619	13620	1	0.0
25.3	13193	13193	0	0.0
26.5	13176	13176	0	0.0
27.7	12905	12737	-168	-1.3
28.9	12892	12574	-318	-2.5
30.1	12539	12423	-116	-0.9
31.3	12303	12281	-22	-0.2
32.5	12254	12120	-134	-1.1
33.7	12120	12044	-76	-0.6
34.9	12042	12041	-1	0.0
36.1	11901	11901	0	0.0
37.3	11820	11818	-2	0.0
38.6	11818	11679	-139	-1.2
39.8	11679	11563	-116	-1.0
41.0	11563	11494	-69	-0.6
42.2	11501	11472	-29	-0.3
43.4	11339	11326	-13	-0.1
44.6	11326	11316	-10	-0.1
45.8	11316	11272	-44	-0.4
47.0	11272	11265	-7	-0.1
48.2	11263	11112	-151	-1.3
49.4	11095	11004	-91	-0.8
50.6	10989	11001	12	0.1
51.8	10926	10989	63	0.6
53.0	10735	10926	191	1.8
54.2	10652	10649	-3	0.0
55.4	10649	10631	-18	-0.2
56.6	10569	10537	-32	-0.3
57.8	10517	10511	-6	-0.1
59.0	10506	10368	-138	-1.3
60.2	10370	10327	-43	-0.4
61.4	10331	10318	-13	-0.1
62.7	10321	10213	-108	-1.0
63.9	10254	10166	-88	-0.9
65.1	10206	10127	-79	-0.8
66.3	10127	10028	-99	-1.0
67.5	10028	9856	-172	-1.7
68.7	9964	9841	-123	-1.2
69.9	9894	9833	-61	-0.6
71.1	9859	9813	-46	-0.5
72.3	9841	9698	-143	-1.5
73.5	9833	9688	-145	-1.5
74.7	9781	9685	-96	-1.0
75.9	9676	9658	-18	-0.2
77.1	9632	9632	0	0.0
78.3	9414	9457	43	0.5
79.5	9407	9407	0	0.0
80.7	9228	9228	0	0.0
81.9	8959	9090	131	1.5
83.1	8929	8959	30	0.3
84.3	8892	8893	1	0.0
85.5	8694	8699	5	0.1
86.7	8080	8101	21	0.3
88.0	8032	8089	57	0.7
89.2	7982	7983	1	0.0
90.4	7614	7613	-1	0.0
91.6	7594	7595	1	0.0
92.8	7427	7428	1	0.0
94.0	7311	7310	-1	0.0
95.2	7074	7074	0	0.0
96.4	6903	6903	0	0.0
97.6	6882	6882	0	0.0
98.8	6713	6713	0	0.0
Min	6713	6713	-318	-2.5
Max	50349	50349	191	1.8
Mean	13060	13031	-28	-0.2
Median	11042	11003	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		12.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	20014	20008	-6	0.0
2.4	20002	19919	-83	-0.4
3.6	19682	19636	-46	-0.2
4.8	19597	19597	0	0.0
6.0	19585	19542	-43	-0.2
7.2	19456	19378	-78	-0.4
8.4	19371	19371	0	0.0
9.6	19264	19329	65	0.3
10.8	19141	19133	-8	0.0
12.0	19029	19022	-7	0.0
13.3	18903	18903	0	0.0
14.5	18713	18697	-16	-0.1
15.7	18688	18656	-32	-0.2
16.9	18682	18654	-28	-0.1
18.1	18670	18577	-93	-0.5
19.3	18669	18570	-99	-0.5
20.5	18577	18482	-95	-0.5
21.7	18482	18440	-42	-0.2
22.9	18403	18362	-41	-0.2
24.1	18376	18156	-220	-1.2
25.3	18155	18125	-30	-0.2
26.5	18124	17930	-194	-1.1
27.7	17870	17871	1	0.0
28.9	17833	17833	0	0.0
30.1	17594	17595	1	0.0
31.3	17570	17573	3	0.0
32.5	17391	17387	-4	0.0
33.7	17377	17384	7	0.0
34.9	17322	17311	-11	-0.1
36.1	17170	17075	-95	-0.6
37.3	17155	17042	-113	-0.7
38.6	16985	16965	-20	-0.1
39.8	16978	16913	-65	-0.4
41.0	16957	16821	-136	-0.8
42.2	16930	16776	-154	-0.9
43.4	16903	16728	-175	-1.0
44.6	16821	16715	-106	-0.6
45.8	16723	16709	-14	-0.1
47.0	16503	16503	0	0.0
48.2	16470	16470	0	0.0
49.4	16276	16440	164	1.0
50.6	16267	16268	1	0.0
51.8	16211	16211	0	0.0
53.0	16185	16184	-1	0.0
54.2	16152	16143	-9	-0.1
55.4	15992	16040	48	0.3
56.6	15751	15751	0	0.0
57.8	15563	15563	0	0.0
59.0	15239	15239	0	0.0
60.2	15200	15123	-77	-0.5
61.4	15087	15087	0	0.0
62.7	15064	14951	-113	-0.8
63.9	14900	14885	-15	-0.1
65.1	14825	14821	-4	0.0
66.3	14789	14580	-209	-1.4
67.5	14580	14460	-120	-0.8
68.7	14381	14381	0	0.0
69.9	14324	14286	-38	-0.3
71.1	14286	14204	-82	-0.6
72.3	14185	14178	-7	0.0
73.5	13913	13913	0	0.0
74.7	13832	13683	-149	-1.1
75.9	13390	13390	0	0.0
77.1	13146	13143	-3	0.0
78.3	12931	12932	1	0.0
79.5	12670	12618	-52	-0.4
80.7	12617	12268	-349	-2.8
81.9	12268	11852	-416	-3.4
83.1	11923	11846	-77	-0.6
84.3	11847	11724	-123	-1.0
85.5	11598	11620	22	0.2
86.7	11228	11228	0	0.0
88.0	11207	10940	-267	-2.4
89.2	10844	10844	0	0.0
90.4	10830	10808	-22	-0.2
91.6	10611	10613	2	0.0
92.8	8461	8460	-1	0.0
94.0	7958	7891	-67	-0.8
95.2	7901	6867	-1034	-13.1
96.4	7686	6859	-827	-10.8
97.6	6883	6721	-162	-2.4
98.8	5852	5852	0	0.0
Min	5852	5852	-1034	-13.1
Max	20014	20008	164	1.0
Mean	15500	15427	-73	-0.6
Median	16272	16354	-16	-0.1

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		9.8
X<=-5.0		2.4
X<=-10.0		2.4
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		10.0
X<=-10.0		10.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-10.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	16244	16245	1	0.0
2.4	16202	16201	-1	0.0
3.6	15847	15848	1	0.0
4.8	15814	15798	-16	-0.1
6.0	15677	15453	-224	-1.4
7.2	15517	15448	-69	-0.4
8.4	15452	15384	-68	-0.4
9.6	15448	15149	-299	-1.9
10.8	15036	15037	1	0.0
12.0	15024	15035	11	0.1
13.3	15014	15017	3	0.0
14.5	14878	14871	-7	0.0
15.7	14870	14856	-14	-0.1
16.9	14870	14809	-61	-0.4
18.1	14798	14800	2	0.0
19.3	14794	14652	-142	-1.0
20.5	14651	14617	-34	-0.2
21.7	14598	14517	-81	-0.6
22.9	14334	14335	1	0.0
24.1	14298	14312	14	0.1
25.3	14260	14261	1	0.0
26.5	14237	14237	0	0.0
27.7	14175	14175	0	0.0
28.9	14129	14129	0	0.0
30.1	14037	14036	-1	0.0
31.3	14035	14031	-4	0.0
32.5	13927	13927	0	0.0
33.7	13924	13921	-3	0.0
34.9	13786	13786	0	0.0
36.1	13716	13716	0	0.0
37.3	13688	13688	0	0.0
38.6	13671	13671	0	0.0
39.8	13470	13470	0	0.0
41.0	13410	13416	6	0.0
42.2	13286	13289	3	0.0
43.4	13229	13229	0	0.0
44.6	13156	13152	-4	0.0
45.8	12748	12749	1	0.0
47.0	12489	12490	1	0.0
48.2	12047	12146	99	0.8
49.4	11995	11995	0	0.0
50.6	11767	11767	0	0.0
51.8	11635	11638	3	0.0
53.0	11565	11565	0	0.0
54.2	11491	11491	0	0.0
55.4	11448	11448	0	0.0
56.6	11434	11426	-8	-0.1
57.8	11384	11384	0	0.0
59.0	11231	11231	0	0.0
60.2	10994	10994	0	0.0
61.4	10972	10986	14	0.1
62.7	10964	10964	0	0.0
63.9	10912	10909	-3	0.0
65.1	10455	10498	43	0.4
66.3	10401	10443	42	0.4
67.5	10300	10243	-57	-0.6
68.7	10234	10219	-15	-0.1
69.9	10218	10128	-90	-0.9
71.1	10032	10037	5	0.0
72.3	10022	10025	3	0.0
73.5	9673	10009	336	3.5
74.7	9601	9601	0	0.0
75.9	9534	9485	-49	-0.5
77.1	9355	9481	126	1.3
78.3	9351	9357	6	0.1
79.5	9230	9210	-20	-0.2
80.7	9046	9068	22	0.2
81.9	9028	9027	-1	0.0
83.1	8875	8875	0	0.0
84.3	8797	8835	38	0.4
85.5	8416	8749	333	4.0
86.7	8415	7847	-568	-6.7
88.0	7853	7806	-47	-0.6
89.2	7821	7578	-243	-3.1
90.4	7819	7416	-403	-5.2
91.6	7614	7404	-210	-2.8
92.8	7375	7358	-17	-0.2
94.0	7359	7181	-178	-2.4
95.2	6775	7066	291	4.3
96.4	6344	6800	456	7.2
97.6	6193	6173	-20	-0.3
98.8	5947	5946	-1	0.0
Min	5947	5946	-568	-6.7
Max	16244	16245	456	7.2
Mean	11886	11873	-13	-0.1
Median	11881	11881	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		6.1
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		20.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		10.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow below Confluence with the Feather River - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	27771	27771	0	0.0
2.4	27098	27062	-36	-0.1
3.6	27037	27037	0	0.0
4.8	26960	26960	0	0.0
6.0	26874	26875	1	0.0
7.2	26707	26707	0	0.0
8.4	26481	26496	15	0.1
9.6	25907	25898	-9	0.0
10.8	25814	25814	0	0.0
12.0	25388	25388	0	0.0
13.3	25286	25346	60	0.2
14.5	25211	25212	1	0.0
15.7	25138	25138	0	0.0
16.9	24991	24993	2	0.0
18.1	24757	24453	-304	-1.2
19.3	24457	24432	-25	-0.1
20.5	24212	24187	-25	-0.1
21.7	24057	24057	0	0.0
22.9	23735	23891	156	0.7
24.1	23706	23706	0	0.0
25.3	23661	23661	0	0.0
26.5	21547	21547	0	0.0
27.7	21228	21229	1	0.0
28.9	20898	20898	0	0.0
30.1	20827	20827	0	0.0
31.3	20543	20190	-353	-1.7
32.5	20030	20073	43	0.2
33.7	19991	19991	0	0.0
34.9	19363	19363	0	0.0
36.1	19286	19313	27	0.1
37.3	18954	18954	0	0.0
38.6	18765	18765	0	0.0
39.8	18189	18179	-10	-0.1
41.0	17301	17301	0	0.0
42.2	17178	17080	-98	-0.6
43.4	16941	16944	3	0.0
44.6	15661	16532	871	5.6
45.8	15510	15662	152	1.0
47.0	14552	14549	-3	0.0
48.2	13542	13547	5	0.0
49.4	13305	13039	-266	-2.0
50.6	13036	13022	-14	-0.1
51.8	13012	12863	-149	-1.1
53.0	12742	12742	0	0.0
54.2	12711	12711	0	0.0
55.4	12419	12419	0	0.0
56.6	12402	12413	11	0.1
57.8	12124	11936	-188	-1.6
59.0	11898	11898	0	0.0
60.2	11836	11836	0	0.0
61.4	11690	11700	10	0.1
62.7	11688	11688	0	0.0
63.9	11678	11530	-148	-1.3
65.1	11345	11309	-36	-0.3
66.3	11311	11212	-99	-0.9
67.5	11291	11089	-202	-1.8
68.7	11257	10759	-498	-4.4
69.9	10639	10729	90	0.8
71.1	10139	10375	236	2.3
72.3	9788	10139	351	3.6
73.5	9787	9791	4	0.0
74.7	9699	9753	54	0.6
75.9	9548	9157	-391	-4.1
77.1	9190	8899	-291	-3.2
78.3	8630	8621	-9	-0.1
79.5	8379	8373	-6	-0.1
80.7	8208	8210	2	0.0
81.9	7583	7947	364	4.8
83.1	7554	7553	-1	0.0
84.3	7166	7044	-122	-1.7
85.5	7091	7004	-87	-1.2
86.7	7004	6955	-49	-0.7
88.0	6834	6835	1	0.0
89.2	6818	6815	-3	0.0
90.4	6780	6783	3	0.0
91.6	6718	6713	-5	-0.1
92.8	6066	6066	0	0.0
94.0	5757	5757	0	0.0
95.2	5719	5712	-7	-0.1
96.4	5643	5642	-1	0.0
97.6	5172	5183	11	0.2
98.8	5046	5046	0	0.0
Min	5046	5046	-498	-4.4
Max	27771	27771	871	5.6
Mean	15637	15626	-12	-0.1
Median	13171	13031	0	0.0

Entire 82-Year Simulation Period

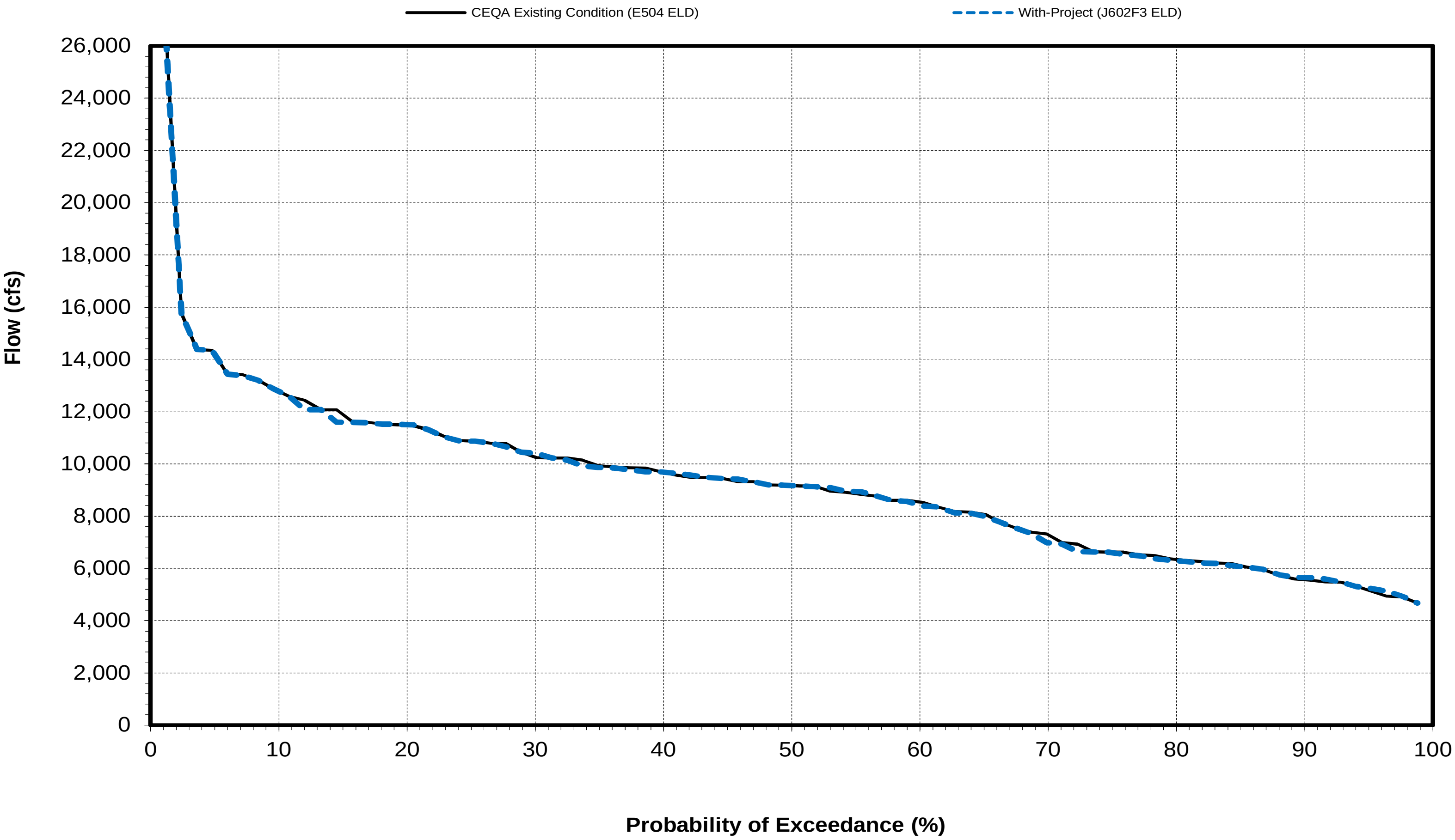
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	80.5
1.1<=X<10.0		4.9
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		14.6
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

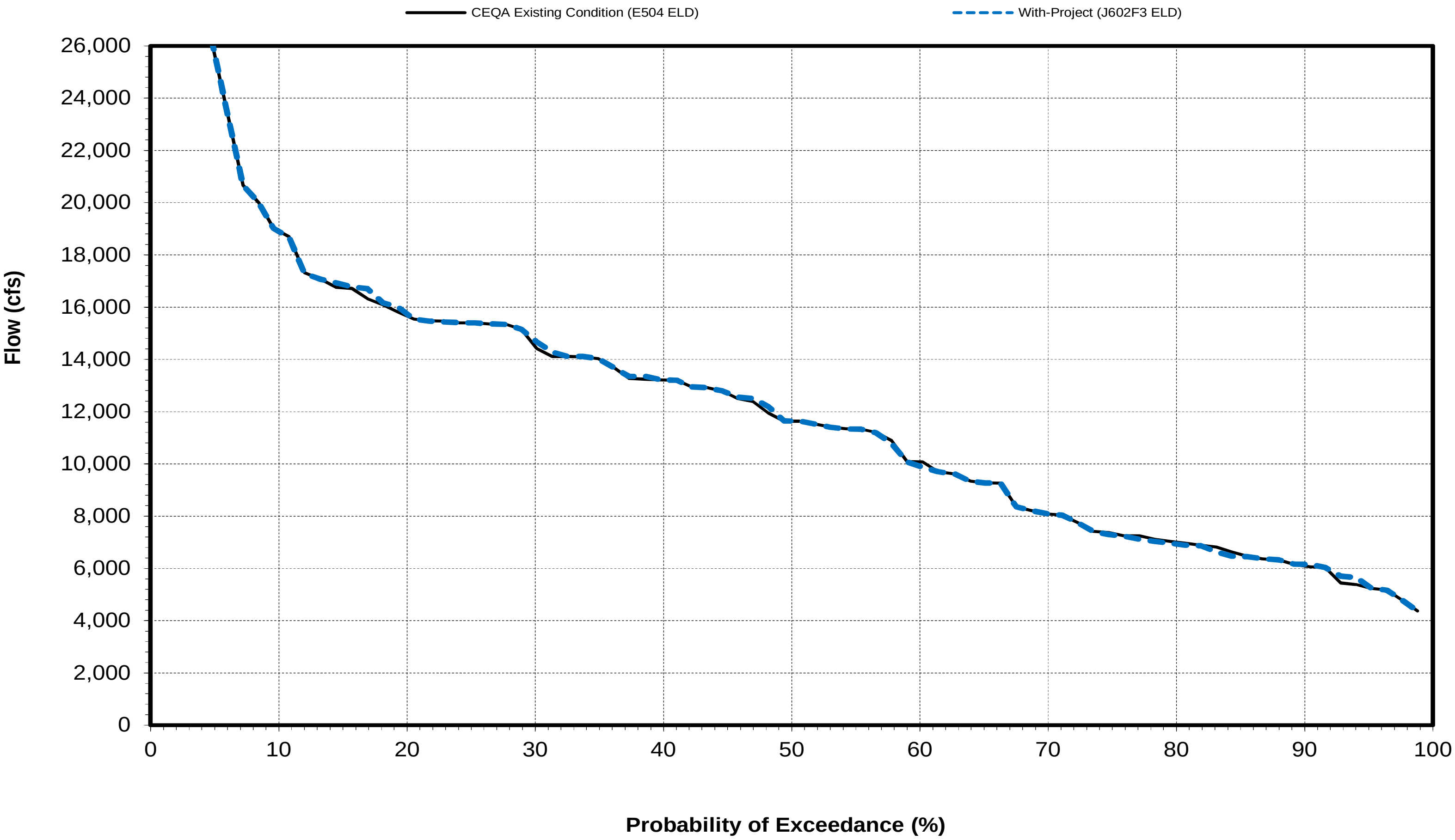
Sacramento River Flow below Confluence with the Feather River

October



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

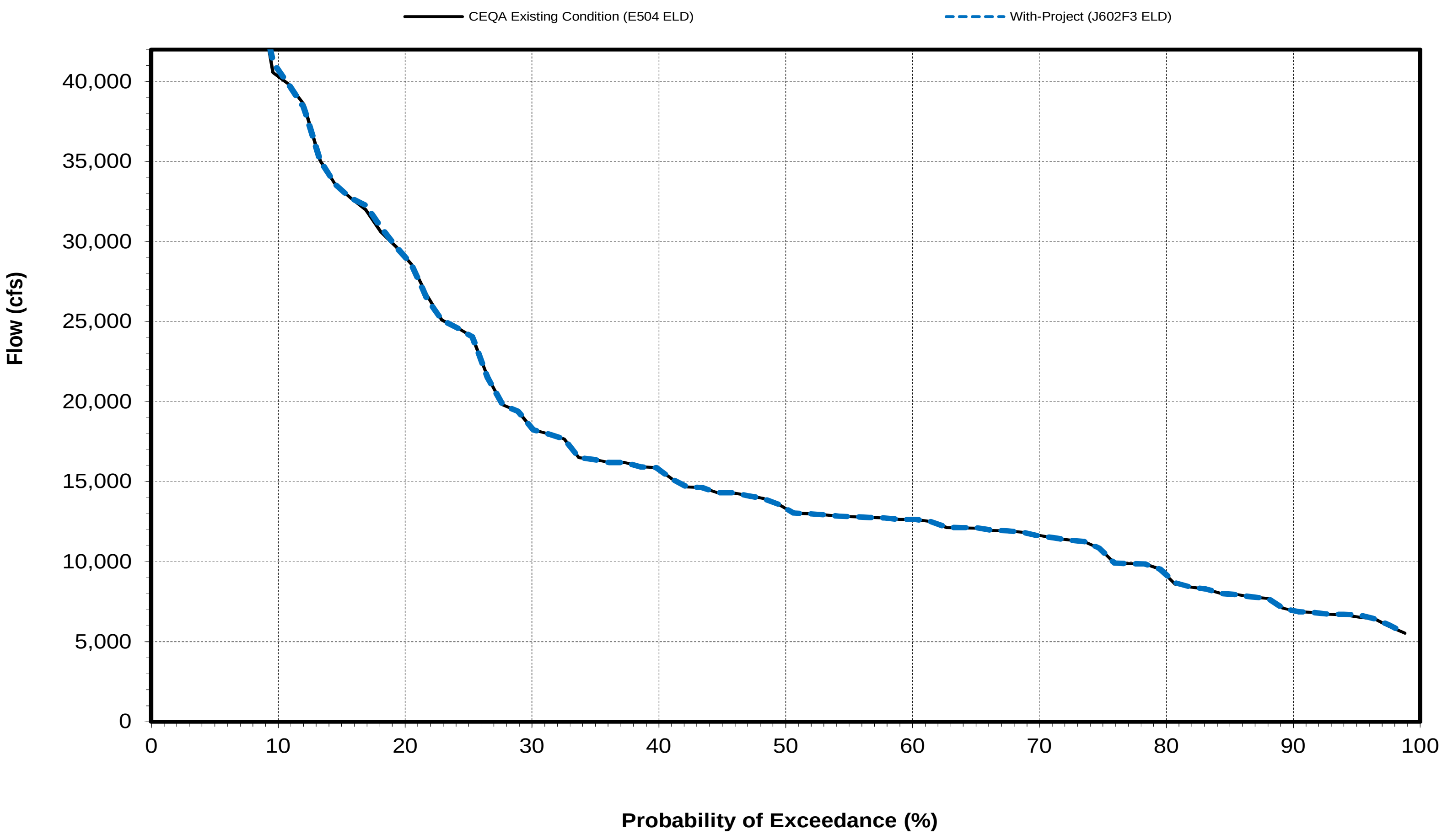
Sacramento River Flow below Confluence with the Feather River **November**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

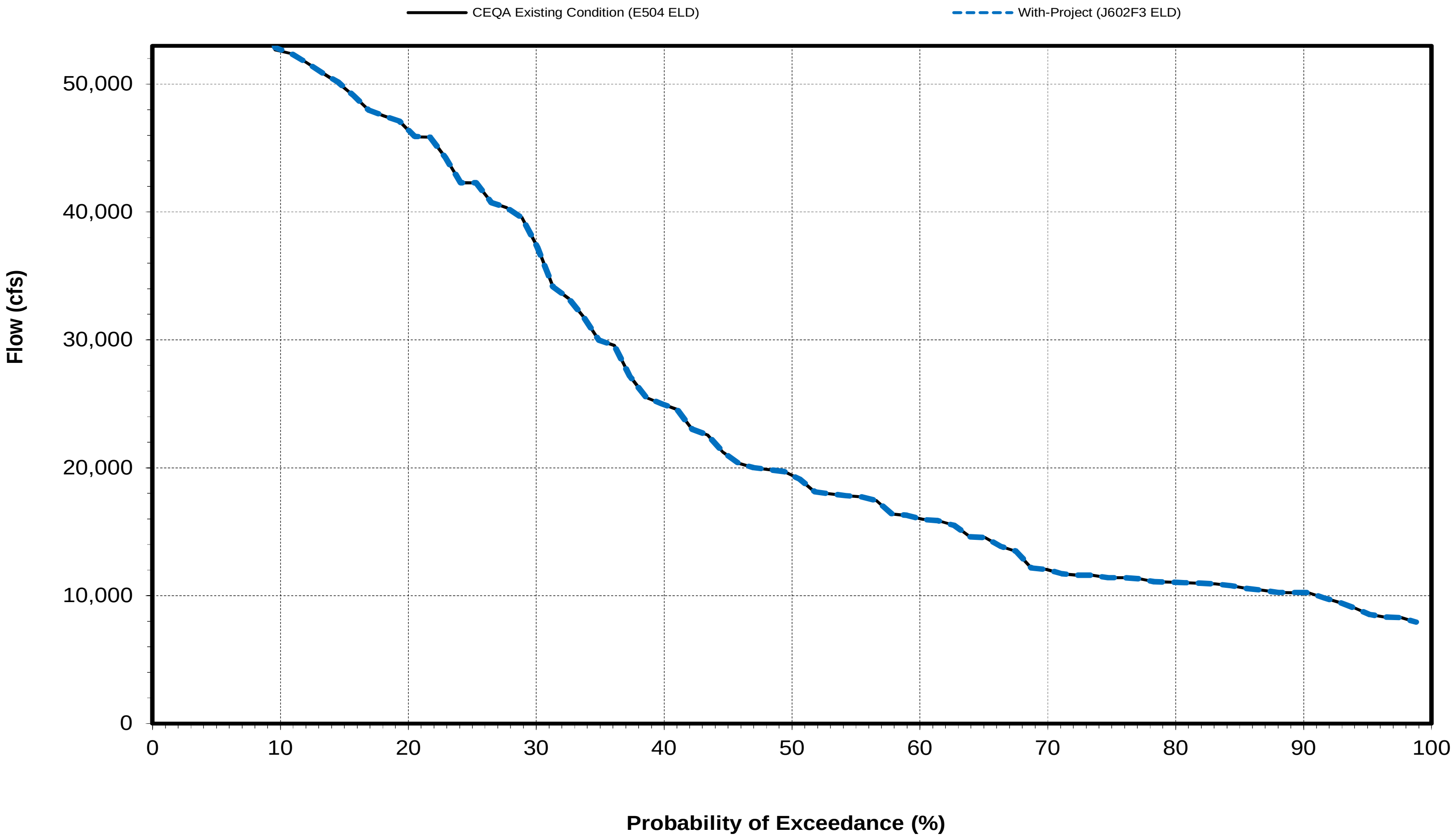
Sacramento River Flow below Confluence with the Feather River

December



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

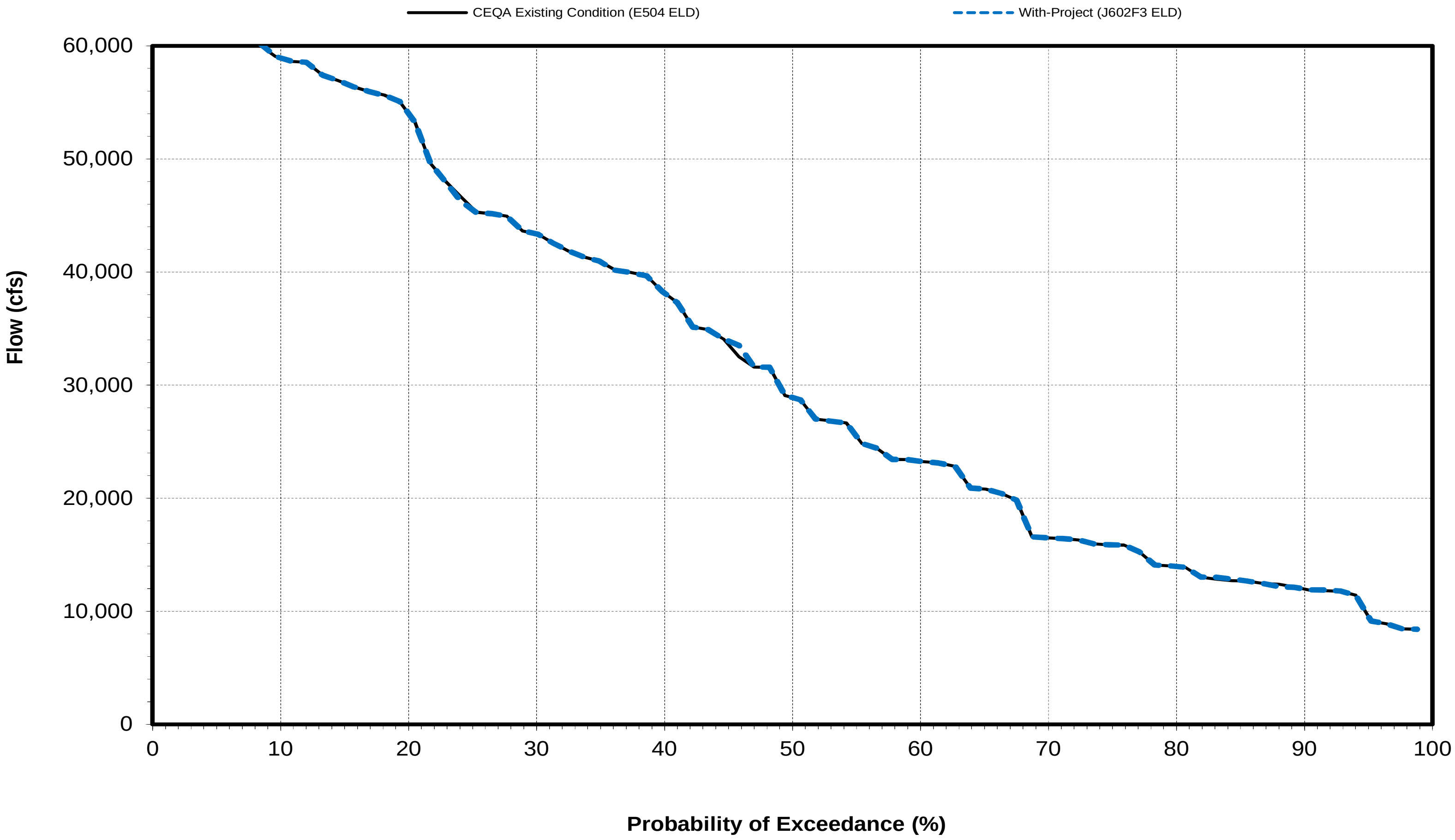
Sacramento River Flow below Confluence with the Feather River **January**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

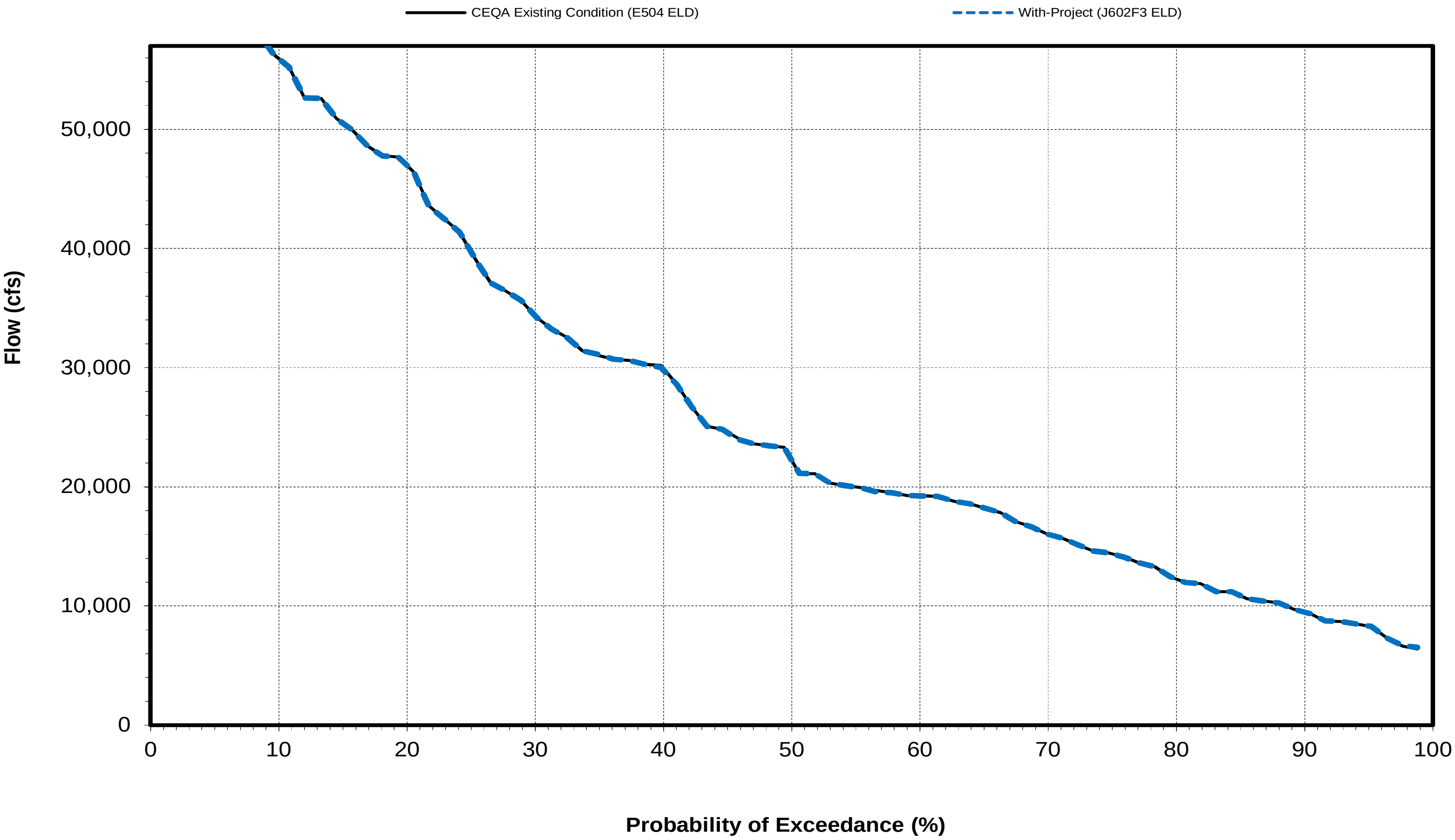
Created: 7/26/2016

Sacramento River Flow below Confluence with the Feather River **February**



Sacramento River Flow below Confluence with the Feather River

March

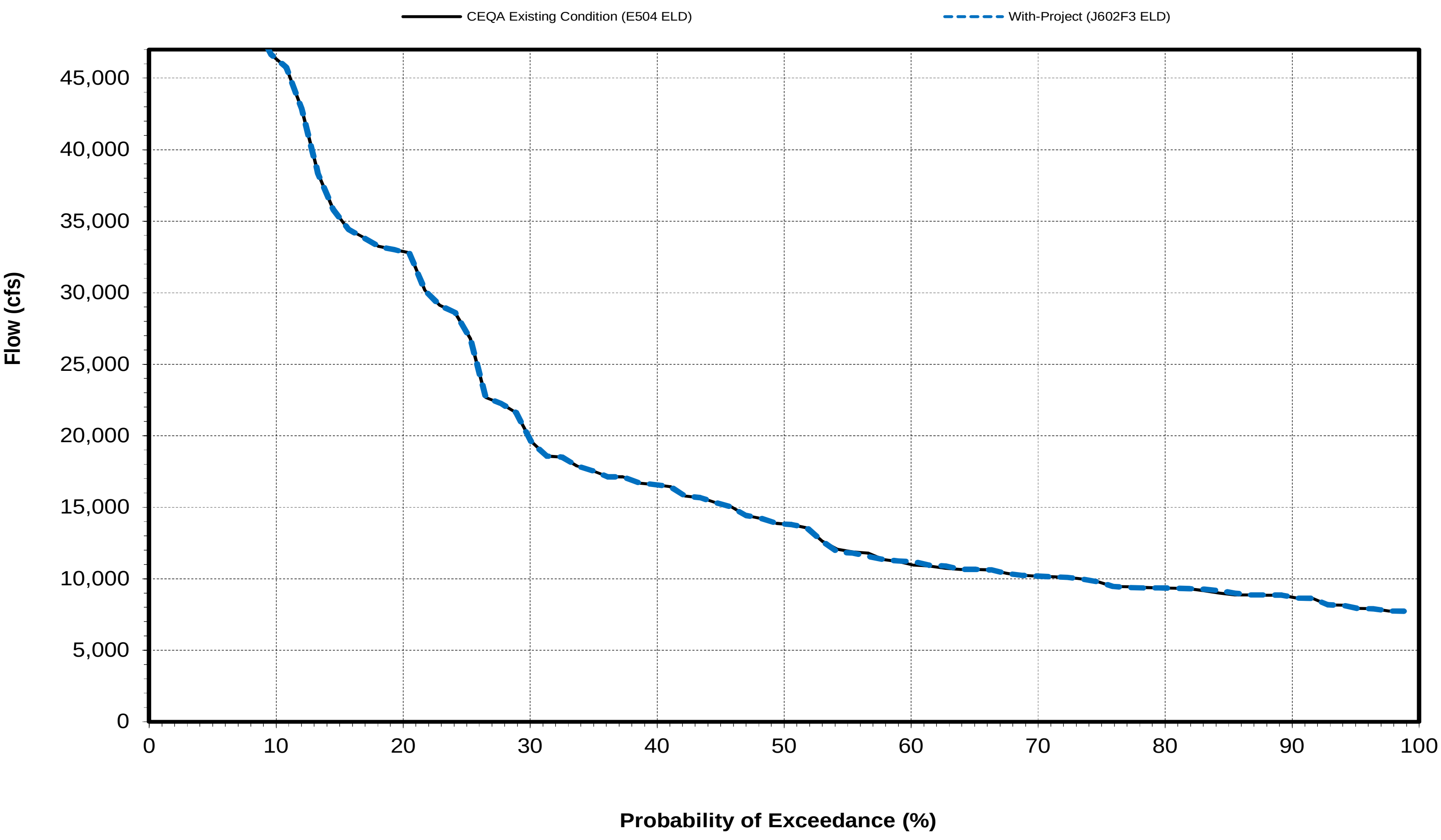


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow below Confluence with the Feather River

April

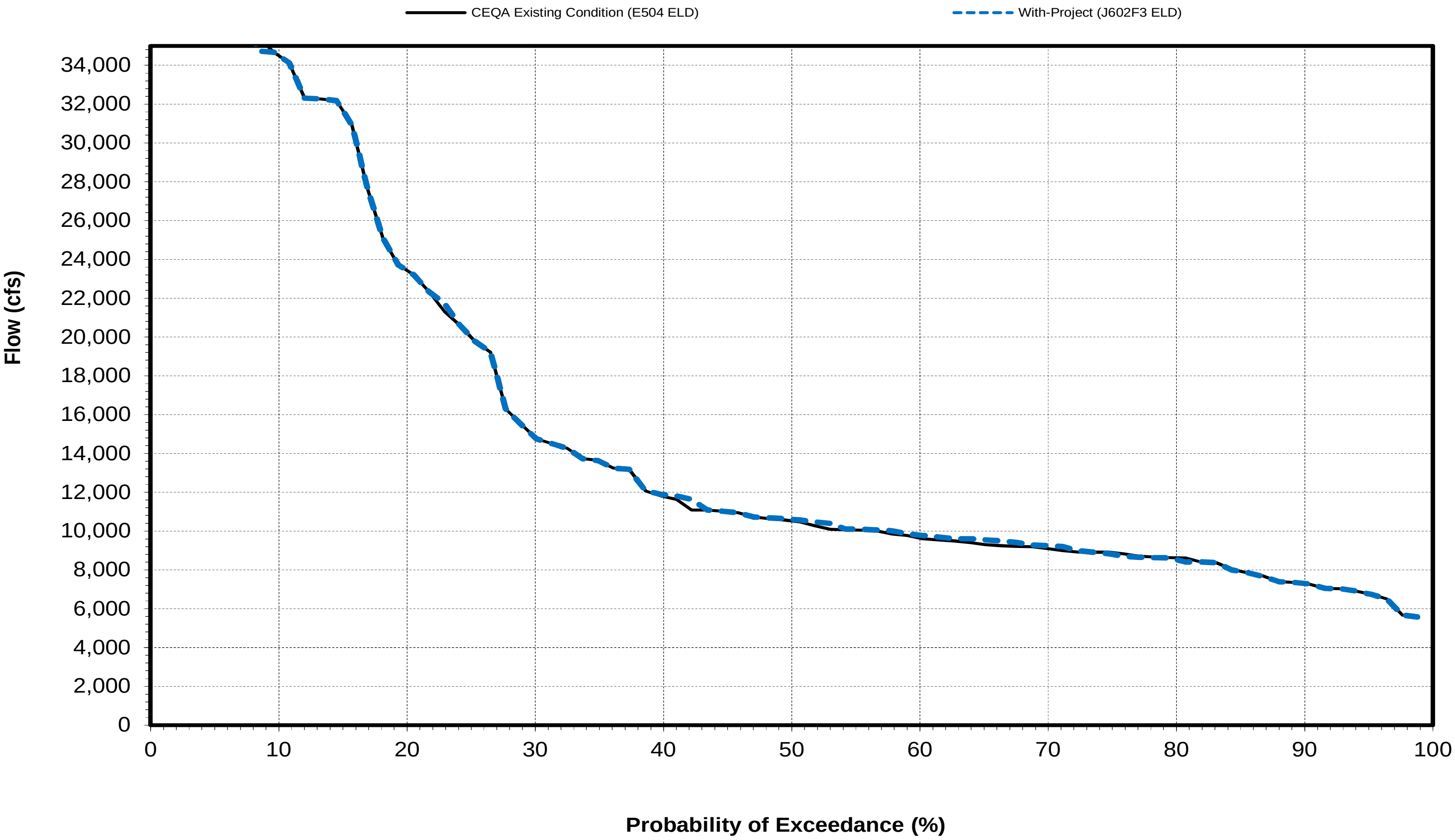


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow below Confluence with the Feather River

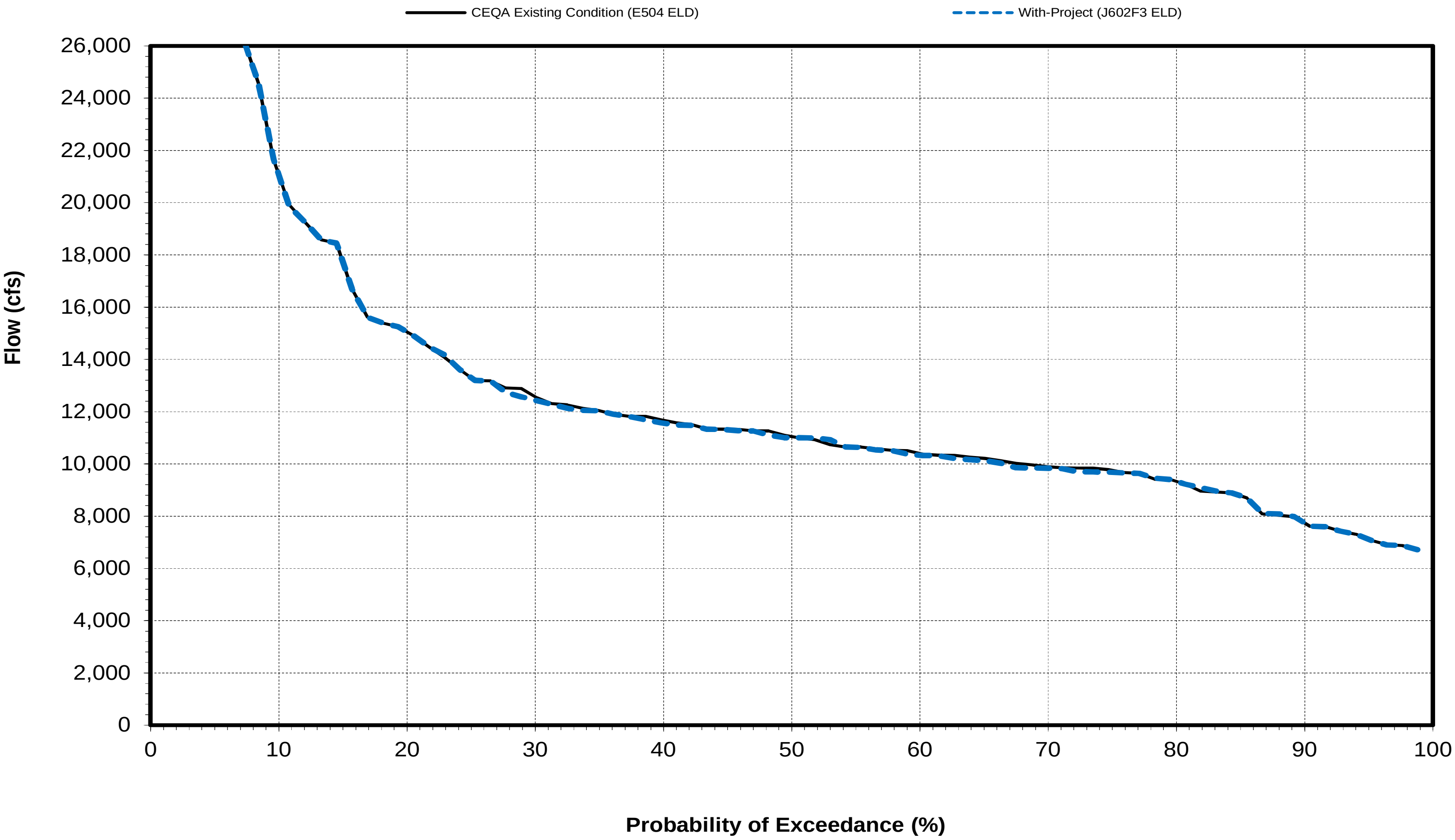
May



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow below Confluence with the Feather River

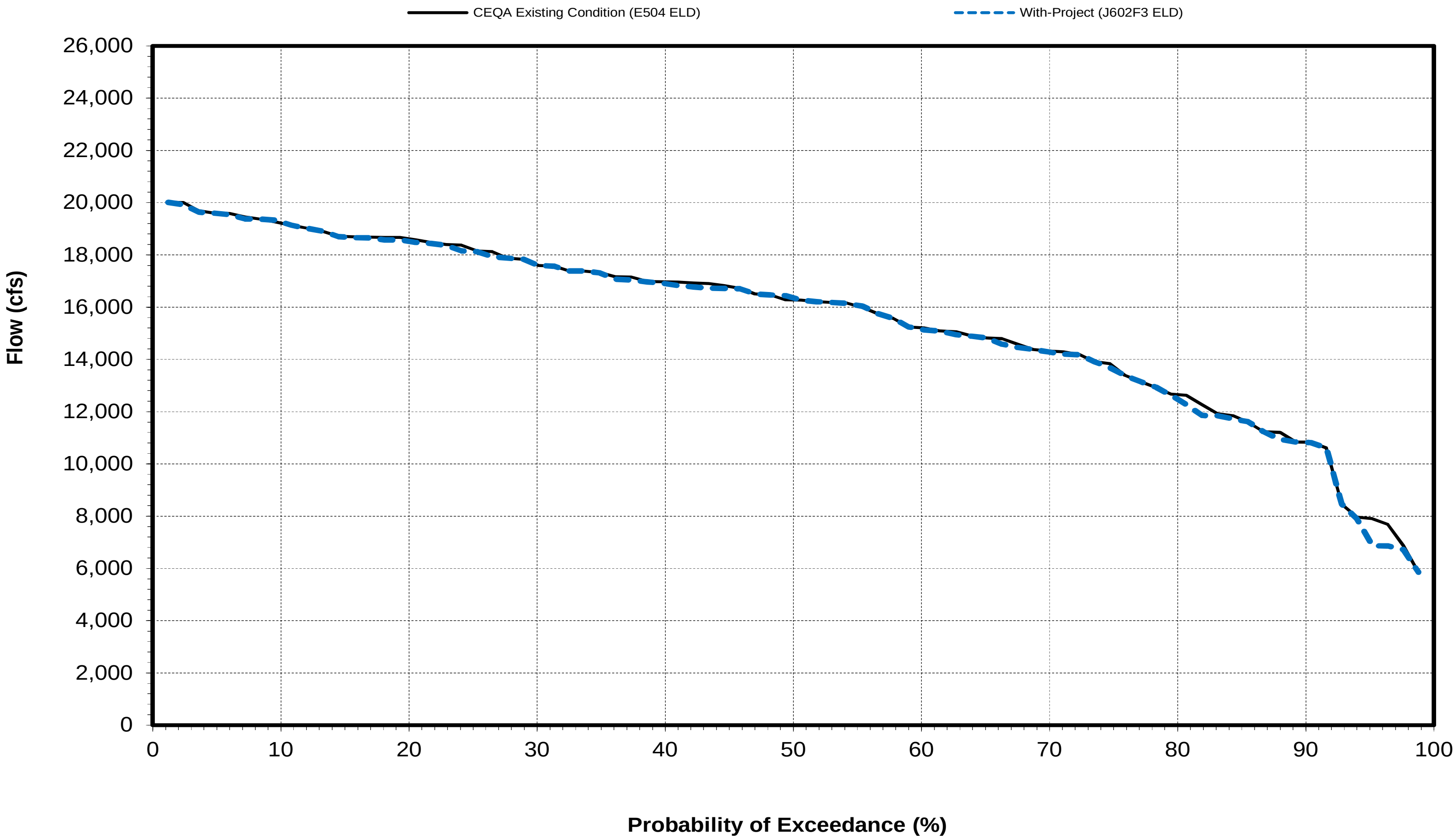
June



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow below Confluence with the Feather River

July

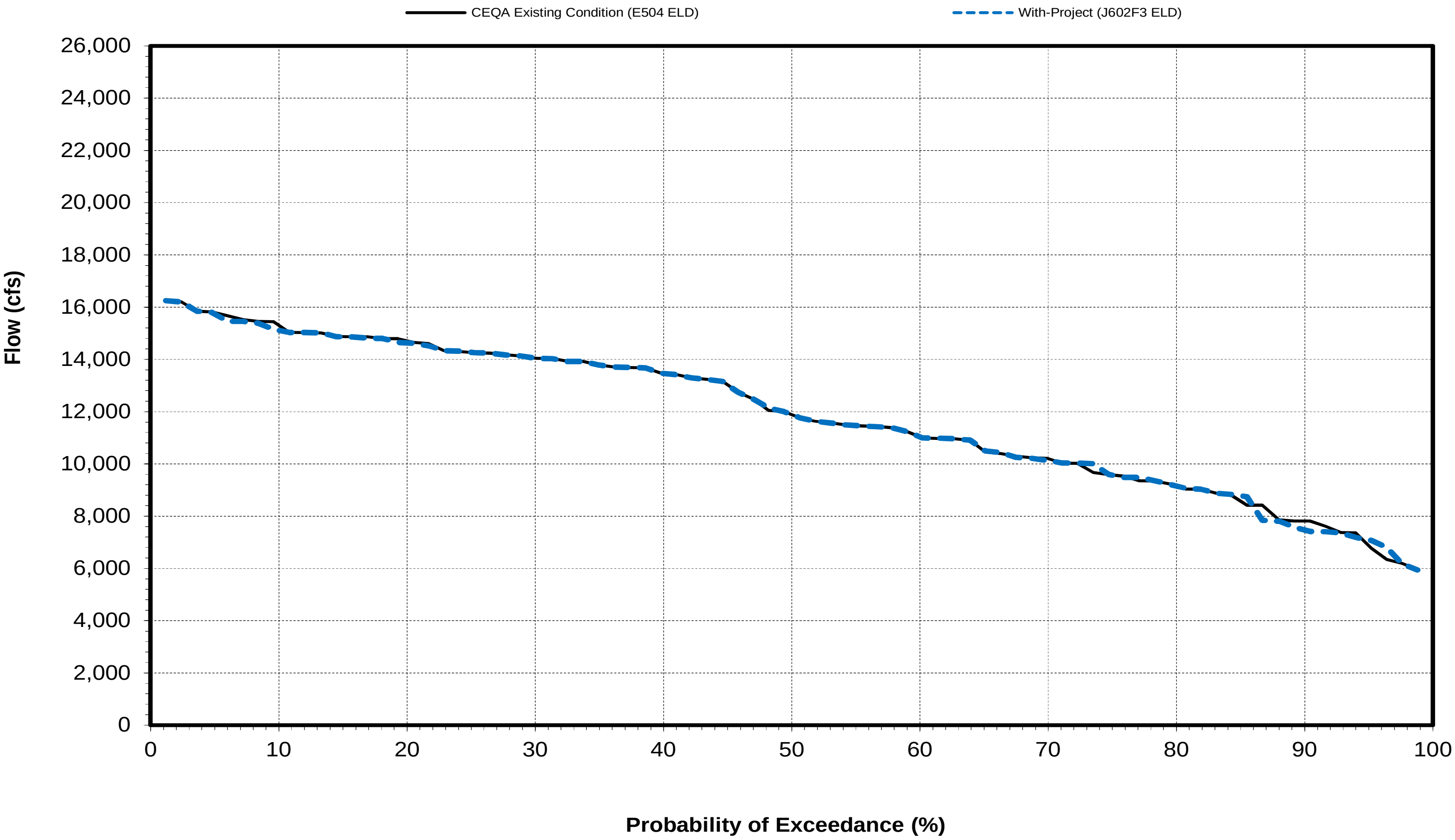


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow below Confluence with the Feather River

August

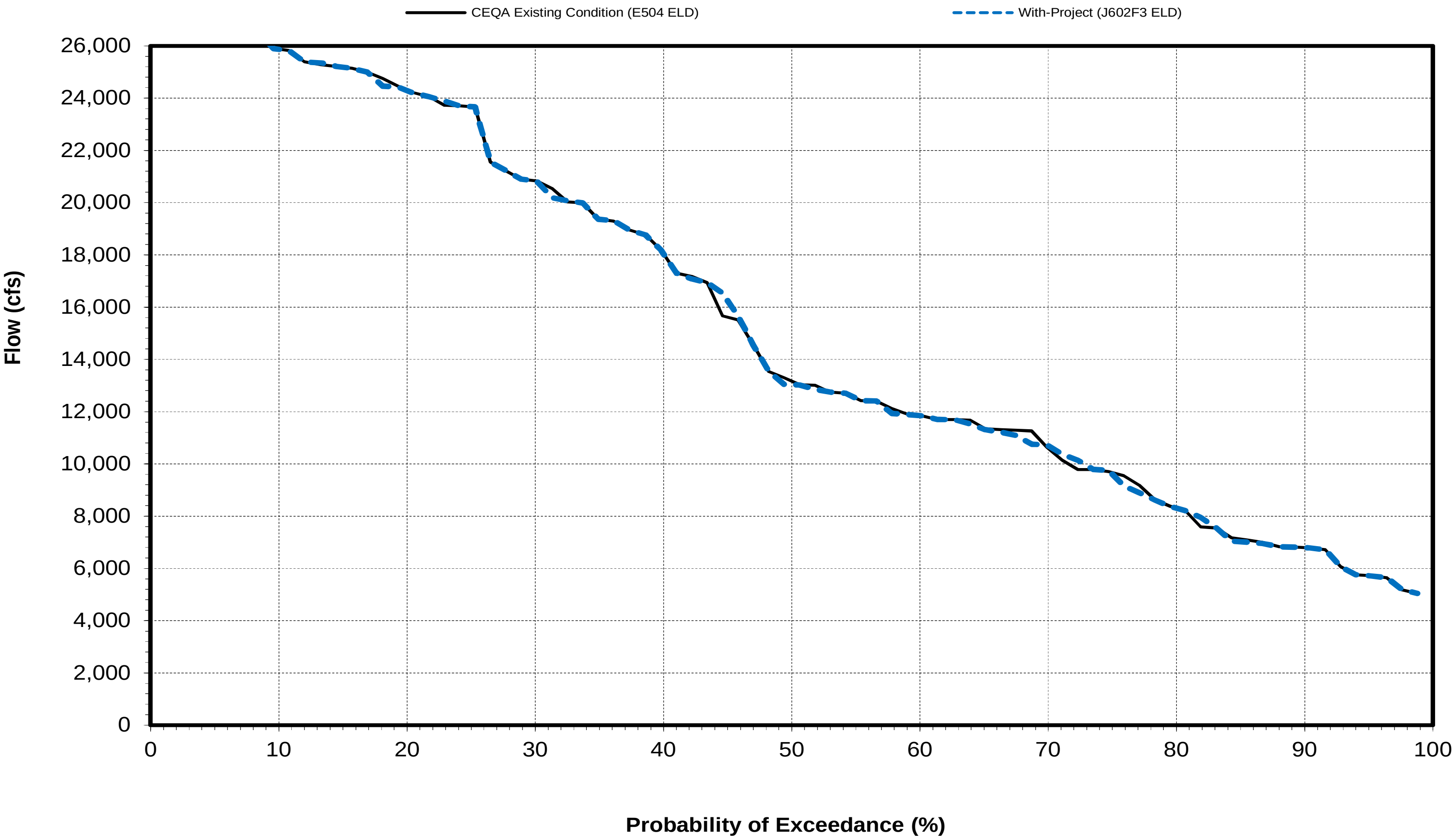


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow below Confluence with the Feather River

September



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Long-term and Water Year Type Average Sacramento River Flow at Freeport Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
					Long-term							
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	11,591	16,172	22,778	31,105	37,719	32,012	23,404	19,340	16,682	19,211	14,364	18,196
With-Project (J602F3 ELD)	11,588	16,096	22,721	31,040	37,345	32,280	23,674	19,468	16,672	19,204	14,376	18,220
Difference	-3	-76	-57	-65	-374	268	270	128	-10	-7	12	24
Percent Difference[3]	0.0	-0.5	-0.3	-0.2	-1.0	0.8	1.2	0.7	-0.1	0.0	0.1	0.1
					Water Year Types[1]							
Wet												
CEQA Existing Condition (E504 ELD)	13,587	21,301	36,258	49,927	57,081	49,003	38,000	32,073	24,305	20,099	16,263	28,516
With-Project (J602F3 ELD)	13,512	21,139	36,099	49,867	56,388	50,009	38,505	32,093	24,307	20,093	16,264	28,526
Difference	-75	-162	-159	-60	-693	1,006	505	20	2	-6	1	10
Percent Difference[3]	-0.6	-0.8	-0.4	-0.1	-1.2	2.1	1.3	0.1	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	10,868	16,979	22,430	38,056	45,470	42,230	26,074	21,104	16,746	22,312	16,575	22,002
With-Project (J602F3 ELD)	10,867	16,789	22,371	37,752	45,103	42,481	26,565	21,408	16,682	22,297	16,577	22,104
Difference	-1	-190	-59	-304	-367	251	491	304	-64	-15	2	102
Percent Difference[3]	0.0	-1.1	-0.3	-0.8	-0.8	0.6	1.9	1.4	-0.4	-0.1	0.0	0.5
Below Normal												
CEQA Existing Condition (E504 ELD)	11,665	14,453	17,005	22,451	31,961	22,834	17,916	14,312	14,041	21,422	16,211	14,150
With-Project (J602F3 ELD)	11,671	14,371	17,001	22,450	31,490	22,843	18,096	14,592	14,002	21,426	16,186	14,081
Difference	6	-82	-4	-1	-471	9	180	280	-39	4	-25	-69
Percent Difference[3]	0.1	-0.6	0.0	0.0	-1.5	0.0	1.0	2.0	-0.3	0.0	-0.2	-0.5
Dry												
CEQA Existing Condition (E504 ELD)	10,582	13,584	15,767	17,092	23,263	20,286	13,355	11,136	12,474	18,787	12,008	11,161
With-Project (J602F3 ELD)	10,648	13,641	15,768	17,084	23,158	19,889	13,386	11,268	12,495	18,805	12,104	11,240
Difference	66	57	1	-8	-105	-397	31	132	21	18	96	79
Percent Difference[3]	0.6	0.4	0.0	0.0	-0.5	-2.0	0.2	1.2	0.2	0.1	0.8	0.7
Critical												
CEQA Existing Condition (E504 ELD)	9,419	10,141	11,172	14,489	16,421	13,279	10,587	8,161	9,496	12,240	9,413	7,305
With-Project (J602F3 ELD)	9,453	10,174	11,188	14,489	16,437	13,265	10,587	8,166	9,503	12,187	9,382	7,305
Difference	34	33	16	0	16	-14	0	5	7	-53	-31	0
Percent Difference[3]	0.4	0.3	0.1	0.0	0.1	-0.1	0.0	0.1	0.1	-0.4	-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 82-year simulation period

3 Relative difference of the monthly average

Sacramento River Flow at Freeport - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	33878	32709	-1169	-3.5
2.4	19106	19155	49	0.3
3.6	18851	18900	49	0.3
4.8	16882	16882	0	0.0
6.0	16002	16051	49	0.3
7.2	15987	15988	1	0.0
8.4	15504	15504	0	0.0
9.6	15498	15498	0	0.0
10.8	14985	14986	1	0.0
12.0	14593	14591	-2	0.0
13.3	14480	14478	-2	0.0
14.5	14456	14456	0	0.0
15.7	14444	14444	0	0.0
16.9	14273	14272	-1	0.0
18.1	14129	14129	0	0.0
19.3	13825	13825	0	0.0
20.5	13611	13810	199	1.5
21.7	13584	13611	27	0.2
22.9	13498	13559	61	0.5
24.1	13481	13485	4	0.0
25.3	13470	13468	-2	0.0
26.5	13446	13465	19	0.1
27.7	13438	13447	9	0.1
28.9	13336	13321	-15	-0.1
30.1	13298	13298	0	0.0
31.3	13296	13296	0	0.0
32.5	13232	13192	-40	-0.3
33.7	13169	13169	0	0.0
34.9	13114	13154	40	0.3
36.1	13105	13111	6	0.0
37.3	13099	13037	-62	-0.5
38.6	13038	12935	-103	-0.8
39.8	12937	12919	-18	-0.1
41.0	12876	12913	37	0.3
42.2	12850	12876	26	0.2
43.4	12250	12850	600	4.9
44.6	12214	12250	36	0.3
45.8	12065	12221	156	1.3
47.0	12059	12186	127	1.1
48.2	12024	12059	35	0.3
49.4	11974	12024	50	0.4
50.6	11909	11915	6	0.1
51.8	11737	11737	0	0.0
53.0	11664	11662	-2	0.0
54.2	11474	11474	0	0.0
55.4	11225	11380	155	1.4
56.6	10864	11015	151	1.4
57.8	10844	10969	125	1.2
59.0	10793	10635	-158	-1.5
60.2	10635	10621	-14	-0.1
61.4	10622	10580	-42	-0.4
62.7	10344	10350	6	0.1
63.9	10062	10099	37	0.4
65.1	10045	9712	-333	-3.3
66.3	9784	9466	-318	-3.3
67.5	9472	9389	-83	-0.9
68.7	9209	9209	0	0.0
69.9	9163	9142	-21	-0.2
71.1	9142	9093	-49	-0.5
72.3	8683	8700	17	0.2
73.5	8581	8552	-29	-0.3
74.7	8353	8353	0	0.0
75.9	8137	8137	0	0.0
77.1	8037	8082	45	0.6
78.3	8025	8037	12	0.1
79.5	8023	8029	6	0.1
80.7	7981	7994	13	0.2
81.9	7973	7981	8	0.1
83.1	7966	7966	0	0.0
84.3	7947	7947	0	0.0
85.5	7942	7945	3	0.0
86.7	7163	7163	0	0.0
88.0	7105	7116	11	0.2
89.2	6869	6865	-4	-0.1
90.4	6571	6571	0	0.0
91.6	6527	6527	0	0.0
92.8	6511	6510	-1	0.0
94.0	6417	6416	-1	0.0
95.2	6410	6410	0	0.0
96.4	6390	6390	0	0.0
97.6	6291	6289	-2	0.0
98.8	6240	6240	0	0.0
Min	6240	6240	-1169	-3.5
Max	33878	32709	600	4.9
Mean	11591	11588	-4	0.0
Median	11942	11970	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	55257	52359	-2898	-5.2
2.4	48605	48517	-88	-0.2
3.6	46930	44012	-2918	-6.2
4.8	33872	33792	-80	-0.2
6.0	33365	32370	-995	-3.0
7.2	26405	26163	-242	-0.9
8.4	25389	25364	-25	-0.1
9.6	24407	24402	-5	0.0
10.8	22683	22713	30	0.1
12.0	22017	22017	0	0.0
13.3	21929	21799	-130	-0.6
14.5	20175	20175	0	0.0
15.7	20164	20164	0	0.0
16.9	20085	20085	0	0.0
18.1	20005	20002	-3	0.0
19.3	19797	19922	125	0.6
20.5	19542	19813	271	1.4
21.7	19518	19796	278	1.4
22.9	19396	19533	137	0.7
24.1	19360	19395	35	0.2
25.3	19318	19377	59	0.3
26.5	19293	19292	-1	0.0
27.7	19283	19283	0	0.0
28.9	19261	19218	-43	-0.2
30.1	19187	19181	-6	0.0
31.3	18489	18558	69	0.4
32.5	18331	18489	158	0.9
33.7	17941	17941	0	0.0
34.9	17599	17761	162	0.9
36.1	17573	17590	17	0.1
37.3	17551	17573	22	0.1
38.6	16860	16861	1	0.0
39.8	16802	16766	-36	-0.2
41.0	16584	16667	83	0.5
42.2	16349	16563	214	1.3
43.4	16225	16190	-35	-0.2
44.6	15899	16106	207	1.3
45.8	15758	15900	142	0.9
47.0	15674	15674	0	0.0
48.2	15571	15582	11	0.1
49.4	15567	15569	2	0.0
50.6	15566	15566	0	0.0
51.8	15534	15541	7	0.0
53.0	15030	15030	0	0.0
54.2	14860	14860	0	0.0
55.4	14736	14728	-8	-0.1
56.6	14488	14337	-151	-1.0
57.8	13714	13715	1	0.0
59.0	13115	13115	0	0.0
60.2	12893	12976	83	0.6
61.4	12730	12516	-214	-1.7
62.7	12202	12206	4	0.0
63.9	12185	12185	0	0.0
65.1	11549	11501	-48	-0.4
66.3	11517	11441	-76	-0.7
67.5	10927	10829	-98	-0.9
68.7	10790	10746	-44	-0.4
69.9	10730	10426	-304	-2.8
71.1	10479	10308	-171	-1.6
72.3	10298	10197	-101	-1.0
73.5	10181	10181	0	0.0
74.7	10180	10043	-137	-1.3
75.9	10053	10036	-17	-0.2
77.1	10035	10015	-20	-0.2
78.3	9637	9634	-3	0.0
79.5	9327	9327	0	0.0
80.7	9073	9013	-60	-0.7
81.9	8699	8872	173	2.0
83.1	8331	8325	-6	-0.1
84.3	8230	8248	18	0.2
85.5	8026	8230	204	2.5
86.7	7971	8019	48	0.6
88.0	7911	7971	60	0.8
89.2	7880	7914	34	0.4
90.4	7405	7405	0	0.0
91.6	6624	6699	75	1.1
92.8	6614	6624	10	0.2
94.0	6598	6601	3	0.0
95.2	6593	6597	4	0.1
96.4	6581	6581	0	0.0
97.6	6483	6483	0	0.0
98.8	6332	6332	0	0.0
Min	6332	6332	-2918	-6.2
Max	55257	52359	278	2.5
Mean	16172	16096	-76	-0.1
Median	15567	15568	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	82.9
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	76061	75103	-958	-1.3
2.4	71202	70085	-1117	-1.6
3.6	66377	64103	-2274	-3.4
4.8	58543	58686	143	0.2
6.0	57216	57244	28	0.0
7.2	56784	56875	91	0.2
8.4	50347	50350	3	0.0
9.6	50118	49319	-799	-1.6
10.8	49747	49136	-611	-1.2
12.0	47371	48184	813	1.7
13.3	44086	43315	-771	-1.7
14.5	38993	38993	0	0.0
15.7	37667	37668	1	0.0
16.9	36256	36531	275	0.8
18.1	35438	35751	313	0.9
19.3	33842	33724	-118	-0.3
20.5	33555	33579	24	0.1
21.7	33206	33200	-6	0.0
22.9	28828	28810	-18	-0.1
24.1	28073	28079	6	0.0
25.3	27360	27360	0	0.0
26.5	26180	26319	139	0.5
27.7	25855	25855	0	0.0
28.9	22444	22436	-8	0.0
30.1	22287	22299	12	0.1
31.3	22228	22228	0	0.0
32.5	21457	21458	1	0.0
33.7	19772	19772	0	0.0
34.9	19578	19572	-6	0.0
36.1	19468	19463	-5	0.0
37.3	19241	19462	221	1.1
38.6	18929	18672	-257	-1.4
39.8	18543	18543	0	0.0
41.0	18292	18285	-7	0.0
42.2	18062	18060	-2	0.0
43.4	17206	17206	0	0.0
44.6	17125	17130	5	0.0
45.8	16908	16920	12	0.1
47.0	16825	16815	-10	-0.1
48.2	16464	16542	78	0.5
49.4	15648	15644	-4	0.0
50.6	15585	15584	-1	0.0
51.8	15568	15568	0	0.0
53.0	15521	15521	0	0.0
54.2	15505	15508	3	0.0
55.4	15493	15505	12	0.1
56.6	15489	15493	4	0.0
57.8	15453	15490	37	0.2
59.0	15341	15341	0	0.0
60.2	15223	15223	0	0.0
61.4	15029	15032	3	0.0
62.7	15012	15012	0	0.0
63.9	14958	14958	0	0.0
65.1	14925	14925	0	0.0
66.3	14874	14874	0	0.0
67.5	14872	14871	-1	0.0
68.7	14709	14685	-24	-0.2
69.9	14670	14371	-299	-2.0
71.1	14048	14013	-35	-0.2
72.3	14012	14004	-8	-0.1
73.5	13739	13739	0	0.0
74.7	13502	13502	0	0.0
75.9	13358	13358	0	0.0
77.1	12758	12757	-1	0.0
78.3	12631	12625	-6	0.0
79.5	12546	12546	0	0.0
80.7	11717	11816	99	0.8
81.9	10714	10719	5	0.0
83.1	10538	10553	15	0.1
84.3	10175	10077	-98	-1.0
85.5	9855	9855	0	0.0
86.7	9754	9755	1	0.0
88.0	9706	9702	-4	0.0
89.2	9504	9502	-2	0.0
90.4	9444	9468	24	0.3
91.6	9418	9444	26	0.3
92.8	9303	9303	0	0.0
94.0	8729	8713	-16	-0.2
95.2	8214	8390	176	2.1
96.4	8110	8339	229	2.8
97.6	7361	7350	-11	-0.1
98.8	6856	6851	-5	-0.1
Min	6856	6851	-2274	-3.4
Max	76061	75103	813	2.8
Mean	22778	22721	-57	0.0
Median	15617	15614	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		9.8
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	78408	79296	888	1.1
2.4	76912	76701	-211	-0.3
3.6	73700	73392	-308	-0.4
4.8	72384	71297	-1087	-1.5
6.0	70464	70407	-57	-0.1
7.2	66424	64283	-2141	-3.2
8.4	63780	64007	227	0.4
9.6	63240	63097	-143	-0.2
10.8	63097	63063	-34	-0.1
12.0	62076	62076	0	0.0
13.3	59189	59574	385	0.7
14.5	58680	58682	2	0.0
15.7	57521	57522	1	0.0
16.9	57174	57173	-1	0.0
18.1	56687	56687	0	0.0
19.3	56424	56425	1	0.0
20.5	55363	55331	-32	-0.1
21.7	53940	54398	458	0.8
22.9	49698	48829	-869	-1.7
24.1	48995	48309	-686	-1.4
25.3	47257	47447	190	0.4
26.5	46350	46330	-20	0.0
27.7	45205	45205	0	0.0
28.9	43507	43291	-216	-0.5
30.1	40288	40289	1	0.0
31.3	38482	38335	-147	-0.4
32.5	38336	38190	-146	-0.4
33.7	37187	37187	0	0.0
34.9	36839	36666	-173	-0.5
36.1	31768	31549	-219	-0.7
37.3	29234	29234	0	0.0
38.6	27394	26984	-410	-1.5
39.8	27190	26964	-226	-0.8
41.0	26975	26741	-234	-0.9
42.2	25623	25623	0	0.0
43.4	25607	25600	-7	0.0
44.6	24838	24839	1	0.0
45.8	23988	23988	0	0.0
47.0	23031	23031	0	0.0
48.2	22702	22703	1	0.0
49.4	22648	22644	-4	0.0
50.6	22467	22399	-68	-0.3
51.8	21550	21550	0	0.0
53.0	21486	21484	-2	0.0
54.2	20937	20931	-6	0.0
55.4	20451	20448	-3	0.0
56.6	20208	20192	-16	-0.1
57.8	20195	20190	-5	0.0
59.0	20064	20072	8	0.0
60.2	18815	18806	-9	0.0
61.4	18640	18636	-4	0.0
62.7	18040	17886	-154	-0.9
63.9	17694	17694	0	0.0
65.1	16535	16535	0	0.0
66.3	16402	16262	-140	-0.9
67.5	16042	16018	-24	-0.1
68.7	14984	15027	43	0.3
69.9	14845	14851	6	0.0
71.1	14627	14627	0	0.0
72.3	14524	14525	1	0.0
73.5	14432	14443	11	0.1
74.7	13967	14087	120	0.9
75.9	13844	13844	0	0.0
77.1	13795	13811	16	0.1
78.3	13687	13687	0	0.0
79.5	13473	13475	2	0.0
80.7	13469	13470	1	0.0
81.9	13438	13439	1	0.0
83.1	13167	13158	-9	-0.1
84.3	13093	13142	49	0.4
85.5	13084	13091	7	0.1
86.7	12792	12787	-5	0.0
88.0	12676	12692	16	0.1
89.2	12423	12422	-1	0.0
90.4	11756	11756	0	0.0
91.6	11588	11587	-1	0.0
92.8	11434	11434	0	0.0
94.0	11239	11239	0	0.0
95.2	10782	10782	0	0.0
96.4	10611	10664	53	0.5
97.6	10606	10606	0	0.0
98.8	8126	8121	-5	-0.1
Min	8126	8121	-2141	-3.2
Max	78408	79296	888	1.1
Mean	31105	31040	-65	-0.1
Median	22558	22522	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	92.7
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	76705	76606	-99	-0.1
2.4	74433	74281	-152	-0.2
3.6	73599	73014	-585	-0.8
4.8	72587	70194	-2393	-3.3
6.0	69470	69178	-292	-0.4
7.2	68920	68947	27	0.0
8.4	68824	68691	-133	-0.2
9.6	68723	68557	-166	-0.2
10.8	67683	67660	-23	0.0
12.0	67603	66534	-1069	-1.6
13.3	66832	65917	-915	-1.4
14.5	65062	64694	-368	-0.6
15.7	63463	63066	-397	-0.6
16.9	62884	62345	-539	-0.9
18.1	62229	61400	-829	-1.3
19.3	61263	60830	-433	-0.7
20.5	60470	60211	-259	-0.4
21.7	60419	59968	-451	-0.7
22.9	59275	58603	-672	-1.1
24.1	58929	56957	-1972	-3.3
25.3	57803	56207	-1596	-2.8
26.5	54313	54458	145	0.3
27.7	53022	53002	-20	0.0
28.9	51004	49977	-1027	-2.0
30.1	49321	48558	-763	-1.5
31.3	47929	47255	-674	-1.4
32.5	47892	46874	-1018	-2.1
33.7	47205	46851	-354	-0.7
34.9	46844	46508	-336	-0.7
36.1	46290	45959	-331	-0.7
37.3	46174	45534	-640	-1.4
38.6	45958	44586	-1372	-3.0
39.8	45282	44319	-963	-2.1
41.0	44129	43276	-853	-1.9
42.2	41921	40780	-1141	-2.7
43.4	40077	40076	-1	0.0
44.6	39781	39781	0	0.0
45.8	36613	36231	-382	-1.0
47.0	36534	35729	-805	-2.2
48.2	35718	35313	-405	-1.1
49.4	35339	34925	-414	-1.2
50.6	34237	34813	576	1.7
51.8	31896	31032	-864	-2.7
53.0	31018	30592	-426	-1.4
54.2	30250	30253	3	0.0
55.4	29562	29562	0	0.0
56.6	27350	26936	-414	-1.5
57.8	26916	26769	-147	-0.5
59.0	26451	26454	3	0.0
60.2	26401	26401	0	0.0
61.4	25816	25351	-465	-1.8
62.7	25252	25252	0	0.0
63.9	24492	24382	-110	-0.4
65.1	24382	23688	-694	-2.8
66.3	23688	23589	-99	-0.4
67.5	21955	21962	7	0.0
68.7	20646	20647	1	0.0
69.9	18971	18972	1	0.0
71.1	18881	18934	53	0.3
72.3	18831	18660	-171	-0.9
73.5	18764	18402	-362	-1.9
74.7	18657	18156	-501	-2.7
75.9	18401	17930	-471	-2.6
77.1	17931	17533	-398	-2.2
78.3	17533	17497	-36	-0.2
79.5	17497	16441	-1056	-6.0
80.7	16368	16440	72	0.4
81.9	16332	16332	0	0.0
83.1	15965	15970	5	0.0
84.3	15394	15394	0	0.0
85.5	15203	15203	0	0.0
86.7	15067	14814	-253	-1.7
88.0	14814	14442	-372	-2.5
89.2	14211	14316	105	0.7
90.4	14196	14140	-56	-0.4
91.6	14117	14117	0	0.0
92.8	13608	13608	0	0.0
94.0	13204	13205	1	0.0
95.2	11387	11422	35	0.3
96.4	10051	10065	14	0.1
97.6	9591	9592	1	0.0
98.8	9159	9159	0	0.0
Min	9159	9159	-2393	-6.0
Max	76705	76606	576	1.7
Mean	37719	37345	-374	-0.9
Median	34788	34869	-276	-0.6

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	61.0
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		37.8
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	81057	81030	-27	0.0
2.4	77088	77048	-40	-0.1
3.6	72349	73376	1027	1.4
4.8	70174	72565	2391	3.4
6.0	68375	69431	1056	1.5
7.2	68360	69069	709	1.0
8.4	67106	67125	19	0.0
9.6	63764	64312	548	0.9
10.8	61087	61988	901	1.5
12.0	60942	61295	353	0.6
13.3	60738	61049	311	0.5
14.5	58679	59833	1154	2.0
15.7	57855	58570	715	1.2
16.9	57104	58119	1015	1.8
18.1	54547	54929	382	0.7
19.3	53775	54701	926	1.7
20.5	52865	53247	382	0.7
21.7	47857	47612	-245	-0.5
22.9	47111	47093	-18	0.0
24.1	45023	45203	180	0.4
25.3	44038	44813	775	1.8
26.5	43412	43264	-148	-0.3
27.7	43064	42382	-682	-1.6
28.9	40633	40255	-378	-0.9
30.1	39510	39087	-423	-1.1
31.3	38582	37925	-657	-1.7
32.5	36158	36750	592	1.6
33.7	35922	36403	481	1.3
34.9	35229	36233	1004	2.8
36.1	34111	35651	1540	4.5
37.3	33613	35300	1687	5.0
38.6	33587	35240	1653	4.9
39.8	33322	34943	1621	4.9
41.0	32729	31873	-856	-2.6
42.2	30390	30614	224	0.7
43.4	29943	29943	0	0.0
44.6	29324	29797	473	1.6
45.8	28042	29179	1137	4.1
47.0	27620	26760	-860	-3.1
48.2	26436	26452	16	0.1
49.4	25247	25861	614	2.4
50.6	24830	25107	277	1.1
51.8	24642	25039	397	1.6
53.0	23028	24106	1078	4.7
54.2	22374	23032	658	2.9
55.4	22303	22454	151	0.7
56.6	22249	22404	155	0.7
57.8	22176	22249	73	0.3
59.0	21681	22101	420	1.9
60.2	21252	21994	742	3.5
61.4	20923	21258	335	1.6
62.7	20192	20926	734	3.6
63.9	20166	20840	674	3.3
65.1	20106	20170	64	0.3
66.3	19901	19522	-379	-1.9
67.5	19761	19143	-618	-3.1
68.7	19527	19075	-452	-2.3
69.9	19199	18816	-383	-2.0
71.1	19142	17896	-1246	-6.5
72.3	18814	17819	-995	-5.3
73.5	17914	17794	-120	-0.7
74.7	17232	17671	439	2.5
75.9	16632	16839	207	1.2
77.1	16196	16196	0	0.0
78.3	15823	15823	0	0.0
79.5	15052	15053	1	0.0
80.7	14189	14189	0	0.0
81.9	13270	13270	0	0.0
83.1	12462	12838	376	3.0
84.3	12430	12462	32	0.3
85.5	12153	12155	2	0.0
86.7	12121	12123	2	0.0
88.0	11754	11754	0	0.0
89.2	11723	11561	-162	-1.4
90.4	11268	11268	0	0.0
91.6	11114	11114	0	0.0
92.8	11005	10998	-7	-0.1
94.0	10355	10356	1	0.0
95.2	8946	8946	0	0.0
96.4	8648	8636	-12	-0.1
97.6	8160	8160	0	0.0
98.8	7516	7513	-3	0.0
Min	7516	7513	-1246	-6.5
Max	81057	81030	2391	5.0
Mean	32012	32280	268	0.6
Median	25039	25484	112	0.4

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	47.6
1.1<=X<10.0		37.8
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		14.6
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	71984	72789	805	1.1
2.4	67751	67125	-626	-0.9
3.6	64274	65369	1095	1.7
4.8	56997	57036	39	0.1
6.0	56009	56989	980	1.7
7.2	55111	55135	24	0.0
8.4	54984	54591	-393	-0.7
9.6	54248	54408	160	0.3
10.8	50098	50465	367	0.7
12.0	49803	50371	568	1.1
13.3	45862	45254	-608	-1.3
14.5	43298	44260	962	2.2
15.7	43061	43502	441	1.0
16.9	42190	42667	477	1.1
18.1	40180	42616	2436	6.1
19.3	39993	40560	567	1.4
20.5	38309	38092	-217	-0.6
21.7	37123	37476	353	1.0
22.9	35002	34848	-154	-0.4
24.1	33863	34373	510	1.5
25.3	33381	34368	987	3.0
26.5	25425	25705	280	1.1
27.7	24900	25349	449	1.8
28.9	24568	24745	177	0.7
30.1	23808	24340	532	2.2
31.3	23751	23719	-32	-0.1
32.5	23210	23376	166	0.7
33.7	22511	22859	348	1.5
34.9	21694	21800	106	0.5
36.1	21417	21627	210	1.0
37.3	21364	21367	3	0.0
38.6	20990	21101	111	0.5
39.8	20736	20421	-315	-1.5
41.0	20062	19825	-237	-1.2
42.2	20022	19614	-408	-2.0
43.4	18876	19553	677	3.6
44.6	18342	18985	643	3.5
45.8	17944	18965	1021	5.7
47.0	17820	18899	1079	6.1
48.2	16824	17857	1033	6.1
49.4	16561	17616	1055	6.4
50.6	16493	17206	713	4.3
51.8	16219	16249	30	0.2
53.0	15805	16198	393	2.5
54.2	14969	15904	935	6.2
55.4	14195	15382	1187	8.4
56.6	14121	14892	771	5.5
57.8	13964	14031	67	0.5
59.0	13673	13758	85	0.6
60.2	13113	13328	215	1.6
61.4	13047	13238	191	1.5
62.7	12882	13075	193	1.5
63.9	12740	12740	0	0.0
65.1	12670	12679	9	0.1
66.3	12570	12630	60	0.5
67.5	12455	12545	90	0.7
68.7	12422	12491	69	0.6
69.9	12330	12468	138	1.1
71.1	12107	12454	347	2.9
72.3	12051	12122	71	0.6
73.5	11802	11803	1	0.0
74.7	11526	11627	101	0.9
75.9	11427	11526	99	0.9
77.1	11401	11427	26	0.2
78.3	11374	11404	30	0.3
79.5	11210	11374	164	1.5
80.7	11127	11210	83	0.7
81.9	10848	10830	-18	-0.2
83.1	10748	10756	8	0.1
84.3	10412	10412	0	0.0
85.5	10335	10335	0	0.0
86.7	10262	10262	0	0.0
88.0	10189	10213	24	0.2
89.2	9836	10189	353	3.6
90.4	9789	9789	0	0.0
91.6	9759	9764	5	0.1
92.8	9722	9722	0	0.0
94.0	9345	9345	0	0.0
95.2	9204	9204	0	0.0
96.4	9115	9116	1	0.0
97.6	9050	9050	0	0.0
98.8	8482	8483	1	0.0
Min	8482	8483	-626	-2.0
Max	71984	72789	2436	8.4
Mean	23404	23674	270	1.3
Median	16527	17411	104	0.7

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	56.1
1.1<=X<10.0		39.0
X>=5.0		9.8
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	58897	58941	44	0.1
2.4	58573	58613	40	0.1
3.6	54471	54520	49	0.1
4.8	52923	52978	55	0.1
6.0	49366	49411	45	0.1
7.2	45220	44550	-670	-1.5
8.4	43196	43249	53	0.1
9.6	43034	43085	51	0.1
10.8	42110	42165	55	0.1
12.0	41069	41106	37	0.1
13.3	39249	39281	32	0.1
14.5	38685	38731	46	0.1
15.7	36940	36986	46	0.1
16.9	31996	32041	45	0.1
18.1	31570	31610	40	0.1
19.3	28824	28579	-245	-0.8
20.5	28288	28344	56	0.2
21.7	27714	28187	473	1.7
22.9	27327	27379	52	0.2
24.1	26409	26448	39	0.1
25.3	24284	24332	48	0.2
26.5	23429	23475	46	0.2
27.7	20621	20661	40	0.2
28.9	18818	18984	166	0.9
30.1	18811	18851	40	0.2
31.3	18410	18457	47	0.3
32.5	18060	18104	44	0.2
33.7	17976	18001	25	0.1
34.9	17110	17155	45	0.3
36.1	16566	16599	33	0.2
37.3	15989	16032	43	0.3
38.6	15641	15666	25	0.2
39.8	15370	15419	49	0.3
41.0	15184	15231	47	0.3
42.2	14651	14699	48	0.3
43.4	14610	14679	69	0.5
44.6	14383	14658	275	1.9
45.8	14138	14420	282	2.0
47.0	14022	14186	164	1.2
48.2	13819	13922	103	0.7
49.4	13773	13863	90	0.7
50.6	12684	13816	1132	8.9
51.8	12667	13260	593	4.7
53.0	12665	13165	500	3.9
54.2	12650	12754	104	0.8
55.4	12450	12736	286	2.3
56.6	12442	12721	279	2.2
57.8	12429	12695	266	2.1
59.0	12218	12666	448	3.7
60.2	12199	12616	417	3.4
61.4	12022	12495	473	3.9
62.7	11560	12417	857	7.4
63.9	11438	12266	828	7.2
65.1	11438	11937	499	4.4
66.3	11427	11559	132	1.2
67.5	11392	11496	104	0.9
68.7	11263	11445	182	1.6
69.9	11257	11438	181	1.6
71.1	11015	11422	407	3.7
72.3	10897	11260	363	3.3
73.5	10760	11252	492	4.6
74.7	10674	11019	345	3.2
75.9	10546	10546	0	0.0
77.1	10536	10536	0	0.0
78.3	10289	10278	-11	-0.1
79.5	10207	10207	0	0.0
80.7	10125	10125	0	0.0
81.9	9718	9596	-122	-1.3
83.1	9581	9397	-184	-1.9
84.3	9397	9218	-179	-1.9
85.5	9144	9207	63	0.7
86.7	9125	9125	0	0.0
88.0	8961	8961	0	0.0
89.2	8664	8664	0	0.0
90.4	8617	8617	0	0.0
91.6	8531	8531	0	0.0
92.8	8390	8390	0	0.0
94.0	7923	7923	0	0.0
95.2	7564	7563	-1	0.0
96.4	6913	6913	0	0.0
97.6	6532	6532	0	0.0
98.8	6044	6044	0	0.0
Min	6044	6044	-670	-1.9
Max	58897	58941	1132	8.9
Mean	19340	19468	128	1.0
Median	13229	13840	47	0.2

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	67.1
1.1<=X<10.0		28.0
X>=5.0		3.7
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	61417	61417	0	0.0
2.4	51762	51762	0	0.0
3.6	38099	38099	0	0.0
4.8	37892	37892	0	0.0
6.0	36121	36120	-1	0.0
7.2	35663	35663	0	0.0
8.4	35032	35032	0	0.0
9.6	29811	29811	0	0.0
10.8	25873	25827	-46	-0.2
12.0	25179	25178	-1	0.0
13.3	24845	24845	0	0.0
14.5	24537	24539	2	0.0
15.7	22417	22416	-1	0.0
16.9	21675	21675	0	0.0
18.1	21107	21107	0	0.0
19.3	21053	21052	-1	0.0
20.5	20923	20924	1	0.0
21.7	19494	19494	0	0.0
22.9	18819	18819	0	0.0
24.1	16896	16896	0	0.0
25.3	16265	16358	93	0.6
26.5	16246	16246	0	0.0
27.7	16064	16064	0	0.0
28.9	15803	15802	-1	0.0
30.1	15707	15675	-32	-0.2
31.3	15675	15496	-179	-1.1
32.5	15423	15423	0	0.0
33.7	15343	15343	0	0.0
34.9	15241	15240	-1	0.0
36.1	14524	15092	568	3.9
37.3	14418	14523	105	0.7
38.6	14408	14417	9	0.1
39.8	14352	14406	54	0.4
41.0	13962	14191	229	1.6
42.2	13909	13962	53	0.4
43.4	13869	13861	-8	-0.1
44.6	13862	13704	-158	-1.1
45.8	13860	13672	-188	-1.4
47.0	13672	13642	-30	-0.2
48.2	13642	13560	-82	-0.6
49.4	13466	13527	61	0.5
50.6	13460	13466	6	0.0
51.8	13444	13460	16	0.1
53.0	13439	13290	-149	-1.1
54.2	13276	13275	-1	0.0
55.4	13274	13205	-69	-0.5
56.6	13196	13196	0	0.0
57.8	12961	12961	0	0.0
59.0	12892	12912	20	0.2
60.2	12866	12883	17	0.1
61.4	12816	12815	-1	0.0
62.7	12785	12785	0	0.0
63.9	12664	12664	0	0.0
65.1	12649	12649	0	0.0
66.3	12648	12648	0	0.0
67.5	12625	12646	21	0.2
68.7	12598	12625	27	0.2
69.9	12586	12586	0	0.0
71.1	12584	12453	-131	-1.0
72.3	12285	12285	0	0.0
73.5	12182	12093	-89	-0.7
74.7	12054	12052	-2	0.0
75.9	12049	11972	-77	-0.6
77.1	11972	11642	-330	-2.8
78.3	11562	11559	-3	0.0
79.5	11406	11449	43	0.4
80.7	11252	11250	-2	0.0
81.9	11076	11077	1	0.0
83.1	10843	10843	0	0.0
84.3	10818	10805	-13	-0.1
85.5	10806	10669	-137	-1.3
86.7	10669	10483	-186	-1.7
88.0	10307	10307	0	0.0
89.2	10068	9838	-230	-2.3
90.4	9737	9737	0	0.0
91.6	9634	9634	0	0.0
92.8	8368	8368	0	0.0
94.0	8290	8291	1	0.0
95.2	8105	8111	6	0.1
96.4	7921	7921	0	0.0
97.6	7736	7735	-1	0.0
98.8	7719	7719	0	0.0
Min	7719	7719	-330	-2.8
Max	61417	61417	568	3.9
Mean	16682	16672	-10	-0.1
Median	13463	13497	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		9.8
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	24942	24896	-46	-0.2
2.4	24750	24739	-11	0.0
3.6	24746	24699	-47	-0.2
4.8	24534	24534	0	0.0
6.0	24531	24531	0	0.0
7.2	24526	24526	0	0.0
8.4	24377	24367	-10	0.0
9.6	24225	24152	-73	-0.3
10.8	24069	24142	73	0.3
12.0	24040	24058	18	0.1
13.3	23955	23948	-7	0.0
14.5	23948	23931	-17	-0.1
15.7	23931	23848	-83	-0.3
16.9	23898	23612	-286	-1.2
18.1	23527	23528	1	0.0
19.3	23153	23167	14	0.1
20.5	23080	23080	0	0.0
21.7	23060	23060	0	0.0
22.9	22846	22847	1	0.0
24.1	22625	22625	0	0.0
25.3	22452	22452	0	0.0
26.5	22450	22450	0	0.0
27.7	22240	22241	1	0.0
28.9	21882	21877	-5	0.0
30.1	21658	21658	0	0.0
31.3	21467	21467	0	0.0
32.5	21139	21139	0	0.0
33.7	20934	20976	42	0.2
34.9	20885	20933	48	0.2
36.1	20851	20933	82	0.4
37.3	20848	20832	-16	-0.1
38.6	20826	20819	-7	0.0
39.8	20644	20800	156	0.8
41.0	20644	20657	13	0.1
42.2	20382	20490	108	0.5
43.4	20300	20300	0	0.0
44.6	20197	20198	1	0.0
45.8	20138	20139	1	0.0
47.0	20135	20135	0	0.0
48.2	20053	20055	2	0.0
49.4	19977	20051	74	0.4
50.6	19936	19960	24	0.1
51.8	19926	19936	10	0.1
53.0	19869	19928	59	0.3
54.2	19778	19869	91	0.5
55.4	19751	19747	-4	0.0
56.6	19670	19721	51	0.3
57.8	19601	19698	97	0.5
59.0	19542	19542	0	0.0
60.2	19442	19442	0	0.0
61.4	19334	19334	0	0.0
62.7	18967	18986	19	0.1
63.9	18629	18810	181	1.0
65.1	18308	18629	321	1.8
66.3	18287	18602	315	1.7
67.5	18285	18234	-51	-0.3
68.7	18236	18226	-10	-0.1
69.9	17921	17921	0	0.0
71.1	17569	17570	1	0.0
72.3	17479	17479	0	0.0
73.5	17395	17395	0	0.0
74.7	17268	17268	0	0.0
75.9	16726	16726	0	0.0
77.1	16128	16644	516	3.2
78.3	16051	16047	-4	0.0
79.5	15232	15194	-38	-0.2
80.7	15194	14910	-284	-1.9
81.9	14961	14853	-108	-0.7
83.1	14910	14691	-219	-1.5
84.3	14691	14569	-122	-0.8
85.5	14568	14235	-333	-2.3
86.7	14363	14148	-215	-1.5
88.0	14148	13777	-371	-2.6
89.2	13726	13770	44	0.3
90.4	12751	12911	160	1.3
91.6	12741	12744	3	0.0
92.8	9996	9406	-590	-5.9
94.0	9421	9283	-138	-1.5
95.2	9235	9234	-1	0.0
96.4	8911	8911	0	0.0
97.6	8734	8738	4	0.0
98.8	8721	8721	0	0.0
Min	8721	8721	-590	-5.9
Max	24942	24896	516	3.2
Mean	19211	19204	-7	-0.1
Median	19957	20006	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		9.8
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		35.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	20390	20390	0	0.0
2.4	20056	20056	0	0.0
3.6	17801	17802	1	0.0
4.8	17797	17797	0	0.0
6.0	17606	17604	-2	0.0
7.2	17538	17538	0	0.0
8.4	17515	17510	-5	0.0
9.6	17341	17341	0	0.0
10.8	17318	17318	0	0.0
12.0	17291	17312	21	0.1
13.3	17264	17264	0	0.0
14.5	17237	17237	0	0.0
15.7	17202	17202	0	0.0
16.9	17049	17049	0	0.0
18.1	17048	17048	0	0.0
19.3	17033	17033	0	0.0
20.5	17004	17004	0	0.0
21.7	16925	16926	1	0.0
22.9	16905	16905	0	0.0
24.1	16763	16763	0	0.0
25.3	16751	16761	10	0.1
26.5	16654	16653	-1	0.0
27.7	16603	16603	0	0.0
28.9	16592	16591	-1	0.0
30.1	16552	16553	1	0.0
31.3	16453	16453	0	0.0
32.5	16358	16355	-3	0.0
33.7	16278	16278	0	0.0
34.9	16240	16237	-3	0.0
36.1	16157	16157	0	0.0
37.3	16097	16097	0	0.0
38.6	16020	16016	-4	0.0
39.8	16007	16007	0	0.0
41.0	15998	15996	-2	0.0
42.2	15954	15953	-1	0.0
43.4	15847	15847	0	0.0
44.6	15771	15771	0	0.0
45.8	15572	15572	0	0.0
47.0	15564	15564	0	0.0
48.2	15551	15551	0	0.0
49.4	15511	15511	0	0.0
50.6	15431	15431	0	0.0
51.8	15364	15364	0	0.0
53.0	15328	15326	-2	0.0
54.2	15273	15273	0	0.0
55.4	15239	15240	1	0.0
56.6	15206	15206	0	0.0
57.8	15068	15073	5	0.0
59.0	14933	14936	3	0.0
60.2	14493	14493	0	0.0
61.4	14407	14408	1	0.0
62.7	14358	14386	28	0.2
63.9	13588	13600	12	0.1
65.1	13190	13397	207	1.6
66.3	12910	13223	313	2.4
67.5	12859	13189	330	2.6
68.7	12824	12907	83	0.6
69.9	12681	12812	131	1.0
71.1	12463	12384	-79	-0.6
72.3	12463	12324	-139	-1.1
73.5	12342	12300	-42	-0.3
74.7	11996	12003	7	0.1
75.9	11804	11824	20	0.2
77.1	11262	11777	515	4.6
78.3	11018	11025	7	0.1
79.5	11007	11007	0	0.0
80.7	10933	10926	-7	-0.1
81.9	10785	10733	-52	-0.5
83.1	10733	10701	-32	-0.3
84.3	10647	10639	-8	-0.1
85.5	10414	10412	-2	0.0
86.7	10071	10066	-5	0.0
88.0	10067	9815	-252	-2.5
89.2	9665	9685	20	0.2
90.4	9493	9663	170	1.8
91.6	9256	9493	237	2.6
92.8	8610	8560	-50	-0.6
94.0	8572	8270	-302	-3.5
95.2	8270	8190	-80	-1.0
96.4	8044	8008	-36	-0.4
97.6	7636	7635	-1	0.0
98.8	7499	7498	-1	0.0
Min	7499	7498	-302	-3.5
Max	20390	20390	515	4.6
Mean	14364	14376	12	0.1
Median	15471	15471	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	31453	31453	0	0.0
2.4	30544	30544	0	0.0
3.6	30383	30383	0	0.0
4.8	30334	30334	0	0.0
6.0	30109	30226	117	0.4
7.2	30087	30088	1	0.0
8.4	29900	29809	-91	-0.3
9.6	29804	29751	-53	-0.2
10.8	29638	29637	-1	0.0
12.0	29588	29597	9	0.0
13.3	29587	29588	1	0.0
14.5	29567	29563	-4	0.0
15.7	29537	29562	25	0.1
16.9	29527	29560	33	0.1
18.1	29449	29527	78	0.3
19.3	29305	29305	0	0.0
20.5	28982	28982	0	0.0
21.7	28814	28971	157	0.5
22.9	28611	28611	0	0.0
24.1	28410	28413	3	0.0
25.3	28000	28000	0	0.0
26.5	24560	24561	1	0.0
27.7	24024	24024	0	0.0
28.9	23971	23971	0	0.0
30.1	23829	23829	0	0.0
31.3	23819	23819	0	0.0
32.5	23602	23602	0	0.0
33.7	23101	23101	0	0.0
34.9	22925	22925	0	0.0
36.1	22611	22838	227	1.0
37.3	22226	22226	0	0.0
38.6	22224	22224	0	0.0
39.8	21976	21944	-32	-0.1
41.0	21913	21913	0	0.0
42.2	21581	21581	0	0.0
43.4	20661	21430	769	3.7
44.6	20408	20661	253	1.2
45.8	20370	20374	4	0.0
47.0	15447	15447	0	0.0
48.2	15425	15427	2	0.0
49.4	15093	15103	10	0.1
50.6	14921	14921	0	0.0
51.8	14767	14772	5	0.0
53.0	14707	14710	3	0.0
54.2	14598	14609	11	0.1
55.4	14459	14403	-56	-0.4
56.6	14446	14314	-132	-0.9
57.8	14403	14303	-100	-0.7
59.0	14303	14289	-14	-0.1
60.2	14289	14181	-108	-0.8
61.4	14181	13793	-388	-2.7
62.7	13793	13710	-83	-0.6
63.9	13698	13590	-108	-0.8
65.1	13115	13194	79	0.6
66.3	12801	12917	116	0.9
67.5	12588	12804	216	1.7
68.7	12242	12242	0	0.0
69.9	11653	12146	493	4.2
71.1	11238	11774	536	4.8
72.3	11234	11238	4	0.0
73.5	11212	11220	8	0.1
74.7	10730	10637	-93	-0.9
75.9	10672	10485	-187	-1.8
77.1	10329	10199	-130	-1.3
78.3	9753	10118	365	3.7
79.5	9435	9433	-2	0.0
80.7	9316	9336	20	0.2
81.9	9181	9175	-6	-0.1
83.1	8794	8784	-10	-0.1
84.3	8786	8776	-10	-0.1
85.5	8633	8633	0	0.0
86.7	8414	8417	3	0.0
88.0	7436	7441	5	0.1
89.2	7431	7431	0	0.0
90.4	6929	6929	0	0.0
91.6	6912	6910	-2	0.0
92.8	6760	6760	0	0.0
94.0	6659	6659	0	0.0
95.2	6588	6581	-7	-0.1
96.4	6561	6561	0	0.0
97.6	6516	6516	0	0.0
98.8	6221	6221	0	0.0
Min	6221	6221	-388	-2.7
Max	31453	31453	769	4.8
Mean	18196	18220	24	0.1
Median	15007	15012	0	0.0

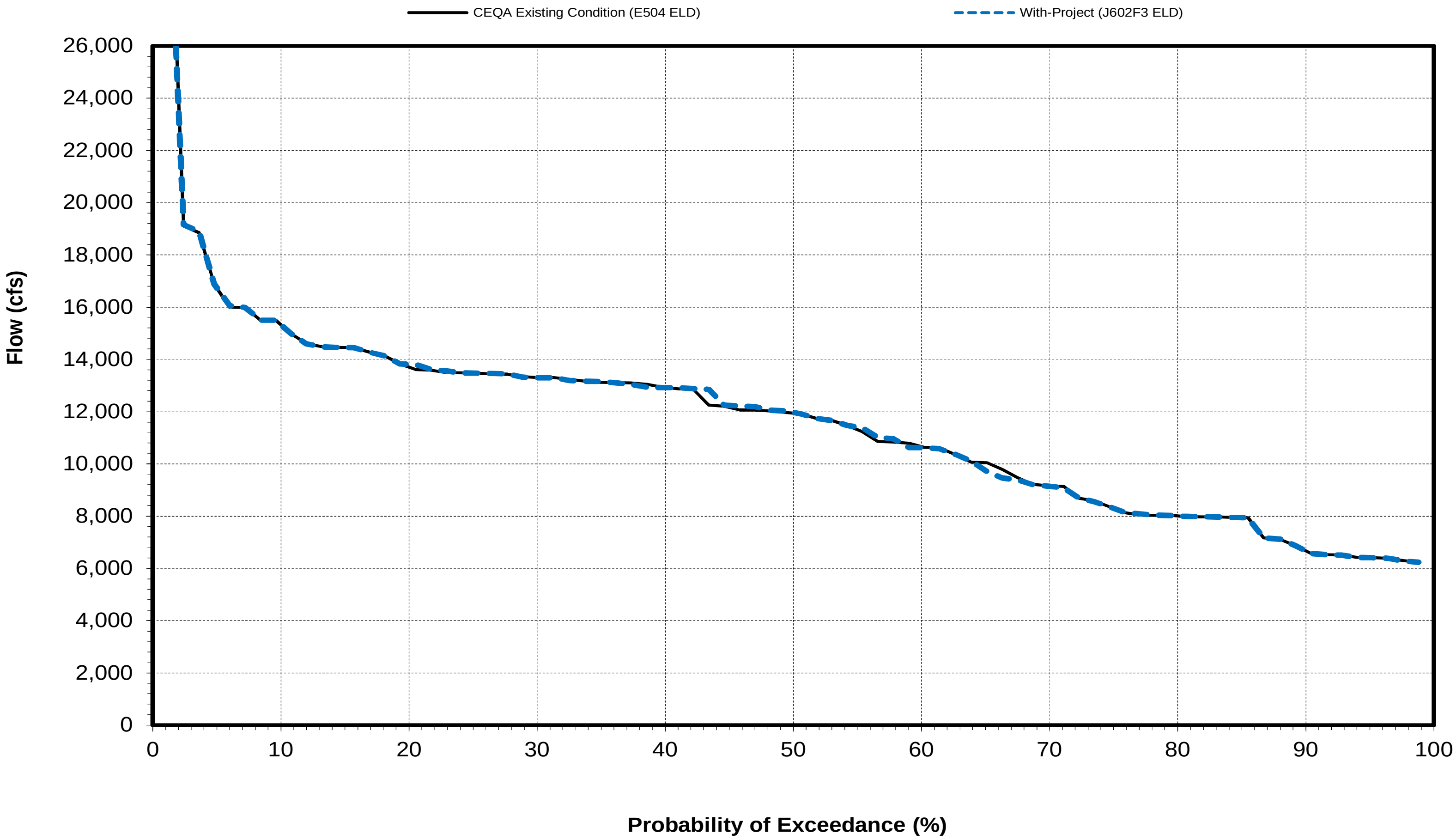
Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

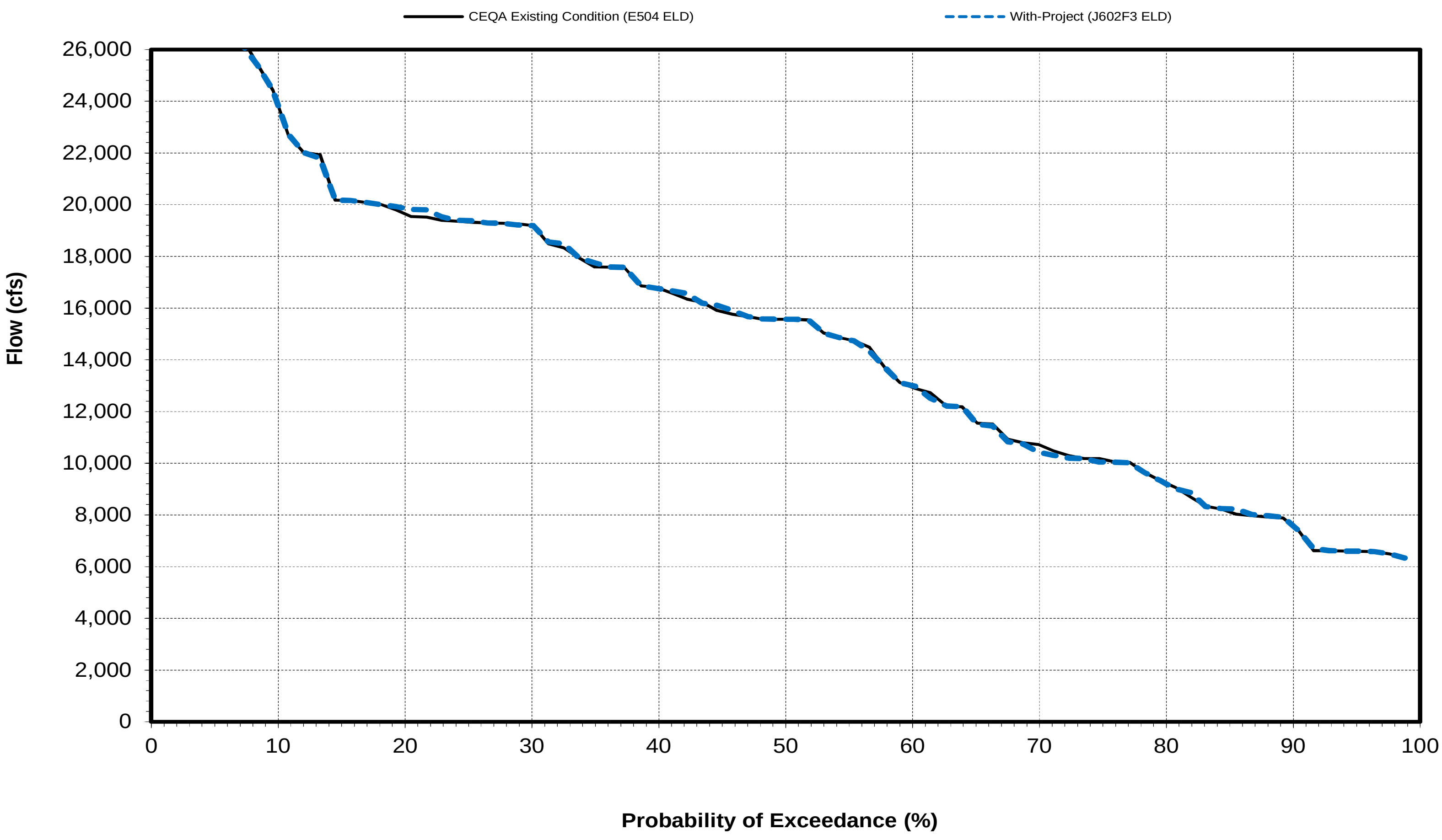
(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Freeport **October**



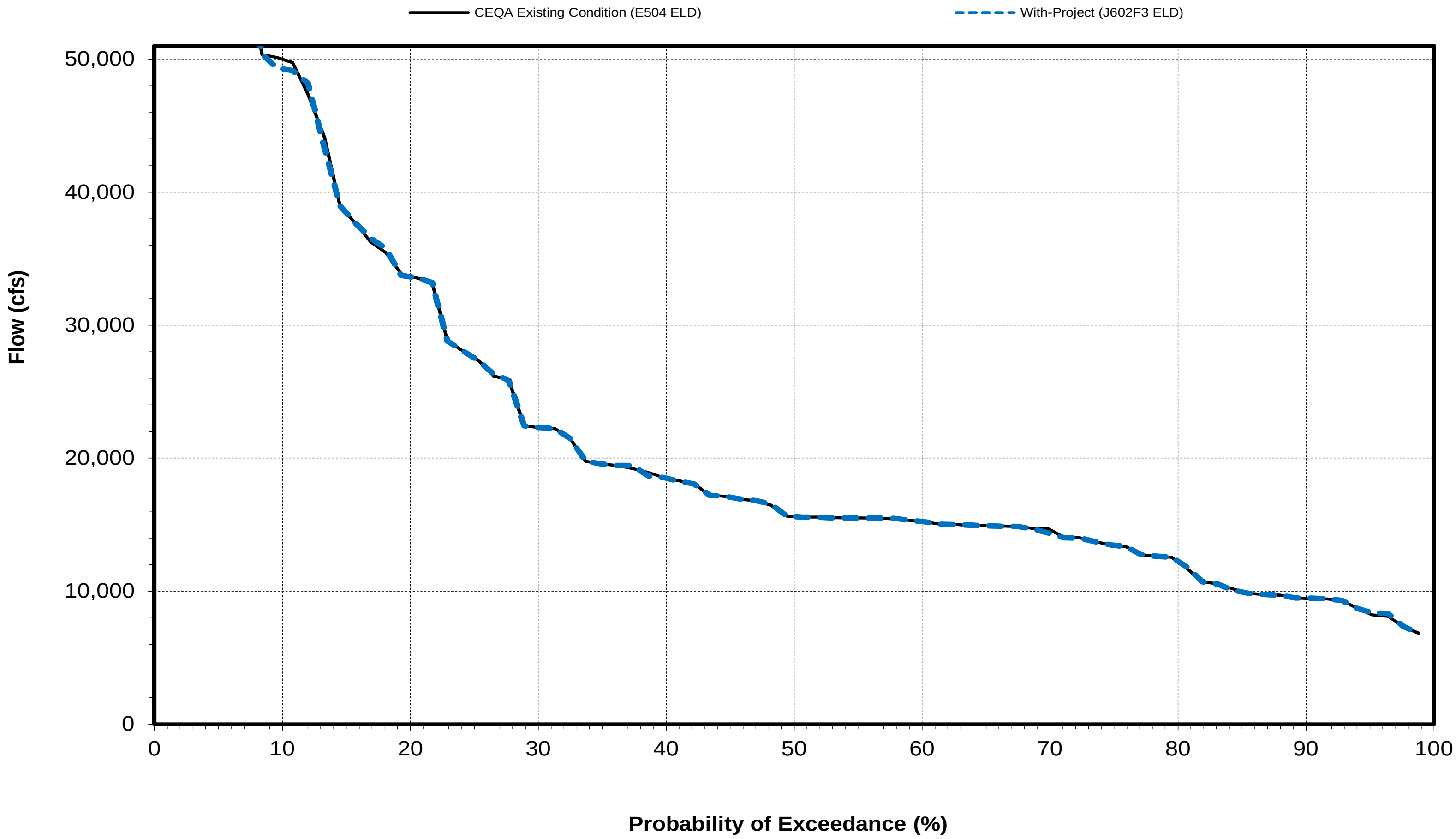
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Freeport **November**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

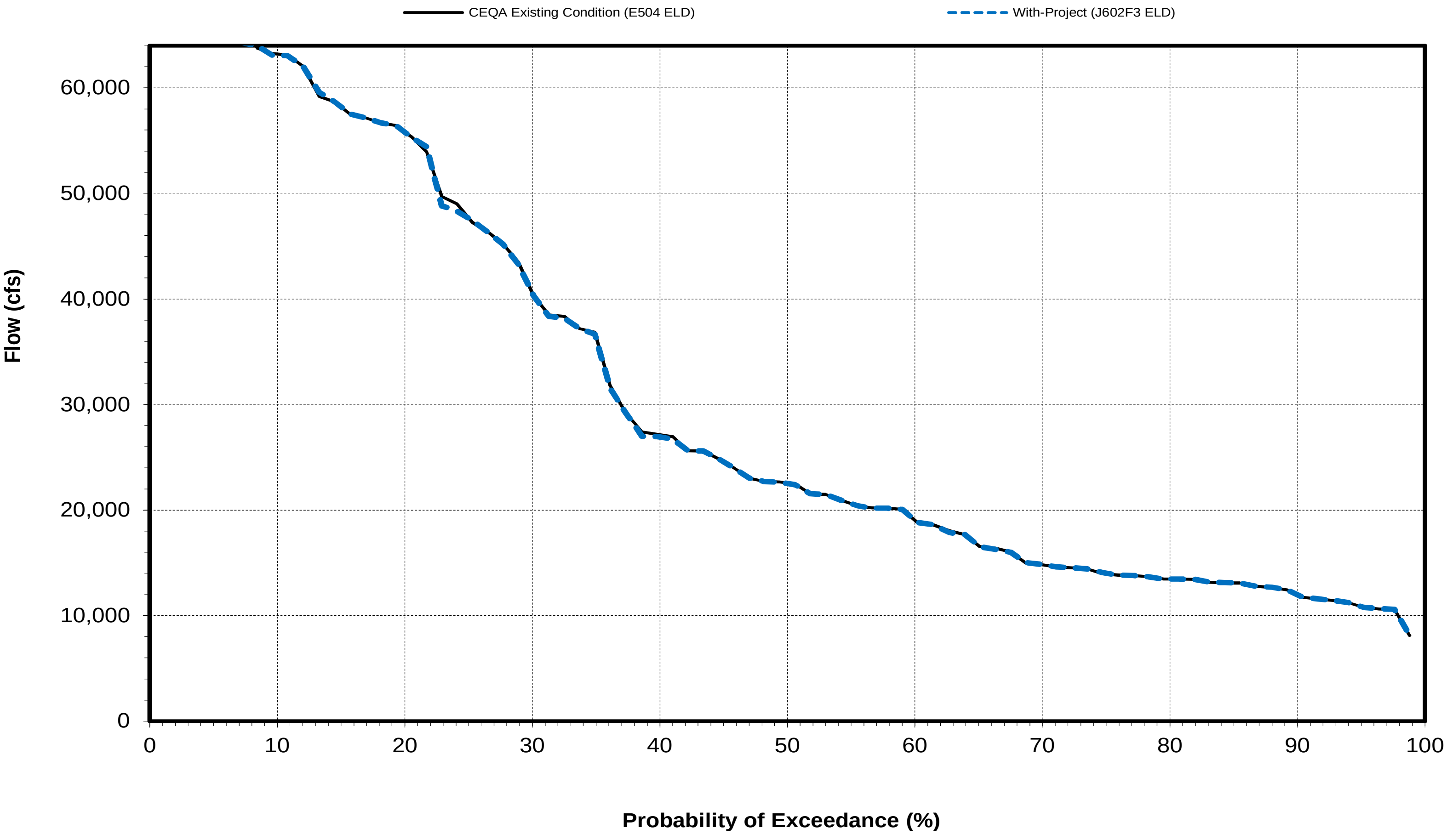
Sacramento River Flow at Freeport **December**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Freeport

January

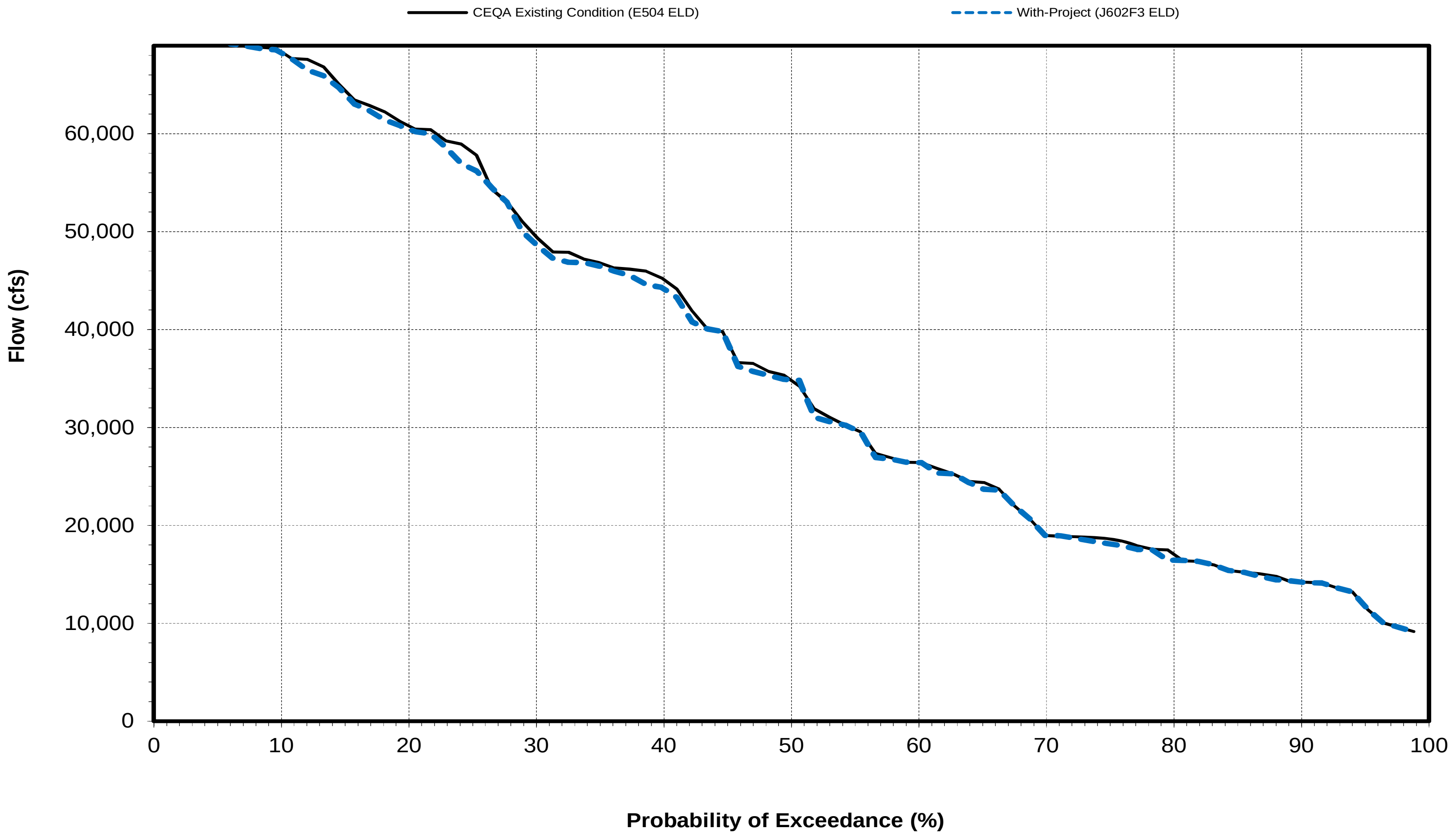


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Freeport

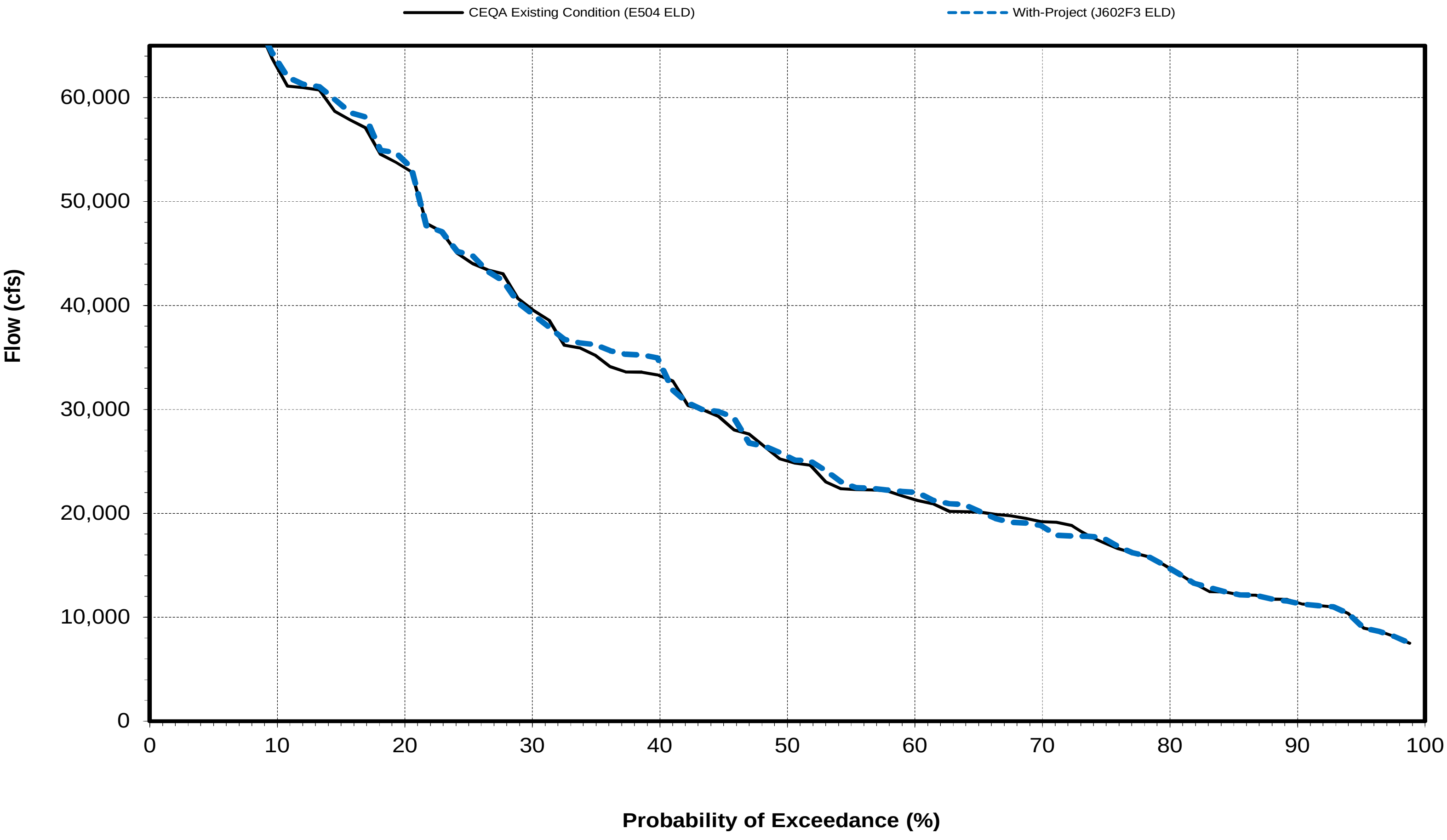
February



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

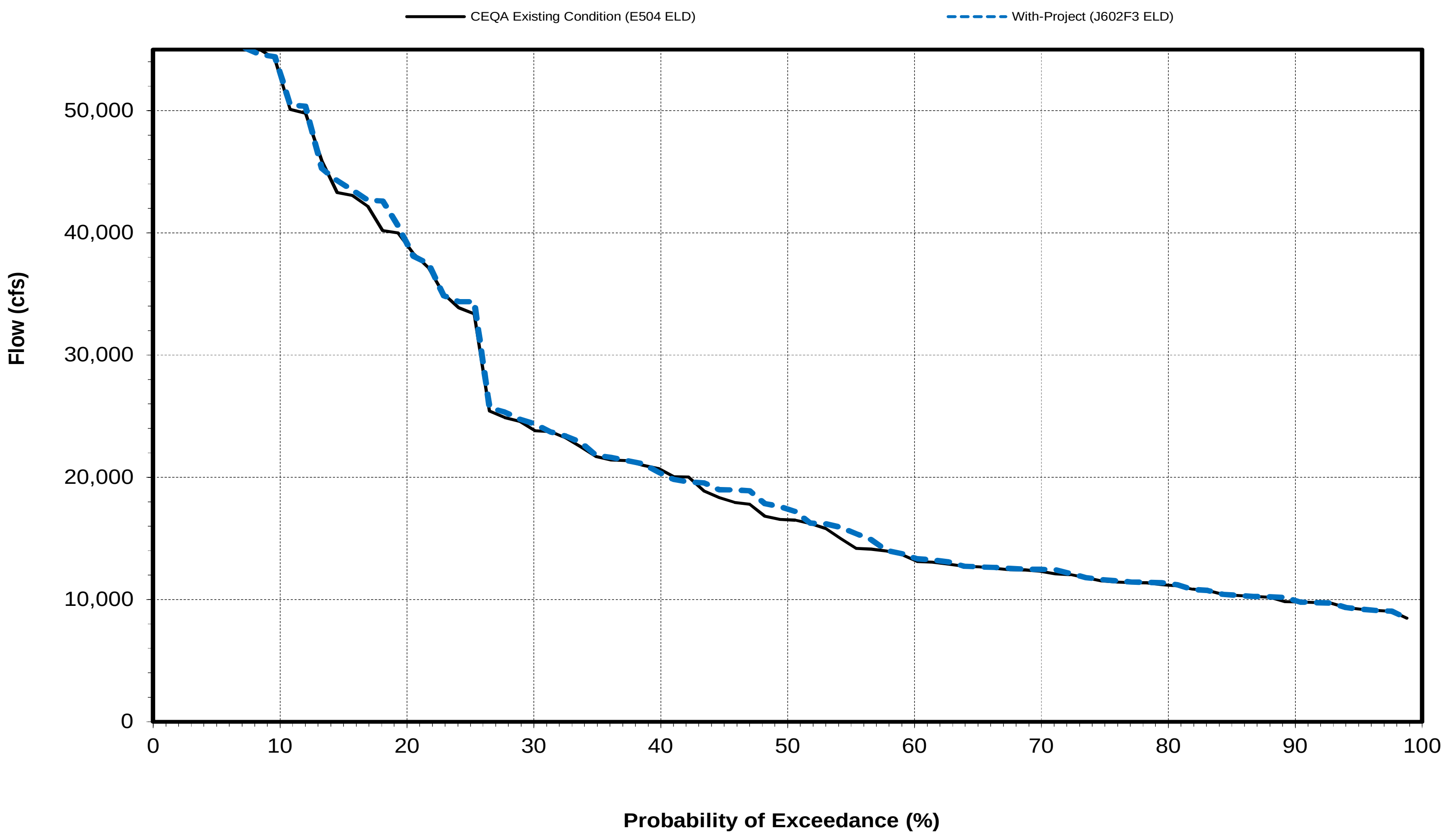
Sacramento River Flow at Freeport **March**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

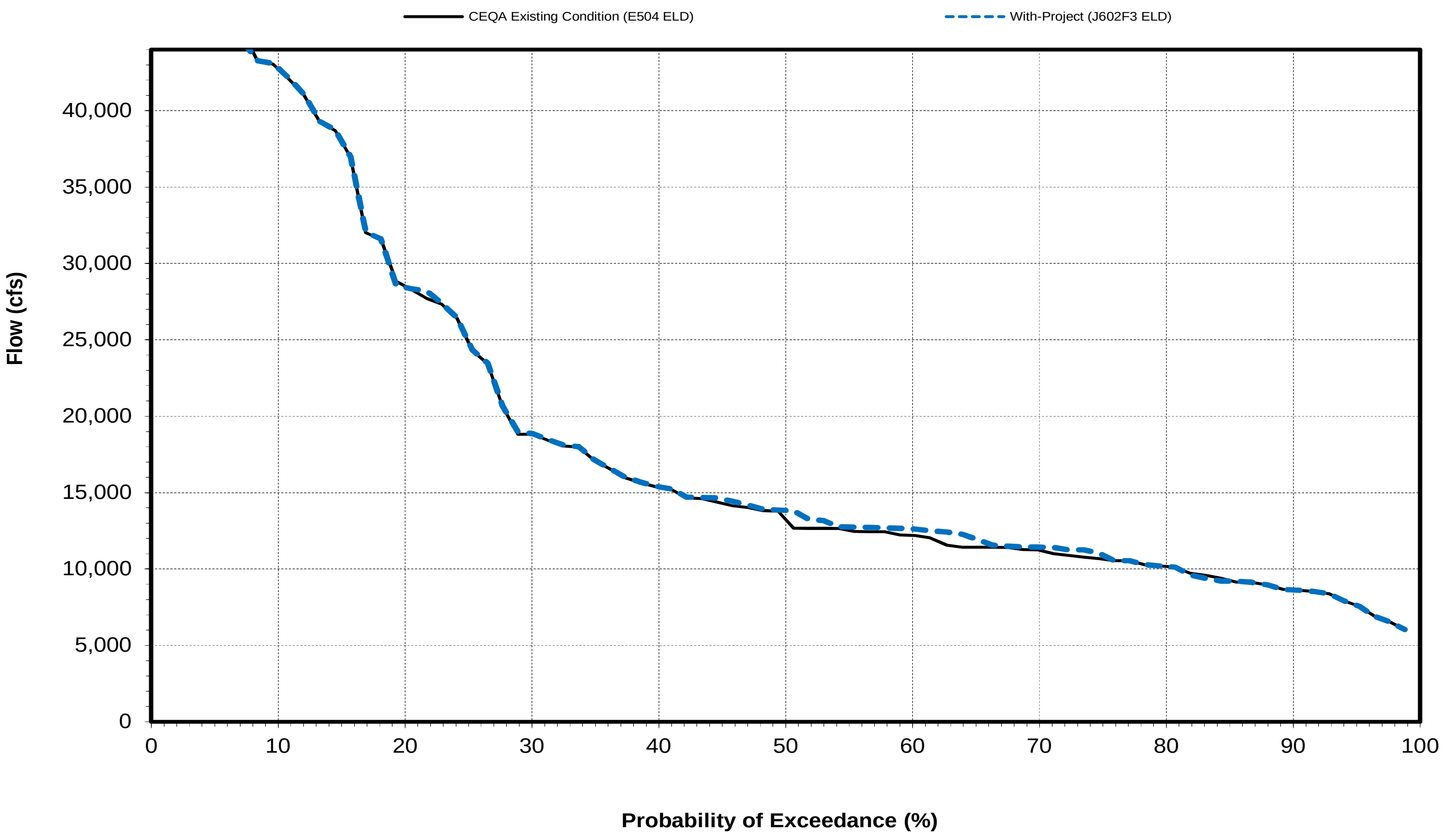
Sacramento River Flow at Freeport **April**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Freeport

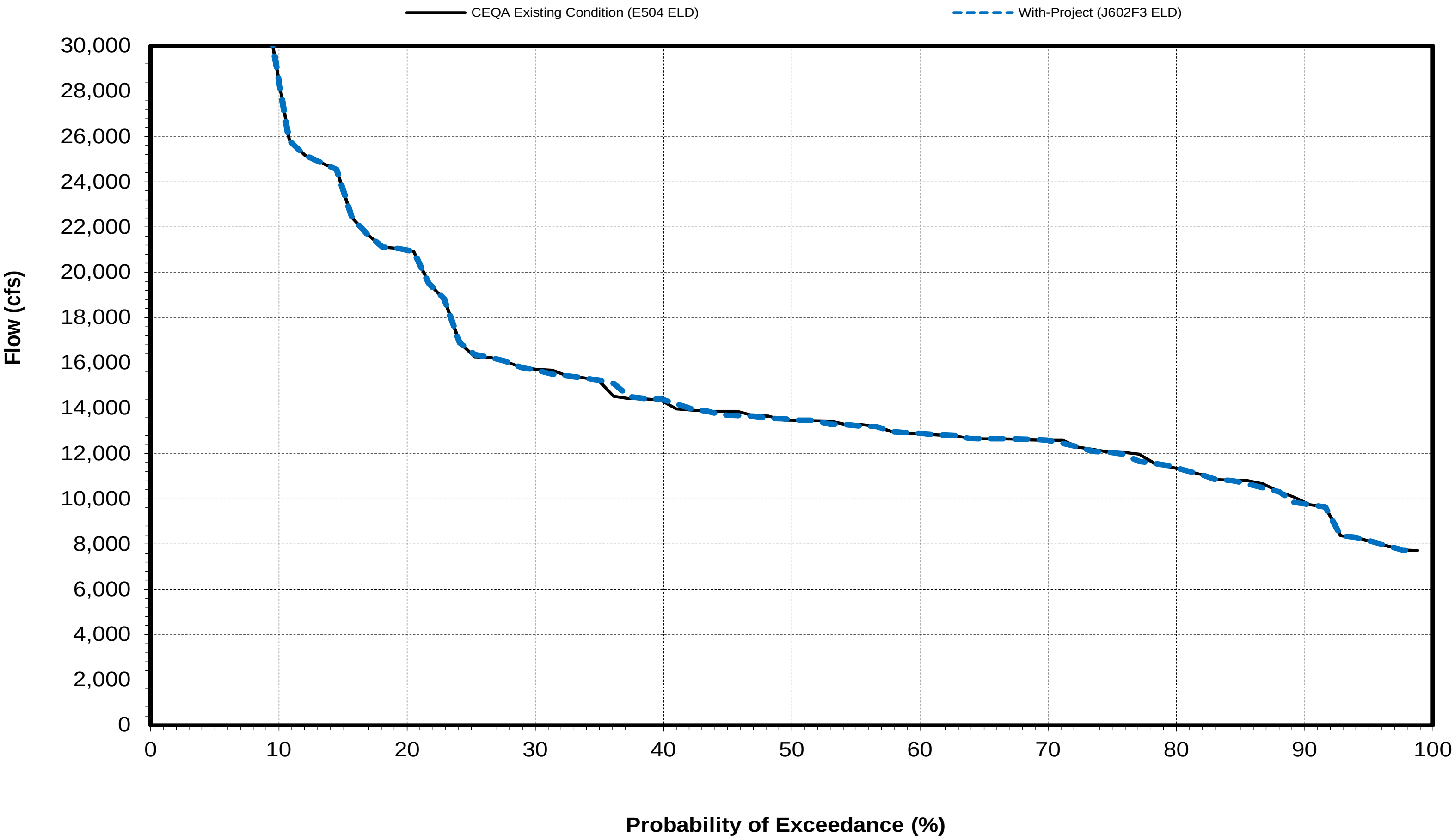
May



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Freeport

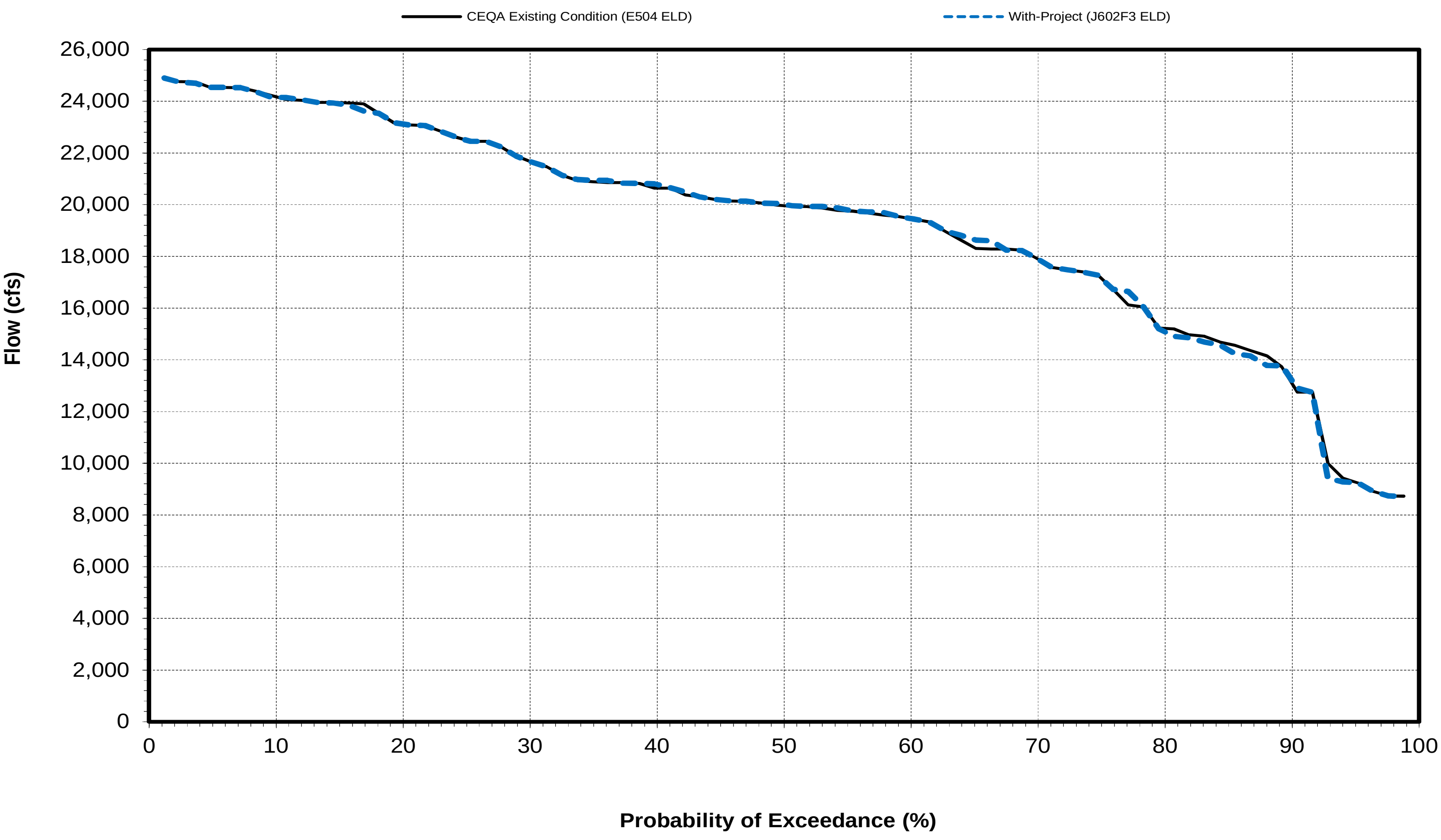
June



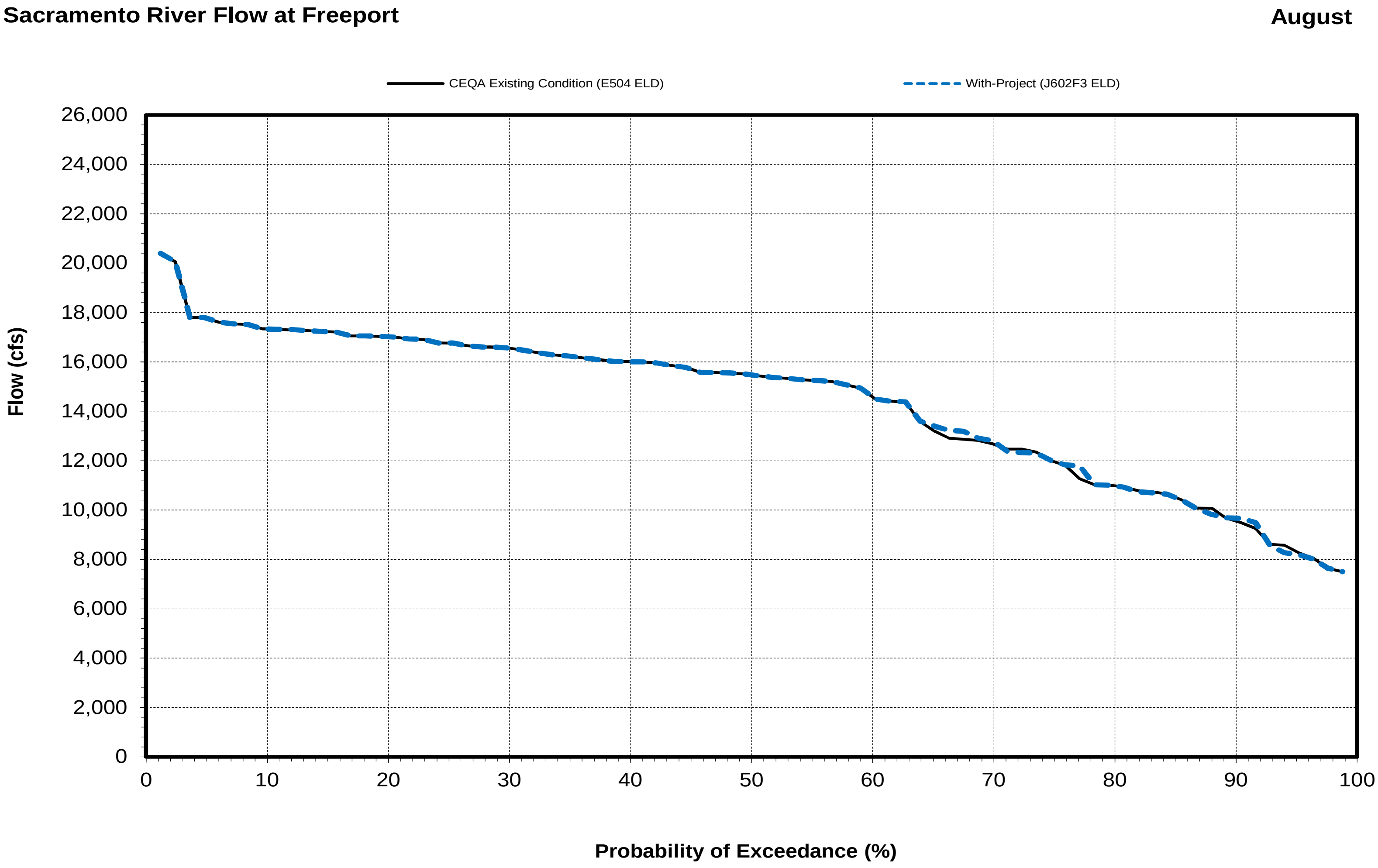
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Freeport **July**



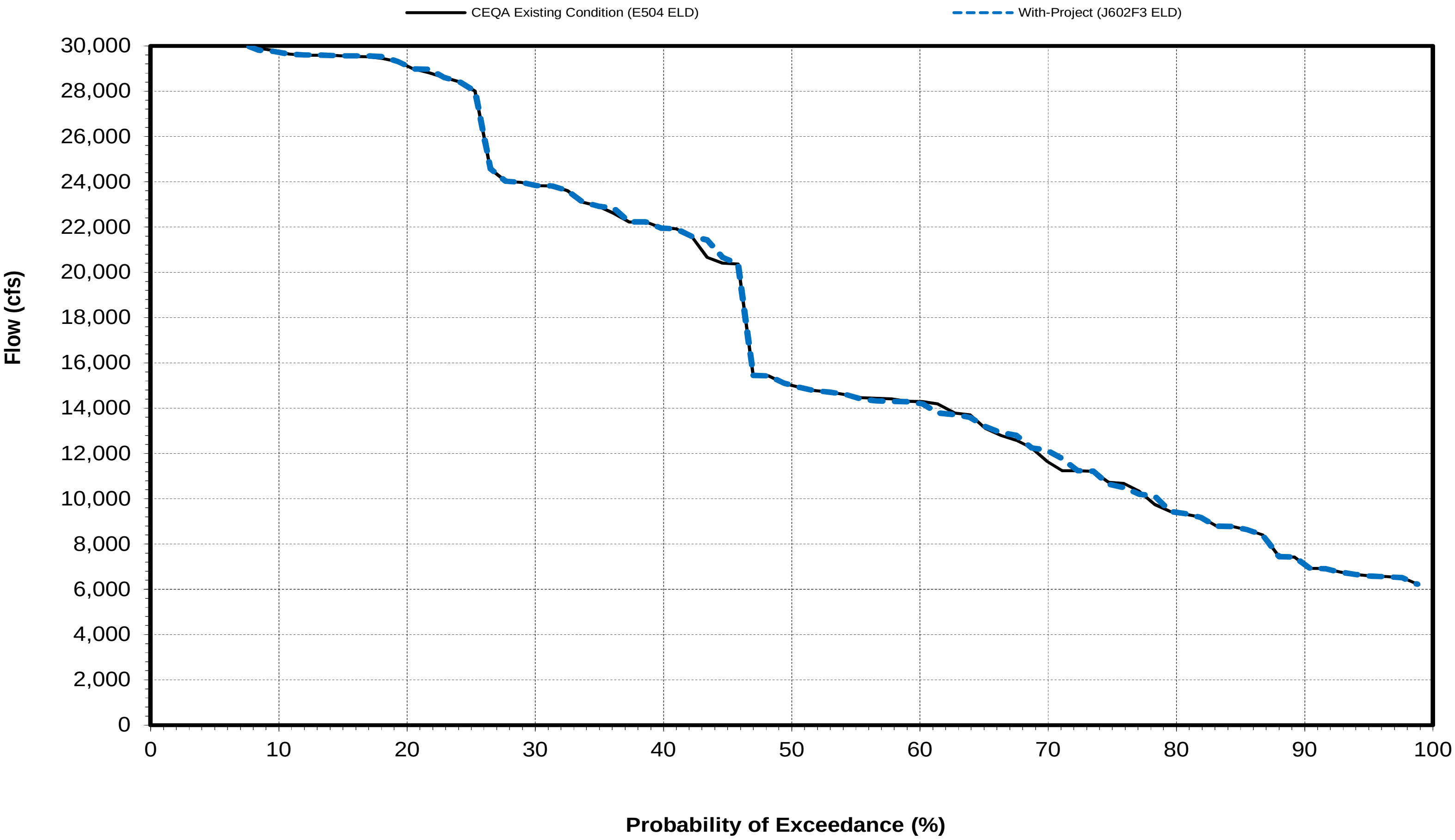
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Freeport **September**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Long-term and Water Year Type Average Sacramento River Flow at Rio Vista Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	6,966	12,357	21,172	35,789	44,461	34,781	21,290	15,236	10,319	10,748	7,926	12,220
With-Project (J602F3 ELD)	6,951	12,287	21,048	35,655	44,068	35,039	21,529	15,349	10,312	10,743	7,933	12,238
Difference	-15	-70	-124	-134	-393	258	239	113	-7	-5	7	18
Percent Difference[3]	-0.2	-0.6	-0.6	-0.4	-0.9	0.7	1.1	0.7	-0.1	0.0	0.1	0.1
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	9,016	17,706	38,357	68,571	79,948	62,852	38,179	26,681	16,959	11,348	9,250	22,300
With-Project (J602F3 ELD)	8,920	17,549	37,981	68,292	79,158	63,813	38,630	26,699	16,960	11,343	9,250	22,309
Difference	-96	-157	-376	-279	-790	961	451	18	1	-5	0	9
Percent Difference[3]	-1.1	-0.9	-1.0	-0.4	-1.0	1.5	1.2	0.1	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	6,030	13,013	19,007	39,462	50,527	42,869	22,536	16,709	10,415	12,846	9,438	13,331
With-Project (J602F3 ELD)	6,030	12,827	18,959	39,162	50,180	43,074	22,962	16,972	10,372	12,836	9,439	13,401
Difference	0	-186	-48	-300	-347	205	426	263	-43	-10	1	70
Percent Difference[3]	0.0	-1.4	-0.3	-0.8	-0.7	0.5	1.9	1.6	-0.4	-0.1	0.0	0.5
Below Normal												
CEQA Existing Condition (E504 ELD)	6,854	10,330	14,282	19,655	29,962	19,301	14,582	10,626	7,678	12,236	9,180	8,037
With-Project (J602F3 ELD)	6,854	10,269	14,280	19,654	29,535	19,309	14,741	10,872	7,651	12,237	9,163	7,990
Difference	0	-61	-2	-1	-427	8	159	246	-27	1	-17	-47
Percent Difference[3]	0.0	-0.6	0.0	0.0	-1.4	0.0	1.1	2.3	-0.4	0.0	-0.2	-0.6
Dry												
CEQA Existing Condition (E504 ELD)	5,915	9,652	12,129	14,479	21,047	17,067	10,372	7,932	6,585	10,489	6,293	6,014
With-Project (J602F3 ELD)	5,961	9,714	12,131	14,472	20,948	16,719	10,399	8,047	6,602	10,500	6,355	6,072
Difference	46	62	2	-7	-99	-348	27	115	17	11	62	58
Percent Difference[3]	0.8	0.6	0.0	0.0	-0.5	-2.0	0.3	1.4	0.3	0.1	1.0	1.0
Critical												
CEQA Existing Condition (E504 ELD)	5,171	6,535	7,705	11,879	13,547	10,506	7,658	5,302	4,514	6,005	4,529	3,458
With-Project (J602F3 ELD)	5,206	6,556	7,718	11,875	13,560	10,494	7,658	5,307	4,519	5,969	4,508	3,458
Difference	35	21	13	-4	13	-12	0	5	5	-36	-21	0
Percent Difference[3]	0.7	0.3	0.2	0.0	0.1	-0.1	0.0	0.1	0.1	-0.6	-0.5	0.0

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

Sacramento River Flow at Rio Vista - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	31704	30583	-1121	-3.5
2.4	15008	15051	43	0.3
3.6	14866	14908	42	0.3
4.8	12356	12357	1	0.0
6.0	11775	11816	41	0.3
7.2	11134	11236	102	0.9
8.4	10473	10473	0	0.0
9.6	10249	10249	0	0.0
10.8	10189	10189	0	0.0
12.0	9927	9925	-2	0.0
13.3	9909	9909	0	0.0
14.5	9514	9394	-120	-1.3
15.7	9393	9086	-307	-3.3
16.9	8667	8706	39	0.4
18.1	8566	8694	128	1.5
19.3	8417	8417	0	0.0
20.5	8400	8402	2	0.0
21.7	8314	8314	0	0.0
22.9	8203	8142	-61	-0.7
24.1	8142	8119	-23	-0.3
25.3	8119	8117	-2	0.0
26.5	8117	8072	-45	-0.6
27.7	8072	8032	-40	-0.5
28.9	8033	8004	-29	-0.4
30.1	8014	7916	-98	-1.2
31.3	7945	7864	-81	-1.0
32.5	7831	7830	-1	0.0
33.7	7711	7684	-27	-0.4
34.9	7706	7668	-38	-0.5
36.1	7662	7666	4	0.1
37.3	7643	7643	0	0.0
38.6	7633	7561	-72	-0.9
39.8	7560	7525	-35	-0.5
41.0	7459	7459	0	0.0
42.2	7439	7440	1	0.0
43.4	7161	7305	144	2.0
44.6	7090	7166	76	1.1
45.8	6850	7095	245	3.6
47.0	6768	6850	82	1.2
48.2	6747	6850	103	1.5
49.4	6746	6747	1	0.0
50.6	6586	6746	160	2.4
51.8	6505	6505	0	0.0
53.0	6462	6460	-2	0.0
54.2	6435	6435	0	0.0
55.4	6253	6375	122	2.0
56.6	6189	6252	63	1.0
57.8	6124	6228	104	1.7
59.0	5991	6005	14	0.2
60.2	5981	5985	4	0.1
61.4	5934	5898	-36	-0.6
62.7	5898	5844	-54	-0.9
63.9	5444	5396	-48	-0.9
65.1	5363	5335	-28	-0.5
66.3	5360	4969	-391	-7.3
67.5	5073	4969	-104	-2.1
68.7	4972	4952	-20	-0.4
69.9	4952	4906	-46	-0.9
71.1	4741	4740	-1	0.0
72.3	4426	4433	7	0.2
73.5	4421	4426	5	0.1
74.7	4335	4316	-19	-0.4
75.9	4204	4204	0	0.0
77.1	4047	4072	25	0.6
78.3	4032	4047	15	0.4
79.5	4000	4000	0	0.0
80.7	4000	4000	0	0.0
81.9	4000	4000	0	0.0
83.1	4000	4000	0	0.0
84.3	4000	4000	0	0.0
85.5	3950	3964	14	0.4
86.7	3519	3519	0	0.0
88.0	3352	3361	9	0.3
89.2	3185	3183	-2	-0.1
90.4	3000	3000	0	0.0
91.6	3000	3000	0	0.0
92.8	3000	3000	0	0.0
94.0	3000	3000	0	0.0
95.2	3000	3000	0	0.0
96.4	3000	3000	0	0.0
97.6	3000	3000	0	0.0
98.8	3000	3000	0	0.0
Min	3000	3000	-1121	-7.3
Max	31704	30583	245	3.6
Mean	6966	6951	-15	-0.1
Median	6666	6747	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	81.7
1.1<=X<10.0		11.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	58688	55765	-2923	-5.0
2.4	50490	50407	-83	-0.2
3.6	40986	38204	-2782	-6.8
4.8	29966	29044	-922	-3.1
6.0	29088	29018	-70	-0.2
7.2	21691	21670	-21	-0.1
8.4	21623	21413	-210	-1.0
9.6	20885	20880	-5	0.0
10.8	18698	18584	-114	-0.6
12.0	18413	18440	27	0.1
13.3	17910	17910	0	0.0
14.5	16430	16955	525	3.2
15.7	16156	16413	257	1.6
16.9	16071	16071	0	0.0
18.1	15939	15939	0	0.0
19.3	15853	15851	-2	0.0
20.5	15712	15711	-1	0.0
21.7	15375	15389	14	0.1
22.9	15374	15373	-1	0.0
24.1	15335	15353	18	0.1
25.3	15266	15331	65	0.4
26.5	15227	15328	101	0.7
27.7	15217	15260	43	0.3
28.9	15211	15179	-32	-0.2
30.1	14965	14965	0	0.0
31.3	14270	14462	192	1.3
32.5	14020	14020	0	0.0
33.7	13818	13818	0	0.0
34.9	13594	13614	20	0.1
36.1	13436	13594	158	1.2
37.3	13245	13237	-8	-0.1
38.6	12541	12714	173	1.4
39.8	12354	12429	75	0.6
41.0	12295	11991	-304	-2.5
42.2	11977	11979	2	0.0
43.4	11926	11925	-1	0.0
44.6	11838	11855	17	0.1
45.8	11709	11851	142	1.2
47.0	11612	11710	98	0.8
48.2	11458	11613	155	1.4
49.4	11012	11464	452	4.1
50.6	10964	10937	-27	-0.2
51.8	10379	10372	-7	-0.1
53.0	10322	10320	-2	0.0
54.2	10302	10302	0	0.0
55.4	10170	9975	-195	-1.9
56.6	9975	9959	-16	-0.2
57.8	9546	9547	1	0.0
59.0	8937	8962	25	0.3
60.2	8897	8685	-212	-2.4
61.4	8326	8326	0	0.0
62.7	8073	8073	0	0.0
63.9	7991	7905	-86	-1.1
65.1	7780	7783	3	0.0
66.3	7131	7121	-10	-0.1
67.5	6717	6696	-21	-0.3
68.7	6685	6634	-51	-0.8
69.9	6605	6585	-20	-0.3
71.1	6585	6482	-103	-1.6
72.3	6481	6389	-92	-1.4
73.5	6377	6363	-14	-0.2
74.7	6355	6283	-72	-1.1
75.9	6322	6065	-257	-4.1
77.1	6073	6041	-32	-0.5
78.3	5941	5892	-49	-0.8
79.5	5715	5715	0	0.0
80.7	5505	5505	0	0.0
81.9	5066	5195	129	2.5
83.1	4825	4825	0	0.0
84.3	4743	4773	30	0.6
85.5	4619	4739	120	2.6
86.7	4500	4613	113	2.5
88.0	4500	4500	0	0.0
89.2	4500	4500	0	0.0
90.4	4064	4064	0	0.0
91.6	3615	3606	-9	-0.2
92.8	3500	3541	41	1.2
94.0	3500	3500	0	0.0
95.2	3500	3500	0	0.0
96.4	3500	3500	0	0.0
97.6	3500	3500	0	0.0
98.8	3500	3500	0	0.0
Min	3500	3500	-2923	-6.8
Max	58688	55765	525	4.1
Mean	12357	12287	-70	-0.1
Median	10988	11201	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	72.0
1.1<=X<10.0		14.6
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		13.4
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	120527	119520	-1007	-0.8
2.4	78965	75723	-3242	-4.1
3.6	73362	71007	-2355	-3.2
4.8	68722	66816	-1906	-2.8
6.0	67968	65284	-2684	-3.9
7.2	60691	60698	7	0.0
8.4	58037	58065	28	0.0
9.6	57445	57716	271	0.5
10.8	51218	51299	81	0.2
12.0	50865	49883	-982	-1.9
13.3	44395	45100	705	1.6
14.5	39634	39633	-1	0.0
15.7	39070	39070	0	0.0
16.9	35376	35832	456	1.3
18.1	33971	33965	-6	0.0
19.3	32776	33048	272	0.8
20.5	30962	30733	-229	-0.7
21.7	28378	28524	146	0.5
22.9	27209	27210	1	0.0
24.1	27148	27132	-16	-0.1
25.3	24201	24206	5	0.0
26.5	23935	23935	0	0.0
27.7	22651	22771	120	0.5
28.9	19678	19689	11	0.1
30.1	18690	18683	-7	0.0
31.3	18175	18175	0	0.0
32.5	18154	18149	-5	0.0
33.7	17397	17398	1	0.0
34.9	17107	17108	1	0.0
36.1	16720	16496	-224	-1.3
37.3	16234	16229	-5	0.0
38.6	15443	15635	192	1.2
39.8	15069	15067	-2	0.0
41.0	14745	14745	0	0.0
42.2	14643	14637	-6	0.0
43.4	13825	13825	0	0.0
44.6	13348	13358	10	0.1
45.8	13228	13232	4	0.0
47.0	13199	13191	-8	-0.1
48.2	12901	12969	68	0.5
49.4	12307	12307	0	0.0
50.6	11696	11653	-43	-0.4
51.8	11657	11597	-60	-0.5
53.0	11596	11411	-185	-1.6
54.2	11369	11370	1	0.0
55.4	11366	11365	-1	0.0
56.6	11300	11345	45	0.4
57.8	11092	11092	0	0.0
59.0	11080	11080	0	0.0
60.2	10901	10901	0	0.0
61.4	10800	10800	0	0.0
62.7	10796	10796	0	0.0
63.9	10658	10658	0	0.0
65.1	10585	10585	0	0.0
66.3	10513	10516	3	0.0
67.5	10476	10476	0	0.0
68.7	10272	10272	0	0.0
69.9	10245	10246	1	0.0
71.1	10028	10040	12	0.1
72.3	9891	9891	0	0.0
73.5	9721	9721	0	0.0
74.7	9567	9543	-24	-0.3
75.9	9543	9532	-11	-0.1
77.1	9531	9531	0	0.0
78.3	8847	8847	0	0.0
79.5	8634	8632	-2	0.0
80.7	8247	8360	113	1.4
81.9	7052	7060	8	0.1
83.1	6949	6928	-21	-0.3
84.3	6916	6872	-44	-0.6
85.5	6403	6402	-1	0.0
86.7	6340	6341	1	0.0
88.0	6151	6148	-3	0.0
89.2	6095	6093	-2	0.0
90.4	5968	6003	35	0.6
91.6	5932	5933	1	0.0
92.8	5868	5868	0	0.0
94.0	5445	5433	-12	-0.2
95.2	4992	5129	137	2.7
96.4	4925	5104	179	3.6
97.6	4317	4308	-9	-0.2
98.8	3961	3957	-4	-0.1
Min	3961	3957	-3242	-4.1
Max	120527	119520	705	3.6
Mean	21172	21048	-124	-0.1
Median	12002	11980	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	198755	195535	-3220	-1.6
2.4	181993	178920	-3073	-1.7
3.6	127814	128030	216	0.2
4.8	118452	117310	-1142	-1.0
6.0	95365	95256	-109	-0.1
7.2	94461	95119	658	0.7
8.4	92731	92673	-58	-0.1
9.6	87813	87814	1	0.0
10.8	87462	87463	1	0.0
12.0	78728	76468	-2260	-2.9
13.3	71105	71105	0	0.0
14.5	68201	68206	5	0.0
15.7	68146	68148	2	0.0
16.9	65375	65375	0	0.0
18.1	62596	63026	430	0.7
19.3	58432	58280	-152	-0.3
20.5	55931	55901	-30	-0.1
21.7	54863	54858	-5	0.0
22.9	54605	53323	-1282	-2.3
24.1	49297	49737	440	0.9
25.3	46439	46605	166	0.4
26.5	43222	43025	-197	-0.5
27.7	43072	42902	-170	-0.4
28.9	42386	42365	-21	0.0
30.1	40131	40131	0	0.0
31.3	38965	38689	-276	-0.7
32.5	37982	37984	2	0.0
33.7	35176	35175	-1	0.0
34.9	34371	34372	1	0.0
36.1	34140	33865	-275	-0.8
37.3	28940	28585	-355	-1.2
38.6	28633	28443	-190	-0.7
39.8	27201	27191	-10	0.0
41.0	24848	24848	0	0.0
42.2	24193	24187	-6	0.0
43.4	22780	22781	1	0.0
44.6	22052	22052	0	0.0
45.8	20699	20699	0	0.0
47.0	20329	20329	0	0.0
48.2	19846	19842	-4	0.0
49.4	19471	19471	0	0.0
50.6	19059	19059	0	0.0
51.8	18960	18948	-12	-0.1
53.0	18953	18902	-51	-0.3
54.2	17689	17687	-2	0.0
55.4	17083	17081	-2	0.0
56.6	16960	16947	-13	-0.1
57.8	16950	16944	-6	0.0
59.0	16476	16484	8	0.0
60.2	15756	15753	-3	0.0
61.4	15449	15441	-8	-0.1
62.7	14933	14806	-127	-0.9
63.9	14806	14799	-7	0.0
65.1	14490	14370	-120	-0.8
66.3	13288	13288	0	0.0
67.5	12883	12862	-21	-0.2
68.7	12449	12449	0	0.0
69.9	12398	12399	1	0.0
71.1	11932	11969	37	0.3
72.3	11873	11877	4	0.0
73.5	11494	11599	105	0.9
74.7	11377	11387	10	0.1
75.9	11272	11273	1	0.0
77.1	11018	11019	1	0.0
78.3	10836	10850	14	0.1
79.5	10723	10770	47	0.4
80.7	10720	10723	3	0.0
81.9	10565	10565	0	0.0
83.1	10544	10547	3	0.0
84.3	10397	10389	-8	-0.1
85.5	10363	10362	-1	0.0
86.7	10056	10051	-5	0.0
88.0	9900	9914	14	0.1
89.2	9622	9622	0	0.0
90.4	9240	9240	0	0.0
91.6	9151	9151	0	0.0
92.8	8923	8923	0	0.0
94.0	8702	8702	0	0.0
95.2	8332	8332	0	0.0
96.4	8147	8147	0	0.0
97.6	8078	8084	6	0.1
98.8	5877	5872	-5	-0.1
Min	5877	5872	-3220	-2.9
Max	198755	195535	658	0.9
Mean	35789	35655	-135	-0.1
Median	19265	19265	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	184951	184856	-95	-0.1
2.4	179675	175576	-4099	-2.3
3.6	133710	133554	-156	-0.1
4.8	133180	132998	-182	-0.1
6.0	126500	125990	-510	-0.4
7.2	111556	111936	380	0.3
8.4	105437	103509	-1928	-1.8
9.6	103132	102963	-169	-0.2
10.8	102691	102227	-464	-0.5
12.0	100649	100125	-524	-0.5
13.3	99565	99196	-369	-0.4
14.5	85281	84870	-411	-0.5
15.7	83616	81883	-1733	-2.1
16.9	79208	78414	-794	-1.0
18.1	72726	72475	-251	-0.3
19.3	71641	71361	-280	-0.4
20.5	67487	67008	-479	-0.7
21.7	63732	62694	-1038	-1.6
22.9	62234	61362	-872	-1.4
24.1	59380	58935	-445	-0.7
25.3	58732	58266	-466	-0.8
26.5	58572	55790	-2782	-4.7
27.7	55668	55668	0	0.0
28.9	53279	53261	-18	0.0
30.1	50813	49684	-1129	-2.2
31.3	49684	49335	-349	-0.7
32.5	48329	47709	-620	-1.3
33.7	48059	47160	-899	-1.9
34.9	46944	46738	-206	-0.4
36.1	46727	46270	-457	-1.0
37.3	44567	43957	-610	-1.4
38.6	44395	43646	-749	-1.7
39.8	42491	41559	-932	-2.2
41.0	41560	41556	-4	0.0
42.2	40599	39942	-657	-1.6
43.4	39058	39058	0	0.0
44.6	37456	36465	-991	-2.6
45.8	33158	32391	-767	-2.3
47.0	32777	32047	-730	-2.2
48.2	30819	31287	468	1.5
49.4	30702	30556	-146	-0.5
50.6	30354	30245	-109	-0.4
51.8	30035	29284	-751	-2.5
53.0	29265	28893	-372	-1.3
54.2	28663	28665	2	0.0
55.4	26561	26562	1	0.0
56.6	23432	23094	-338	-1.4
57.8	23091	23077	-14	-0.1
59.0	23076	22927	-149	-0.6
60.2	22331	22331	0	0.0
61.4	22283	22300	17	0.1
62.7	21542	21529	-13	-0.1
63.9	21528	21139	-389	-1.8
65.1	20757	20757	0	0.0
66.3	20276	19493	-783	-3.9
67.5	18028	18034	6	0.0
68.7	16823	16823	0	0.0
69.9	15770	15502	-268	-1.7
71.1	15500	15234	-266	-1.7
72.3	15232	15223	-9	-0.1
73.5	15220	15168	-52	-0.3
74.7	15118	15046	-72	-0.5
75.9	15078	14489	-589	-3.9
77.1	14850	14082	-768	-5.2
78.3	14082	14022	-60	-0.4
79.5	14022	14006	-16	-0.1
80.7	13943	13556	-387	-2.8
81.9	13218	13218	0	0.0
83.1	12998	13003	5	0.0
84.3	12311	12311	0	0.0
85.5	11968	11921	-47	-0.4
86.7	11916	11578	-338	-2.8
88.0	11578	11448	-130	-1.1
89.2	11234	11221	-13	-0.1
90.4	11130	11163	33	0.3
91.6	10925	10925	0	0.0
92.8	10598	10598	0	0.0
94.0	10235	10235	0	0.0
95.2	8673	8704	31	0.4
96.4	7549	7561	12	0.2
97.6	7206	7206	0	0.0
98.8	6689	6689	0	0.0
Min	6689	6689	-4099	-5.2
Max	184951	184856	468	1.5
Mean	44461	44068	-394	-0.9
Median	30528	30401	-194	-0.4

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	64.6
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		34.1
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	190057	190133	76	0.0
2.4	182936	183252	316	0.2
3.6	128189	129274	1085	0.8
4.8	106959	109440	2481	2.3
6.0	100461	101170	709	0.7
7.2	94833	95959	1126	1.2
8.4	90656	90661	5	0.0
9.6	76221	76186	-35	0.0
10.8	71893	73018	1125	1.6
12.0	66246	66736	490	0.7
13.3	66081	64331	-1750	-2.6
14.5	62204	63984	1780	2.9
15.7	60713	62578	1865	3.1
16.9	57601	58364	763	1.3
18.1	56946	58001	1055	1.9
19.3	53222	53005	-217	-0.4
20.5	50669	51487	818	1.6
21.7	48362	48699	337	0.7
22.9	47939	47923	-16	0.0
24.1	43894	44978	1084	2.5
25.3	42279	43797	1518	3.6
26.5	41993	41864	-129	-0.3
27.7	39590	38895	-695	-1.8
28.9	39223	37238	-1985	-5.1
30.1	35119	35558	439	1.3
31.3	35102	34902	-200	-0.6
32.5	34389	33725	-664	-1.9
33.7	32622	33077	455	1.4
34.9	31737	33074	1337	4.2
36.1	30353	32070	1717	5.7
37.3	29994	30769	775	2.6
38.6	29090	30524	1434	4.9
39.8	28607	29746	1139	4.0
41.0	28495	28209	-286	-1.0
42.2	28209	27864	-345	-1.2
43.4	26495	25980	-515	-1.9
44.6	24246	25978	1732	7.1
45.8	23747	24122	375	1.6
47.0	23382	23280	-102	-0.4
48.2	23266	23169	-97	-0.4
49.4	21844	21855	11	0.1
50.6	20642	20905	263	1.3
51.8	20560	20668	108	0.5
53.0	20375	20615	240	1.2
54.2	20281	20282	1	0.0
55.4	19790	19794	4	0.0
56.6	18890	19433	543	2.9
57.8	18163	19161	998	5.5
59.0	17758	18377	619	3.5
60.2	17640	18293	653	3.7
61.4	16919	17264	345	2.0
62.7	16365	16922	557	3.4
63.9	16342	16779	437	2.7
65.1	16290	16368	78	0.5
66.3	16217	16338	121	0.7
67.5	16086	15799	-287	-1.8
68.7	16050	15668	-382	-2.4
69.9	15798	15395	-403	-2.6
71.1	15666	14730	-936	-6.0
72.3	15265	14364	-901	-5.9
73.5	14746	14204	-542	-3.7
74.7	13823	14046	223	1.6
75.9	13075	13255	180	1.4
77.1	12834	12834	0	0.0
78.3	12569	12569	0	0.0
79.5	11627	11628	1	0.0
80.7	11047	11047	0	0.0
81.9	10526	10527	1	0.0
83.1	9450	9797	347	3.7
84.3	9443	9450	7	0.1
85.5	9184	9186	2	0.0
86.7	9098	9100	2	0.0
88.0	8799	8723	-76	-0.9
89.2	8722	8659	-63	-0.7
90.4	8376	8376	0	0.0
91.6	8222	8222	0	0.0
92.8	8195	8189	-6	-0.1
94.0	7790	7791	1	0.0
95.2	6525	6525	0	0.0
96.4	6123	6112	-11	-0.2
97.6	5791	5791	0	0.0
98.8	5146	5144	-2	0.0
Min	5146	5144	-1985	-6.0
Max	190057	190133	2481	7.1
Mean	34781	35039	258	0.6
Median	21243	21380	9	0.1

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	47.6
1.1<=X<10.0		37.8
X>=5.0		3.7
X>=10.0		0.0
-10.0<X<=-1.1		14.6
X<=-5.0		3.7
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	102415	103246	831	0.8
2.4	79982	81083	1101	1.4
3.6	72333	71717	-616	-0.9
4.8	60589	60920	331	0.5
6.0	59180	59215	35	0.1
7.2	56977	57108	131	0.2
8.4	53500	54018	518	1.0
9.6	53108	53820	712	1.3
10.8	52650	52033	-617	-1.2
12.0	46500	46993	493	1.1
13.3	42862	42498	-364	-0.8
14.5	41632	42335	703	1.7
15.7	40160	40530	370	0.9
16.9	40101	40507	406	1.0
18.1	36487	38405	1918	5.3
19.3	36076	36353	277	0.8
20.5	34994	35366	372	1.1
21.7	34509	35324	815	2.4
22.9	34074	33886	-188	-0.6
24.1	30804	31130	326	1.1
25.3	30688	31111	423	1.4
26.5	21149	21468	319	1.5
27.7	21113	21357	244	1.2
28.9	21078	21050	-28	-0.1
30.1	20907	20377	-530	-2.5
31.3	20454	20258	-196	-1.0
32.5	19809	19963	154	0.8
33.7	19747	19527	-220	-1.1
34.9	18025	18326	301	1.7
36.1	17554	17837	283	1.6
37.3	17458	17511	53	0.3
38.6	17153	17202	49	0.3
39.8	16687	16799	112	0.7
41.0	16429	16783	354	2.2
42.2	16161	16473	312	1.9
43.4	14825	15557	732	4.9
44.6	14379	14938	559	3.9
45.8	14052	14892	840	6.0
47.0	14006	14844	838	6.0
48.2	13321	13982	661	5.0
49.4	13065	13652	587	4.5
50.6	12858	13597	739	5.7
51.8	12385	12853	468	3.8
53.0	12090	12432	342	2.8
54.2	11502	12278	776	6.7
55.4	10731	11861	1130	10.5
56.6	10697	11362	665	6.2
57.8	10634	10692	58	0.5
59.0	10304	10318	14	0.1
60.2	9831	10023	192	2.0
61.4	9715	9977	262	2.7
62.7	9632	9941	309	3.2
63.9	9584	9545	-39	-0.4
65.1	9545	9528	-17	-0.2
66.3	9468	9429	-39	-0.4
67.5	9421	9420	-1	0.0
68.7	9291	9411	120	1.3
69.9	9112	9290	178	2.0
71.1	9058	9279	221	2.4
72.3	9014	9027	13	0.1
73.5	8916	8917	1	0.0
74.7	8552	8746	194	2.3
75.9	8393	8552	159	1.9
77.1	8337	8396	59	0.7
78.3	8335	8336	1	0.0
79.5	8312	8335	23	0.3
80.7	8192	8192	0	0.0
81.9	7795	7780	-15	-0.2
83.1	7766	7773	7	0.1
84.3	7512	7512	0	0.0
85.5	7433	7439	6	0.1
86.7	7343	7397	54	0.7
88.0	7331	7343	12	0.2
89.2	7070	7331	261	3.7
90.4	6957	6962	5	0.1
91.6	6934	6934	0	0.0
92.8	6883	6883	0	0.0
94.0	6827	6827	0	0.0
95.2	6452	6452	0	0.0
96.4	6401	6401	0	0.0
97.6	6339	6339	0	0.0
98.8	5868	5868	0	0.0
Min	5868	5868	-617	-2.5
Max	102415	103246	1918	10.5
Mean	21290	21529	239	1.4
Median	12962	13625	157	0.8

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	52.4
1.1<=X<10.0		42.7
X>=5.0		9.8
X>=10.0		1.2
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	58251	58290	39	0.1
2.4	49504	49543	39	0.1
3.6	47012	47054	42	0.1
4.8	45180	45229	49	0.1
6.0	41092	41131	39	0.1
7.2	37383	36801	-582	-1.6
8.4	36453	36500	47	0.1
9.6	35886	35931	45	0.1
10.8	35276	35312	36	0.1
12.0	34886	34933	47	0.1
13.3	33430	33469	39	0.1
14.5	32347	32375	28	0.1
15.7	31955	31994	39	0.1
16.9	26375	26415	40	0.2
18.1	25580	25615	35	0.1
19.3	23165	23081	-84	-0.4
20.5	23032	22952	-80	-0.3
21.7	22340	22750	410	1.8
22.9	22073	22118	45	0.2
24.1	21321	21354	33	0.2
25.3	19370	19411	41	0.2
26.5	18652	18692	40	0.2
27.7	16075	16110	35	0.2
28.9	14926	15070	144	1.0
30.1	14592	14627	35	0.2
31.3	14211	14253	42	0.3
32.5	13869	13908	39	0.3
33.7	13829	13850	21	0.2
34.9	12884	12924	40	0.3
36.1	12650	12679	29	0.2
37.3	12165	12203	38	0.3
38.6	11790	11812	22	0.2
39.8	11611	11654	43	0.4
41.0	11408	11449	41	0.4
42.2	10917	10992	75	0.7
43.4	10846	10959	113	1.0
44.6	10775	10888	113	1.0
45.8	10710	10808	98	0.9
47.0	10376	10748	372	3.6
48.2	10305	10417	112	1.1
49.4	10250	10289	39	0.4
50.6	9249	10217	968	10.5
51.8	9192	10179	987	10.7
53.0	9182	9622	440	4.8
54.2	9104	9309	205	2.3
55.4	9029	9231	202	2.2
56.6	9026	9215	189	2.1
57.8	8994	9132	138	1.5
59.0	8819	9112	293	3.3
60.2	8818	9065	247	2.8
61.4	8631	9029	398	4.6
62.7	8234	8860	626	7.6
63.9	8214	8809	595	7.2
65.1	8129	8668	539	6.6
66.3	8043	8270	227	2.8
67.5	8039	8214	175	2.2
68.7	7985	8130	145	1.8
69.9	7850	8053	203	2.6
71.1	7815	8048	233	3.0
72.3	7696	8034	338	4.4
73.5	7676	8031	355	4.6
74.7	7447	7680	233	3.1
75.9	7259	7259	0	0.0
77.1	7240	7232	-8	-0.1
78.3	7210	7210	0	0.0
79.5	7150	7150	0	0.0
80.7	6896	6896	0	0.0
81.9	6593	6500	-93	-1.4
83.1	6487	6312	-175	-2.7
84.3	6312	6160	-152	-2.4
85.5	6095	6150	55	0.9
86.7	6076	6076	0	0.0
88.0	6070	6070	0	0.0
89.2	5802	5802	0	0.0
90.4	5771	5771	0	0.0
91.6	5580	5580	0	0.0
92.8	5571	5571	0	0.0
94.0	5271	5271	0	0.0
95.2	4749	4749	0	0.0
96.4	4102	4102	0	0.0
97.6	3621	3621	0	0.0
98.8	3601	3601	0	0.0
Min	3601	3601	-582	-2.7
Max	58251	58290	987	10.7
Mean	15236	15349	112	1.2
Median	9750	10253	40	0.2

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	65.9
1.1<=X<10.0		26.8
X>=5.0		6.1
X>=10.0		2.4
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	55002	55001	-1	0.0
2.4	43659	43659	0	0.0
3.6	31028	31029	1	0.0
4.8	30841	30841	0	0.0
6.0	29211	29211	0	0.0
7.2	28710	28710	0	0.0
8.4	28364	28364	0	0.0
9.6	23704	23703	-1	0.0
10.8	20435	20395	-40	-0.2
12.0	15465	15464	-1	0.0
13.3	15415	15415	0	0.0
14.5	14983	14984	1	0.0
15.7	13656	13656	0	0.0
16.9	13094	13093	-1	0.0
18.1	12696	12696	0	0.0
19.3	12672	12672	0	0.0
20.5	12625	12625	0	0.0
21.7	11508	11508	0	0.0
22.9	11132	11133	1	0.0
24.1	9696	9696	0	0.0
25.3	9278	9344	66	0.7
26.5	9266	9266	0	0.0
27.7	9013	9013	0	0.0
28.9	8902	8902	0	0.0
30.1	8875	8875	0	0.0
31.3	8820	8751	-69	-0.8
32.5	8552	8552	0	0.0
33.7	8529	8529	0	0.0
34.9	8529	8529	0	0.0
36.1	8064	8413	349	4.3
37.3	8061	8063	2	0.0
38.6	7914	8061	147	1.9
39.8	7913	7913	0	0.0
41.0	7623	7800	177	2.3
42.2	7593	7623	30	0.4
43.4	7560	7560	0	0.0
44.6	7497	7387	-110	-1.5
45.8	7411	7354	-57	-0.8
47.0	7306	7306	0	0.0
48.2	7295	7295	0	0.0
49.4	7294	7287	-7	-0.1
50.6	7287	7261	-26	-0.4
51.8	7262	7213	-49	-0.7
53.0	7261	7190	-71	-1.0
54.2	7196	7176	-20	-0.3
55.4	7176	7157	-19	-0.3
56.6	7158	7089	-69	-1.0
57.8	6865	6877	12	0.2
59.0	6863	6865	2	0.0
60.2	6853	6853	0	0.0
61.4	6848	6853	5	0.1
62.7	6841	6847	6	0.1
63.9	6806	6805	-1	0.0
65.1	6721	6721	0	0.0
66.3	6707	6707	0	0.0
67.5	6705	6706	1	0.0
68.7	6666	6705	39	0.6
69.9	6664	6614	-50	-0.8
71.1	6614	6564	-50	-0.8
72.3	6389	6332	-57	-0.9
73.5	6332	6326	-6	-0.1
74.7	6284	6283	-1	0.0
75.9	6232	6157	-75	-1.2
77.1	6157	6045	-112	-1.8
78.3	6013	5946	-67	-1.1
79.5	5909	5906	-3	-0.1
80.7	5745	5745	0	0.0
81.9	5658	5659	1	0.0
83.1	5495	5494	-1	0.0
84.3	5494	5480	-14	-0.3
85.5	5480	5283	-197	-3.6
86.7	5283	5271	-12	-0.2
88.0	5271	5259	-12	-0.2
89.2	5021	5021	0	0.0
90.4	4973	4811	-162	-3.3
91.6	4376	4376	0	0.0
92.8	3522	3523	1	0.0
94.0	3505	3505	0	0.0
95.2	3420	3424	4	0.1
96.4	3367	3367	0	0.0
97.6	3320	3320	0	0.0
98.8	3191	3191	0	0.0
Min	3191	3191	-197	-3.6
Max	55002	55001	349	4.3
Mean	10319	10312	-6	-0.1
Median	7291	7274	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	14566	14542	-24	-0.2
2.4	14551	14535	-16	-0.1
3.6	14491	14456	-35	-0.2
4.8	14321	14321	0	0.0
6.0	14318	14319	1	0.0
7.2	14272	14272	0	0.0
8.4	14193	14186	-7	0.0
9.6	14124	14107	-17	-0.1
10.8	14031	14067	36	0.3
12.0	13990	13982	-8	-0.1
13.3	13938	13927	-11	-0.1
14.5	13931	13871	-60	-0.4
15.7	13885	13870	-15	-0.1
16.9	13871	13691	-180	-1.3
18.1	13688	13688	0	0.0
19.3	13516	13526	10	0.1
20.5	13327	13327	0	0.0
21.7	13311	13311	0	0.0
22.9	13204	13204	0	0.0
24.1	12985	12985	0	0.0
25.3	12981	12981	0	0.0
26.5	12961	12961	0	0.0
27.7	12814	12814	0	0.0
28.9	12654	12651	-3	0.0
30.1	12355	12355	0	0.0
31.3	12334	12335	1	0.0
32.5	12016	12016	0	0.0
33.7	11933	11933	0	0.0
34.9	11901	11901	0	0.0
36.1	11880	11896	16	0.1
37.3	11844	11885	41	0.3
38.6	11813	11827	14	0.1
39.8	11731	11782	51	0.4
41.0	11676	11740	64	0.5
42.2	11441	11463	22	0.2
43.4	11434	11441	7	0.1
44.6	11423	11434	11	0.1
45.8	11382	11382	0	0.0
47.0	11368	11369	1	0.0
48.2	11329	11328	-1	0.0
49.4	11310	11310	0	0.0
50.6	11296	11285	-11	-0.1
51.8	11274	11274	0	0.0
53.0	11250	11250	0	0.0
54.2	11162	11186	24	0.2
55.4	11074	11160	86	0.8
56.6	11071	11105	34	0.3
57.8	11002	11074	72	0.7
59.0	10944	11014	70	0.6
60.2	10886	10886	0	0.0
61.4	10743	10743	0	0.0
62.7	10558	10579	21	0.2
63.9	10357	10571	214	2.1
65.1	10284	10498	214	2.1
66.3	10224	10357	133	1.3
67.5	10199	10149	-50	-0.5
68.7	10061	10054	-7	-0.1
69.9	9824	9824	0	0.0
71.1	9680	9681	1	0.0
72.3	9540	9540	0	0.0
73.5	9536	9536	0	0.0
74.7	9448	9448	0	0.0
75.9	9053	9148	95	1.0
77.1	8796	9053	257	2.9
78.3	8693	8691	-2	0.0
79.5	8119	7962	-157	-1.9
80.7	7962	7797	-165	-2.1
81.9	7846	7775	-71	-0.9
83.1	7797	7773	-24	-0.3
84.3	7775	7715	-60	-0.8
85.5	7715	7498	-217	-2.8
86.7	7585	7236	-349	-4.6
88.0	7236	7128	-108	-1.5
89.2	7038	7068	30	0.4
90.4	6410	6527	117	1.8
91.6	6264	6259	-5	-0.1
92.8	4336	4167	-169	-3.9
94.0	4177	3852	-325	-7.8
95.2	3853	3852	-1	0.0
96.4	3792	3792	0	0.0
97.6	3747	3747	0	0.0
98.8	3645	3648	3	0.1
Min	3645	3648	-349	-7.8
Max	14566	14542	257	2.9
Mean	10748	10743	-6	-0.2
Median	11303	11298	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		9.8
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		35.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	11976	11976	0	0.0
2.4	11929	11929	0	0.0
3.6	10585	10586	1	0.0
4.8	10163	10163	0	0.0
6.0	10154	10153	-1	0.0
7.2	10139	10140	1	0.0
8.4	10053	10053	0	0.0
9.6	10052	10052	0	0.0
10.8	10011	10011	0	0.0
12.0	9963	9963	0	0.0
13.3	9949	9945	-4	0.0
14.5	9896	9896	0	0.0
15.7	9889	9889	0	0.0
16.9	9847	9862	15	0.2
18.1	9846	9845	-1	0.0
19.3	9733	9733	0	0.0
20.5	9716	9716	0	0.0
21.7	9617	9617	0	0.0
22.9	9616	9616	0	0.0
24.1	9559	9559	0	0.0
25.3	9535	9528	-7	-0.1
26.5	9516	9516	0	0.0
27.7	9423	9424	1	0.0
28.9	9422	9421	-1	0.0
30.1	9409	9409	0	0.0
31.3	9374	9374	0	0.0
32.5	9365	9363	-2	0.0
33.7	9289	9289	0	0.0
34.9	9251	9252	1	0.0
36.1	9218	9217	-1	0.0
37.3	9164	9164	0	0.0
38.6	9102	9101	-1	0.0
39.8	9096	9096	0	0.0
41.0	9020	9020	0	0.0
42.2	9009	9007	-2	0.0
43.4	8949	8949	0	0.0
44.6	8942	8941	-1	0.0
45.8	8940	8940	0	0.0
47.0	8708	8708	0	0.0
48.2	8698	8698	0	0.0
49.4	8633	8633	0	0.0
50.6	8621	8621	0	0.0
51.8	8568	8567	-1	0.0
53.0	8557	8557	0	0.0
54.2	8551	8549	-2	0.0
55.4	8492	8492	0	0.0
56.6	8392	8393	1	0.0
57.8	8306	8314	8	0.1
59.0	8246	8247	1	0.0
60.2	8022	8022	0	0.0
61.4	7951	7970	19	0.2
62.7	7867	7867	0	0.0
63.9	7320	7328	8	0.1
65.1	7160	7160	0	0.0
66.3	6893	7150	257	3.7
67.5	6821	7075	254	3.7
68.7	6798	6885	87	1.3
69.9	6686	6795	109	1.6
71.1	6662	6623	-39	-0.6
72.3	6560	6459	-101	-1.5
73.5	6513	6444	-69	-1.1
74.7	6239	6244	5	0.1
75.9	6109	6121	12	0.2
77.1	5745	6092	347	6.0
78.3	5741	5733	-8	-0.1
79.5	5680	5692	12	0.2
80.7	5545	5548	3	0.1
81.9	5506	5445	-61	-1.1
83.1	5433	5433	0	0.0
84.3	5374	5369	-5	-0.1
85.5	5173	5172	-1	0.0
86.7	5013	4875	-138	-2.8
88.0	4875	4840	-35	-0.7
89.2	4663	4681	18	0.4
90.4	4595	4679	84	1.8
91.6	4404	4595	191	4.3
92.8	3981	3973	-8	-0.2
94.0	3881	3835	-46	-1.2
95.2	3835	3596	-239	-6.2
96.4	3571	3546	-25	-0.7
97.6	3542	3541	-1	0.0
98.8	3246	3246	0	0.0
Min	3246	3246	-239	-6.2
Max	11976	11976	347	6.0
Mean	7926	7933	8	0.1
Median	8627	8627	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		8.5
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	65.0
1.1<=X<10.0		15.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	25635	25635	0	0.0
2.4	24832	24847	15	0.1
3.6	24745	24832	87	0.4
4.8	24723	24723	0	0.0
6.0	24706	24706	0	0.0
7.2	24647	24555	-92	-0.4
8.4	24555	24527	-28	-0.1
9.6	24527	24515	-12	0.0
10.8	24241	24246	5	0.0
12.0	24206	24206	0	0.0
13.3	24200	24179	-21	-0.1
14.5	24096	24096	0	0.0
15.7	24033	24085	52	0.2
16.9	23977	24073	96	0.4
18.1	23953	23950	-3	0.0
19.3	23772	23772	0	0.0
20.5	23437	23454	17	0.1
21.7	23318	23437	119	0.5
22.9	23136	23136	0	0.0
24.1	22941	22940	-1	0.0
25.3	22624	22624	0	0.0
26.5	15117	15118	1	0.0
27.7	14686	14686	0	0.0
28.9	14684	14684	0	0.0
30.1	14682	14682	0	0.0
31.3	14631	14631	0	0.0
32.5	14384	14384	0	0.0
33.7	14070	14070	0	0.0
34.9	13936	13937	1	0.0
36.1	13718	13872	154	1.1
37.3	13464	13464	0	0.0
38.6	13459	13459	0	0.0
39.8	13349	13328	-21	-0.2
41.0	13271	13271	0	0.0
42.2	13041	13041	0	0.0
43.4	12424	12938	514	4.1
44.6	12315	12424	109	0.9
45.8	12244	12318	74	0.6
47.0	9061	9063	2	0.0
48.2	8881	8881	0	0.0
49.4	8783	8789	6	0.1
50.6	8551	8551	0	0.0
51.8	8549	8551	2	0.0
53.0	8474	8477	3	0.0
54.2	8401	8408	7	0.1
55.4	8380	8281	-99	-1.2
56.6	8198	8136	-62	-0.8
57.8	8136	8084	-52	-0.6
59.0	8084	8078	-6	-0.1
60.2	8078	8044	-34	-0.4
61.4	8044	7730	-314	-3.9
62.7	7730	7651	-79	-1.0
63.9	7643	7628	-15	-0.2
65.1	7370	7438	68	0.9
66.3	7044	7174	130	1.8
67.5	6961	7046	85	1.2
68.7	6723	6723	0	0.0
69.9	6399	6713	314	4.9
71.1	6097	6480	383	6.3
72.3	6094	6084	-10	-0.2
73.5	6020	6022	2	0.0
74.7	5694	5665	-29	-0.5
75.9	5685	5524	-161	-2.8
77.1	5443	5477	34	0.6
78.3	5129	5351	222	4.3
79.5	4779	4779	0	0.0
80.7	4642	4655	13	0.3
81.9	4607	4603	-4	-0.1
83.1	4403	4397	-6	-0.1
84.3	4368	4362	-6	-0.1
85.5	4343	4343	0	0.0
86.7	4127	4130	3	0.1
88.0	3485	3484	-1	0.0
89.2	3458	3461	3	0.1
90.4	3293	3293	0	0.0
91.6	3103	3101	-2	-0.1
92.8	3006	3006	0	0.0
94.0	3000	3000	0	0.0
95.2	3000	3000	0	0.0
96.4	3000	3000	0	0.0
97.6	3000	3000	0	0.0
98.8	3000	3000	0	0.0
Min	3000	3000	-314	-3.9
Max	25635	25635	514	6.3
Mean	12220	12238	18	0.2
Median	8667	8670	0	0.0

Entire 82-Year Simulation Period

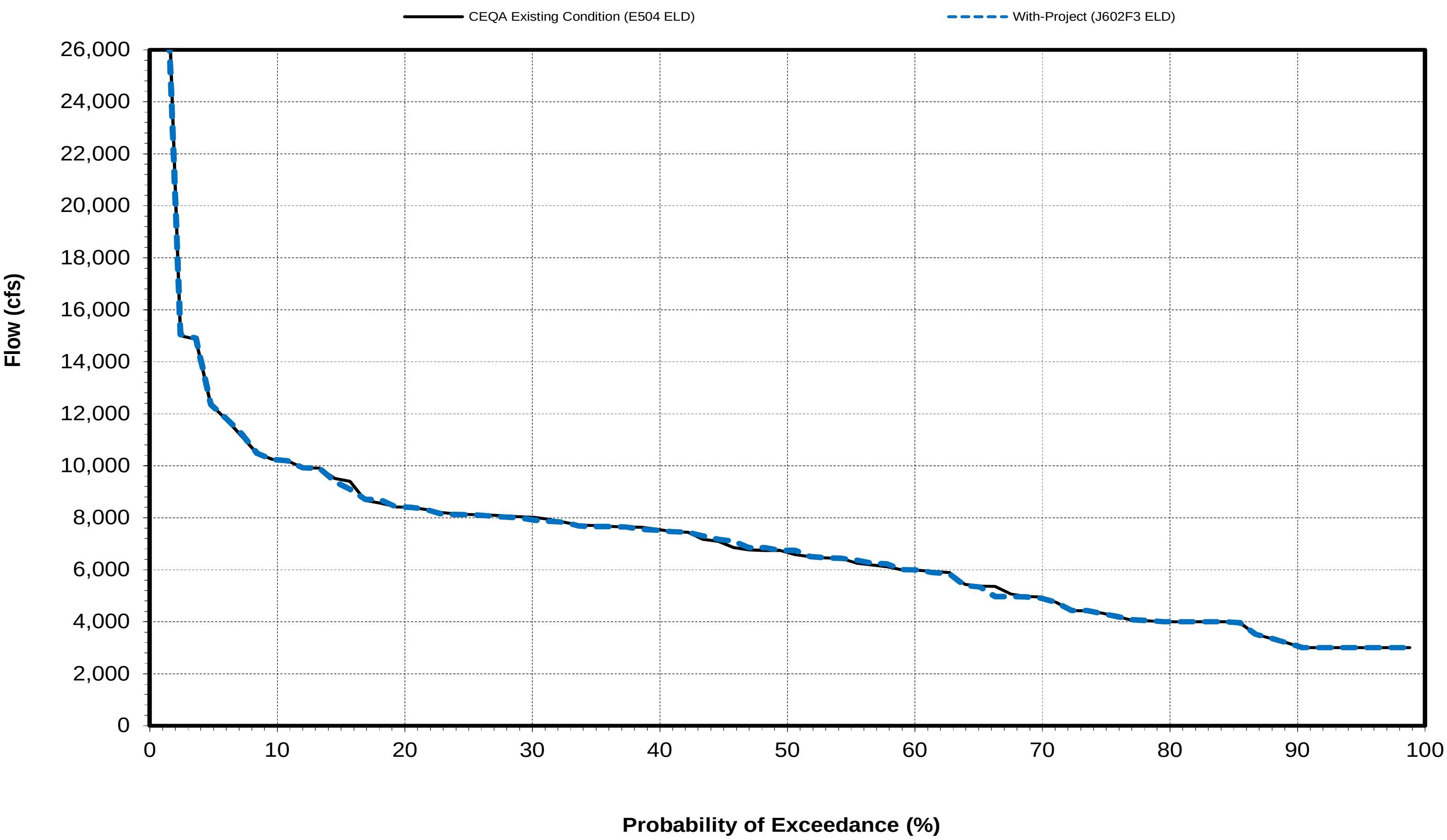
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		8.5
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Rio Vista

October

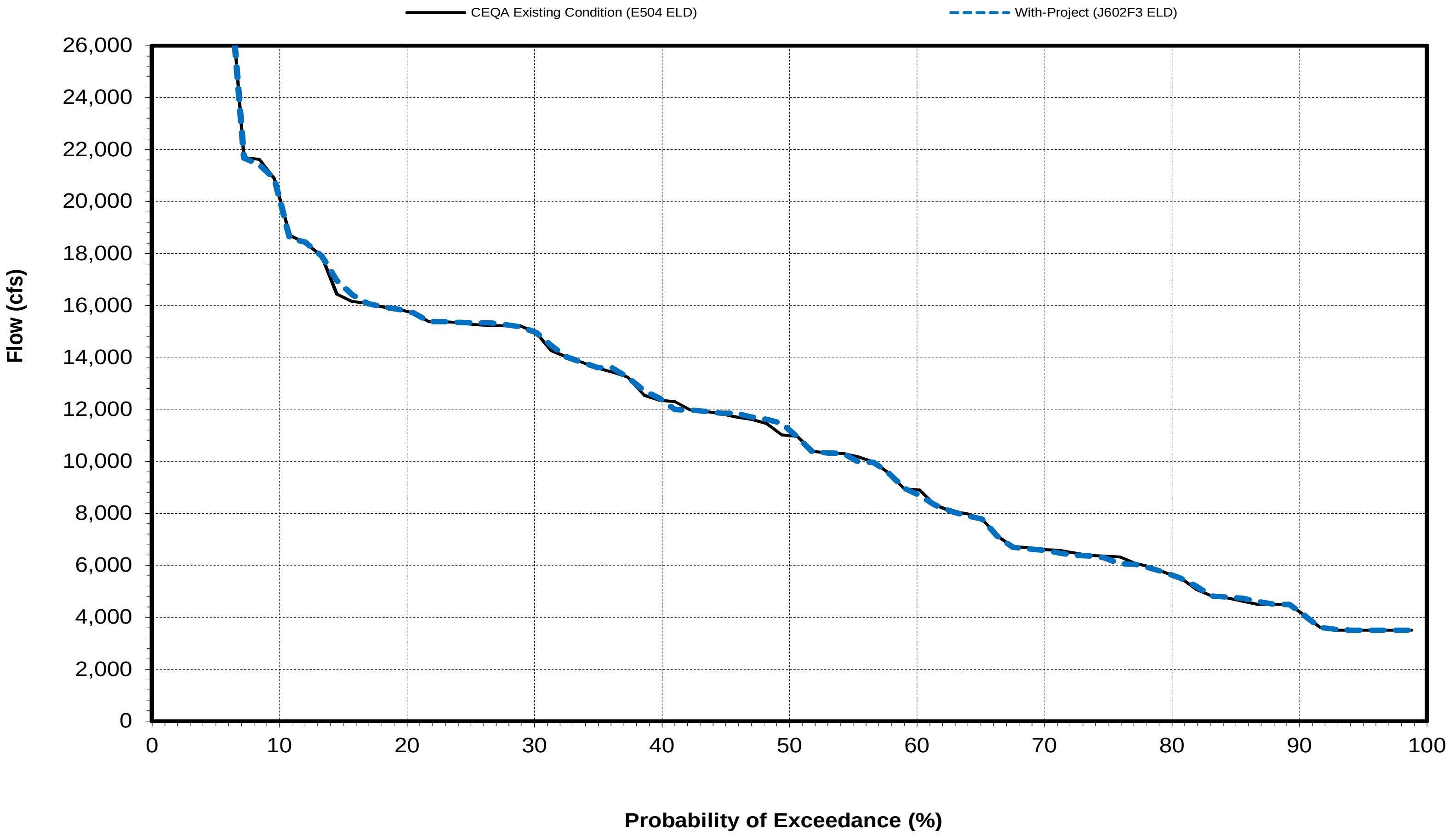


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Rio Vista

November

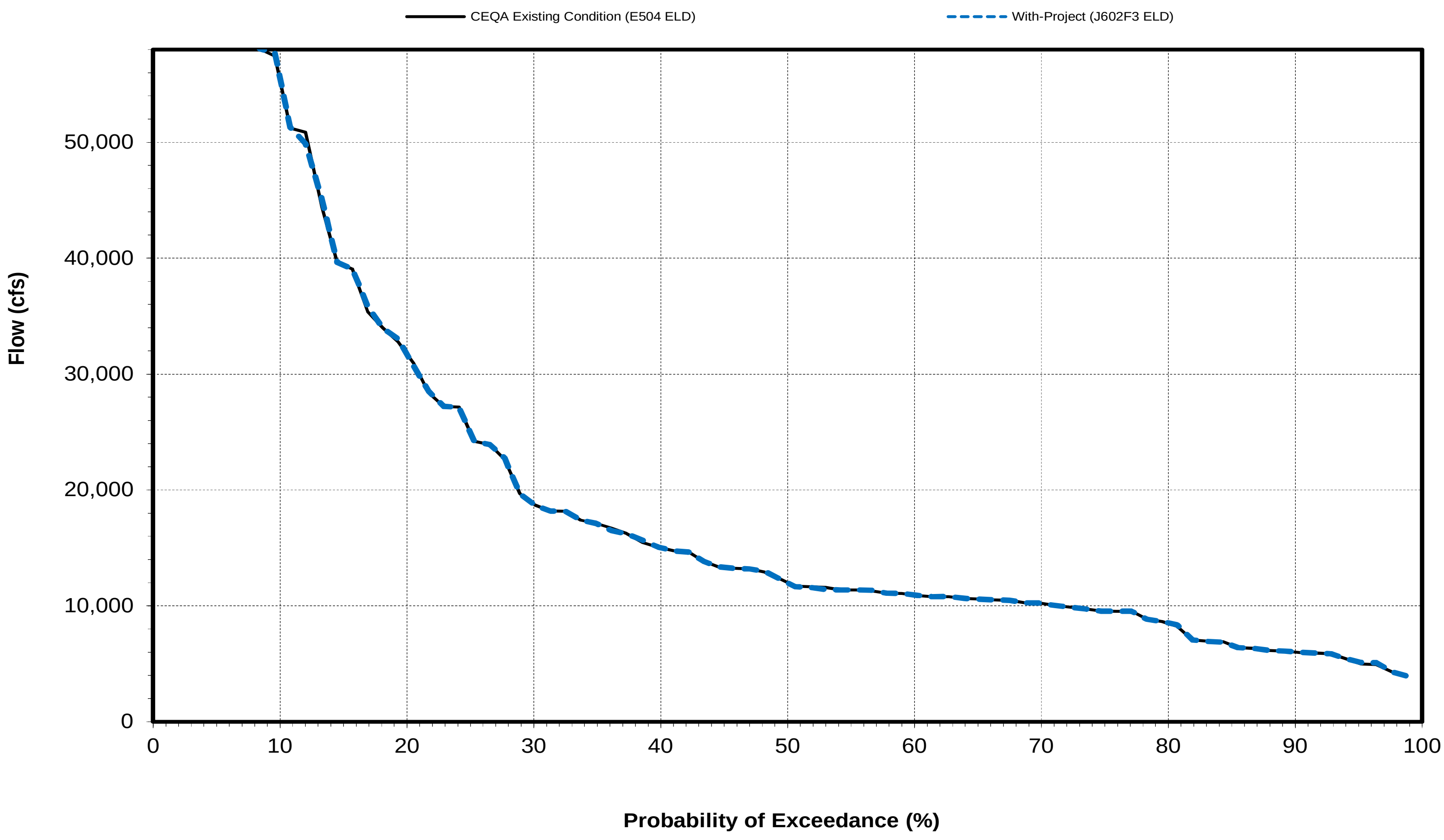


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

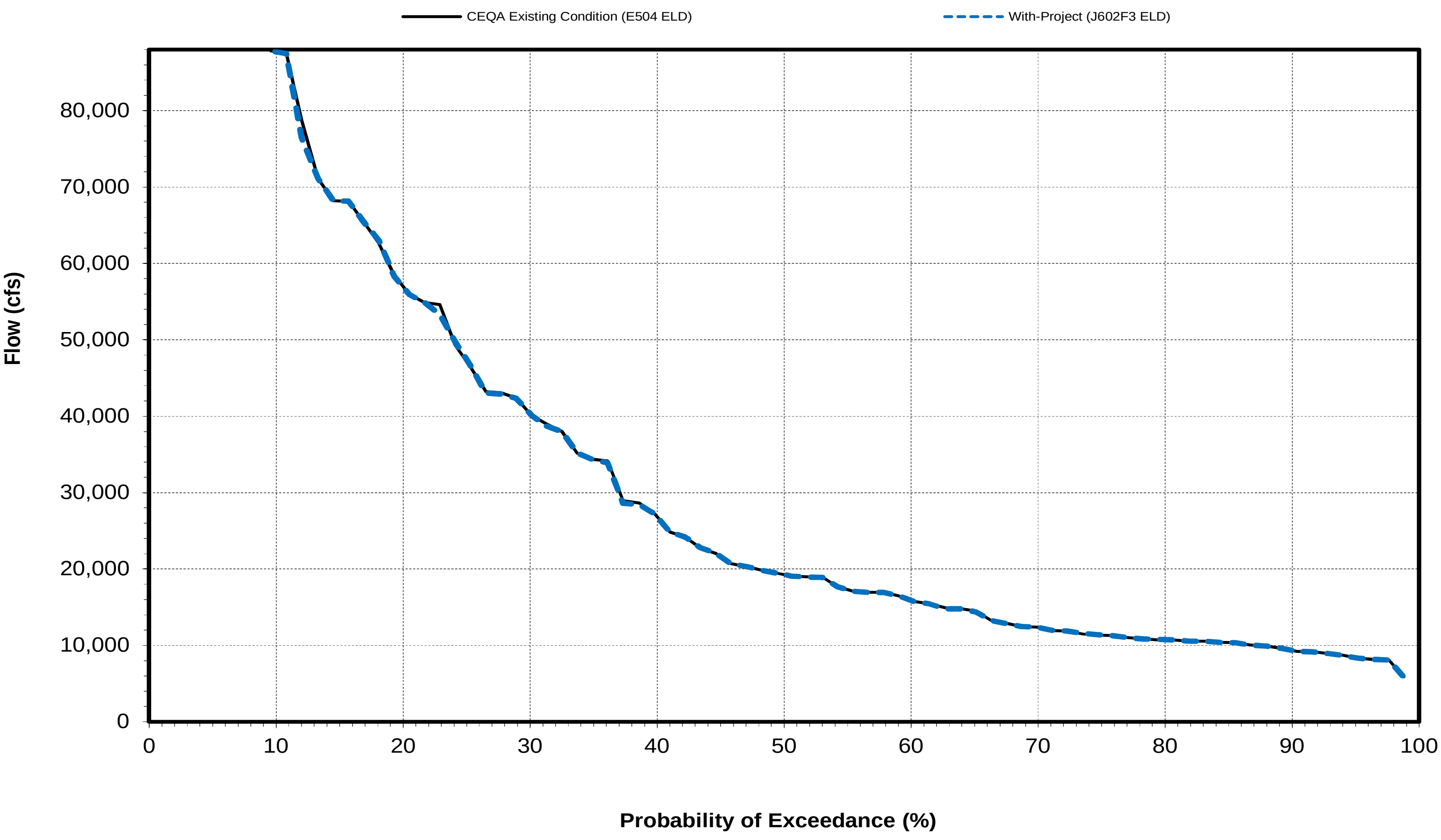
Sacramento River Flow at Rio Vista

December



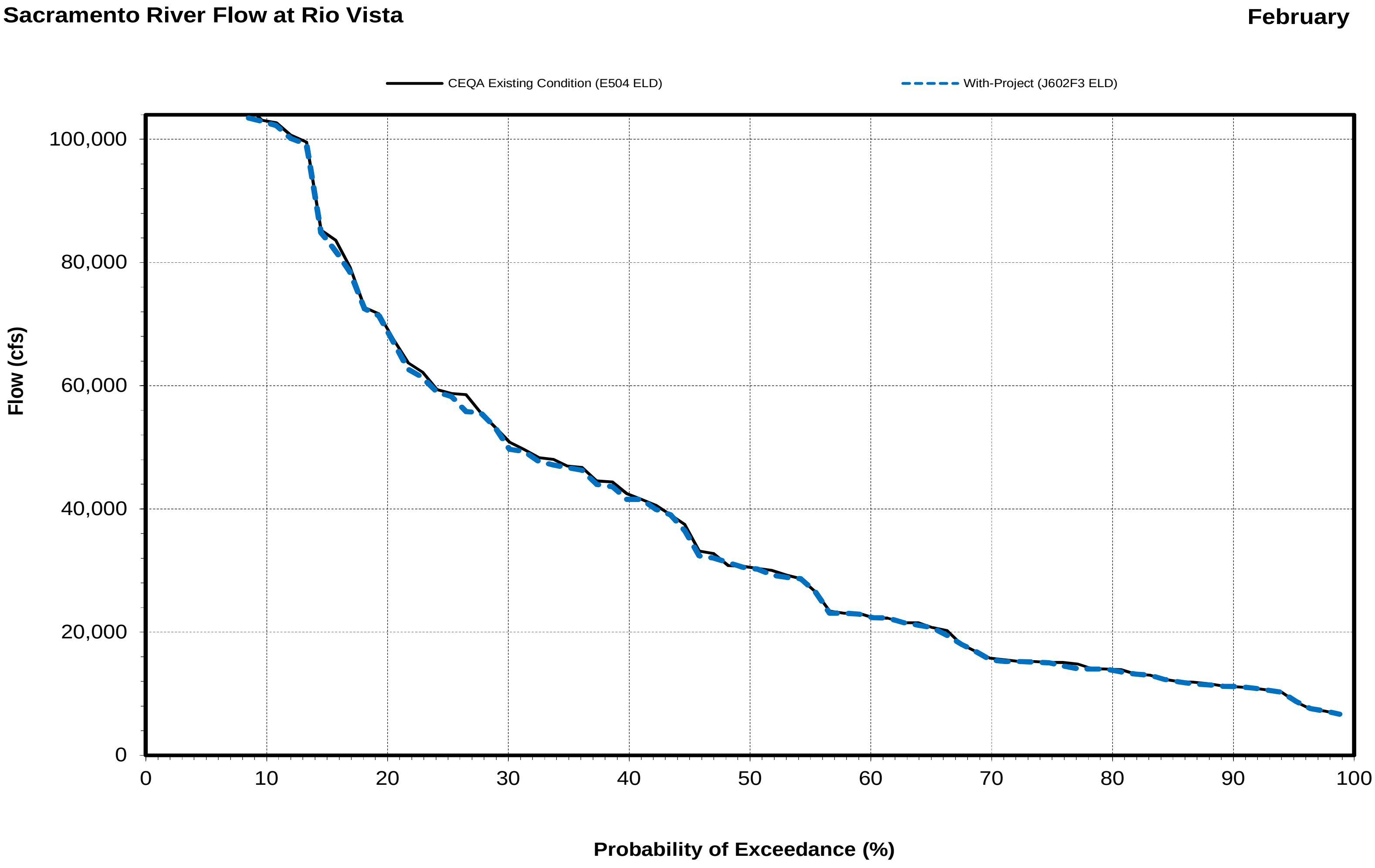
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Rio Vista **January**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

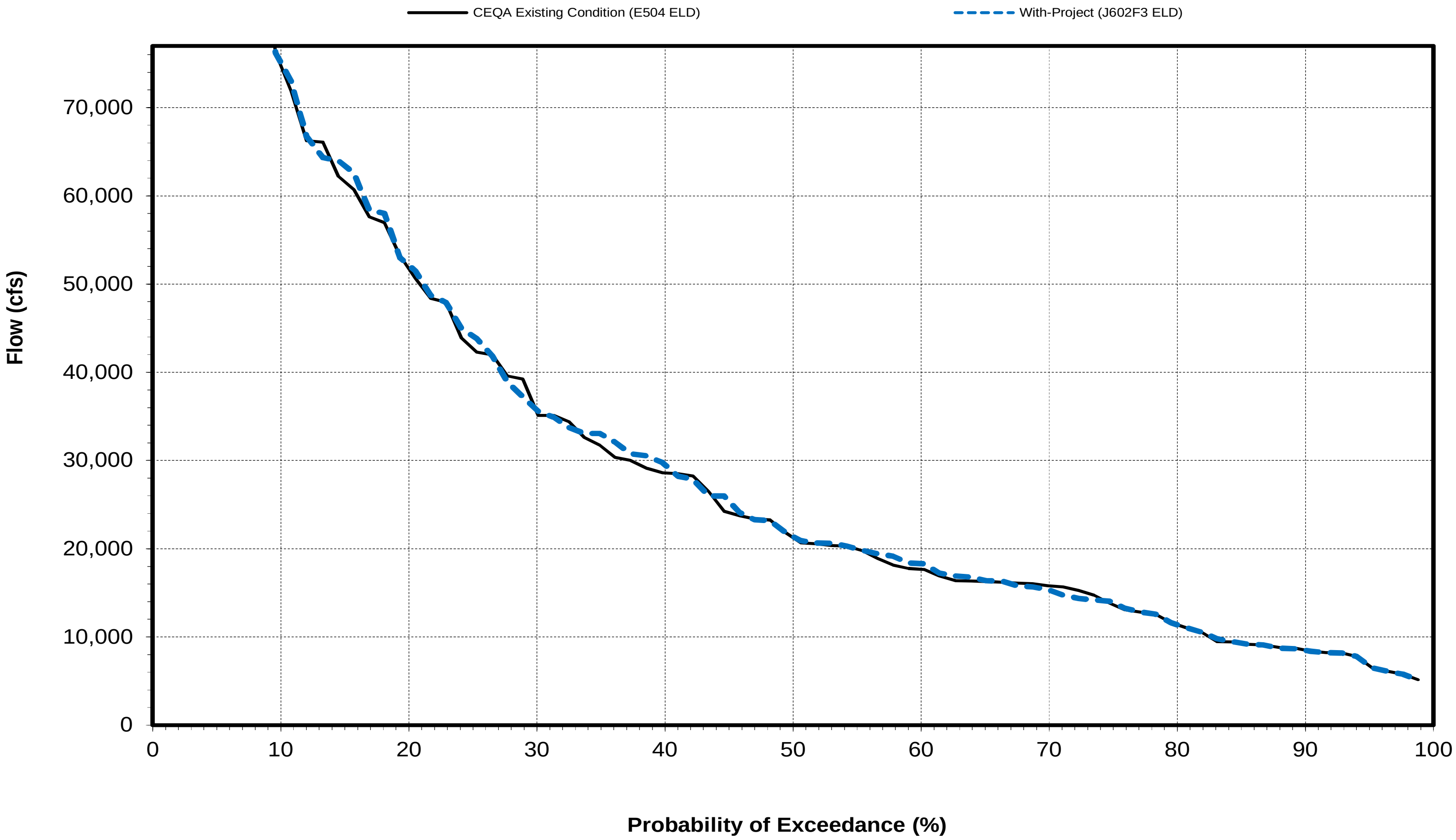
Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

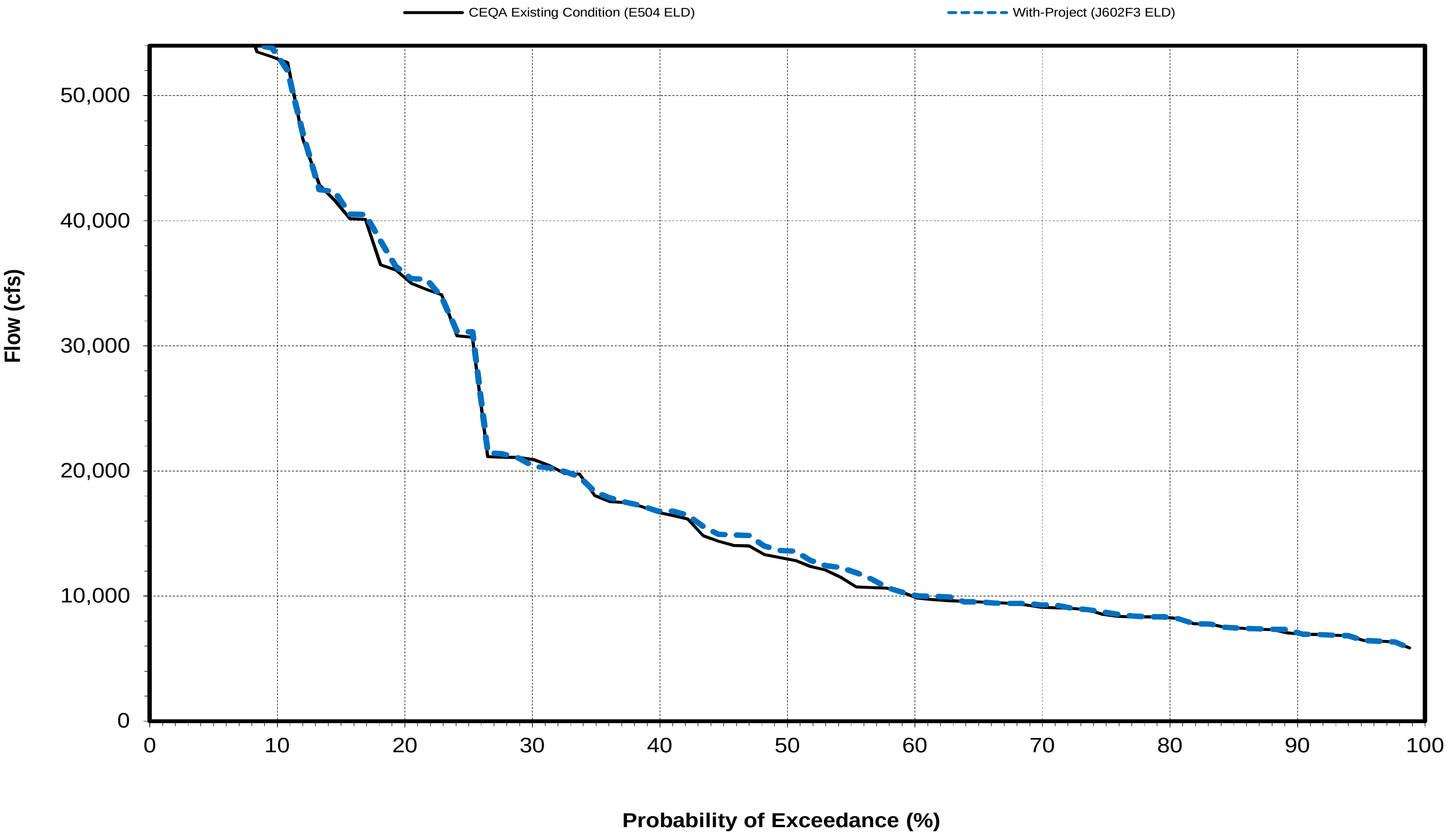
Sacramento River Flow at Rio Vista **March**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Rio Vista

April

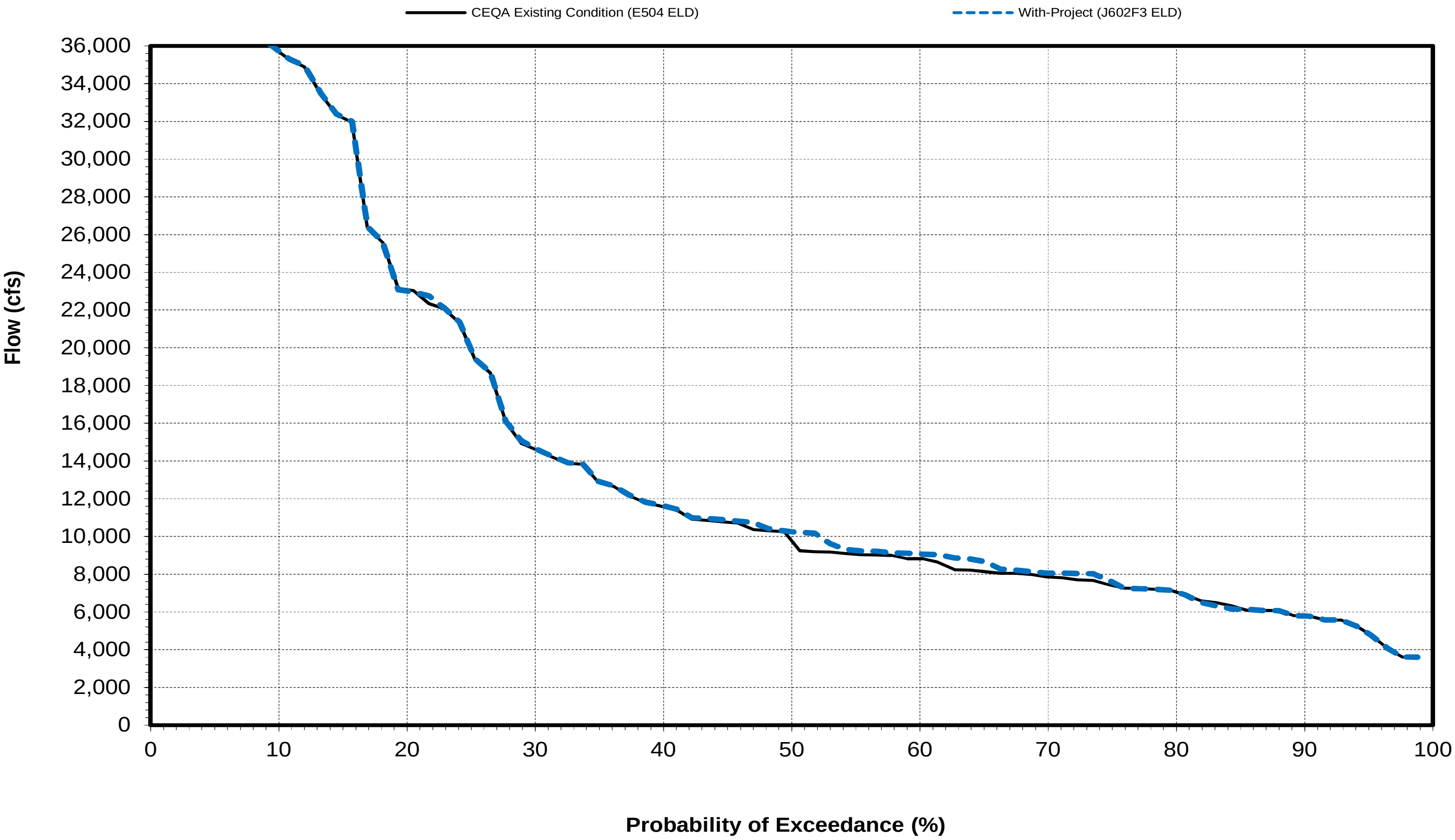


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Rio Vista

May

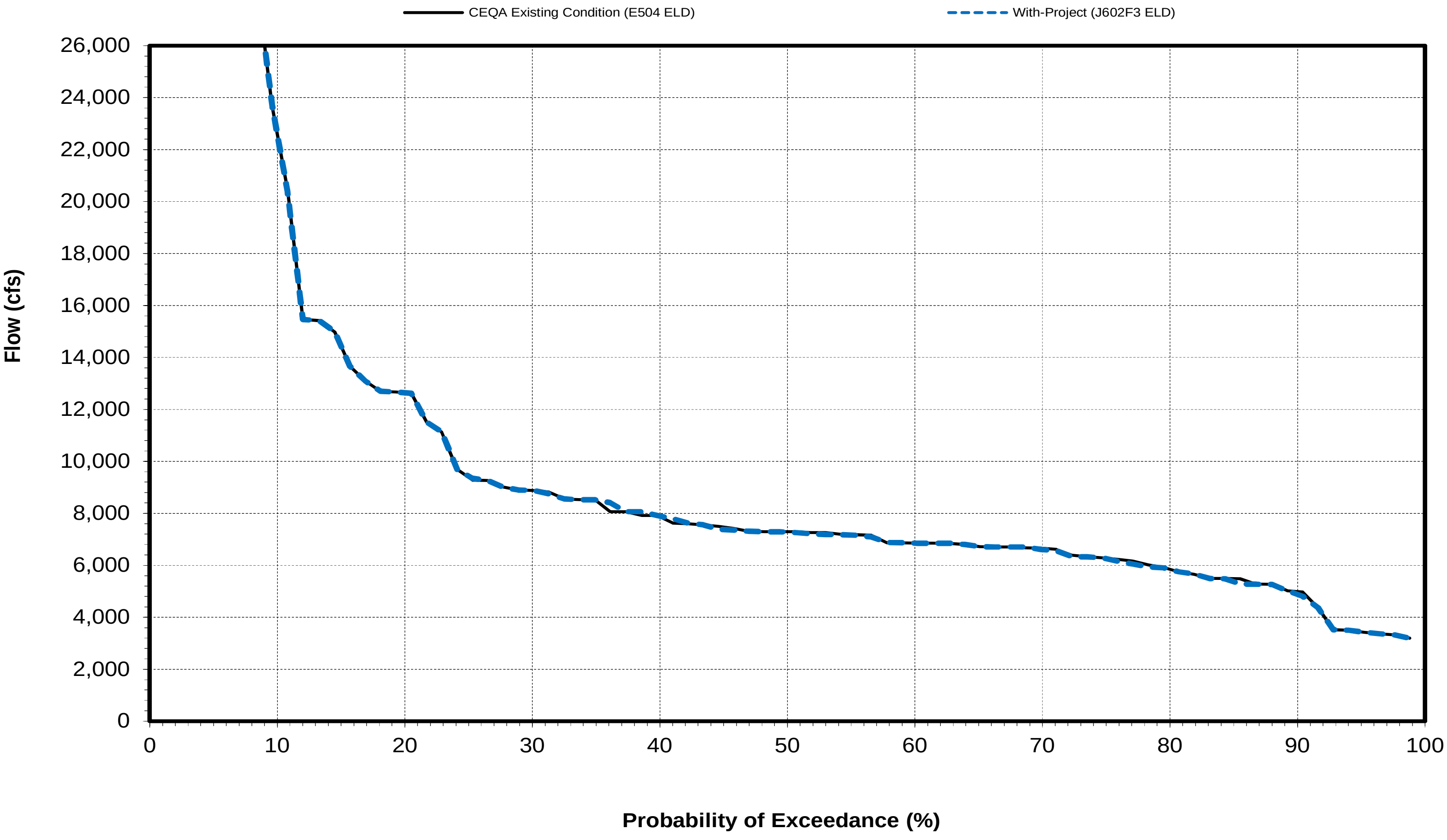


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Rio Vista

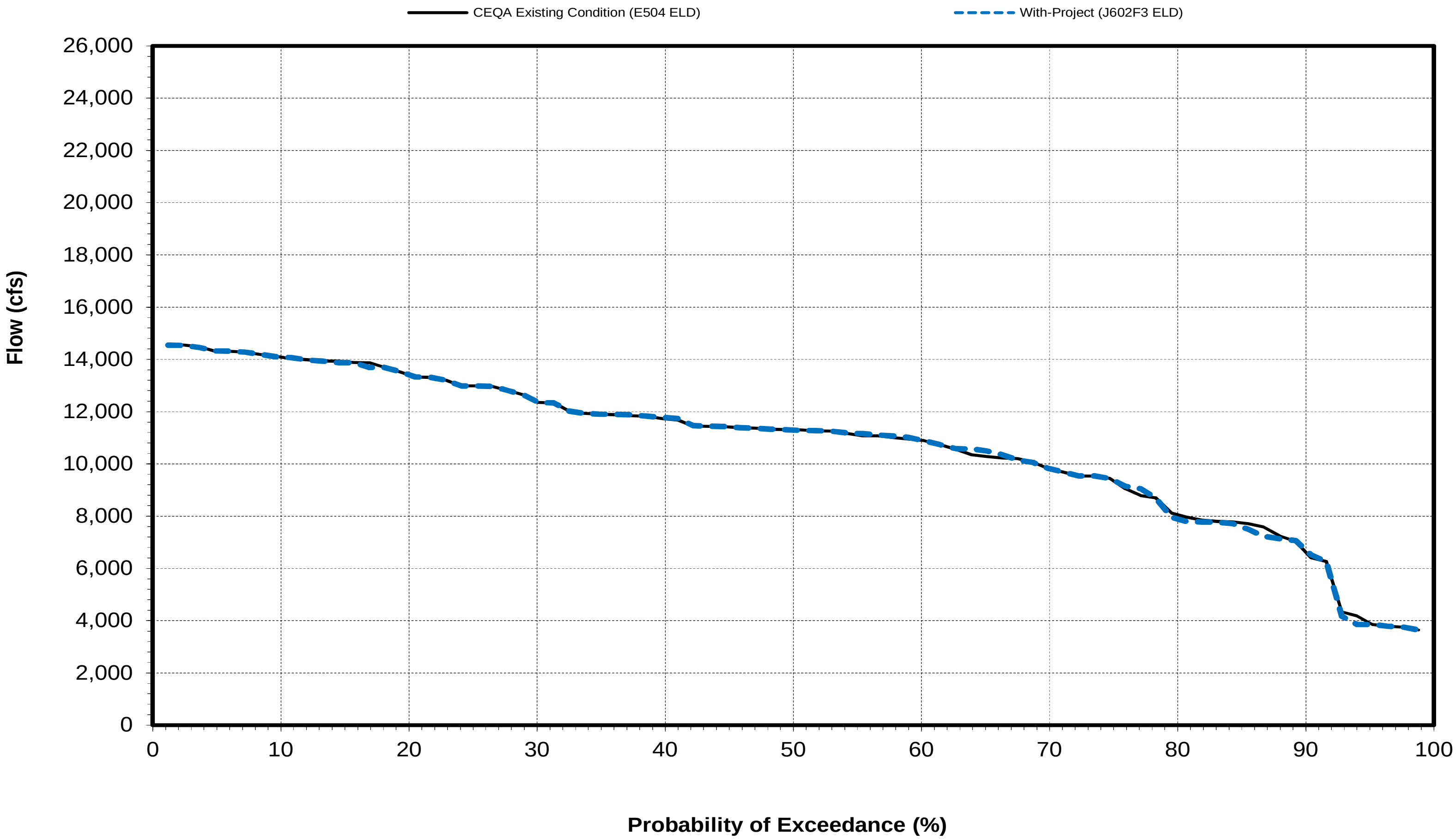
June



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Rio Vista

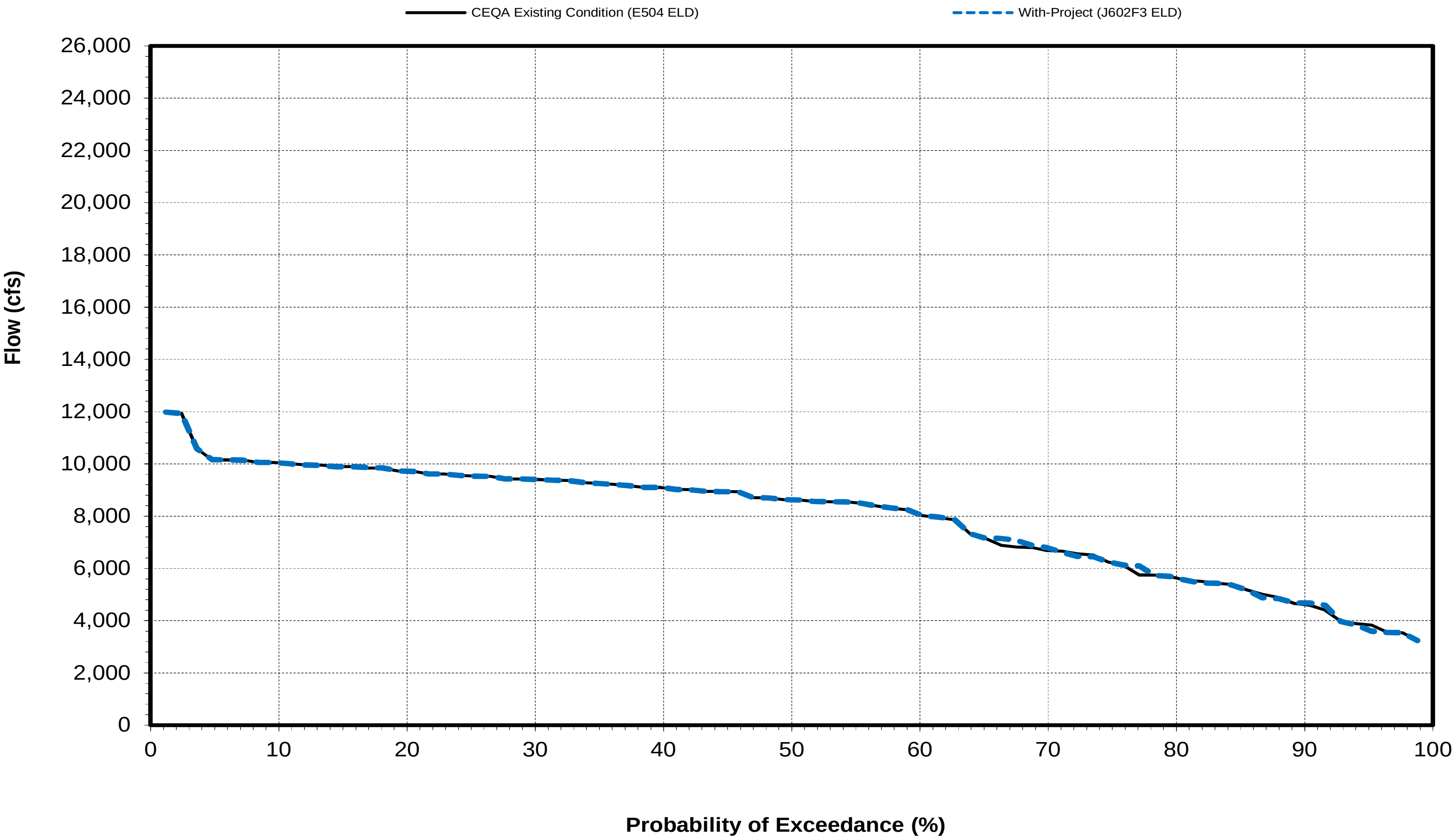
July



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Rio Vista

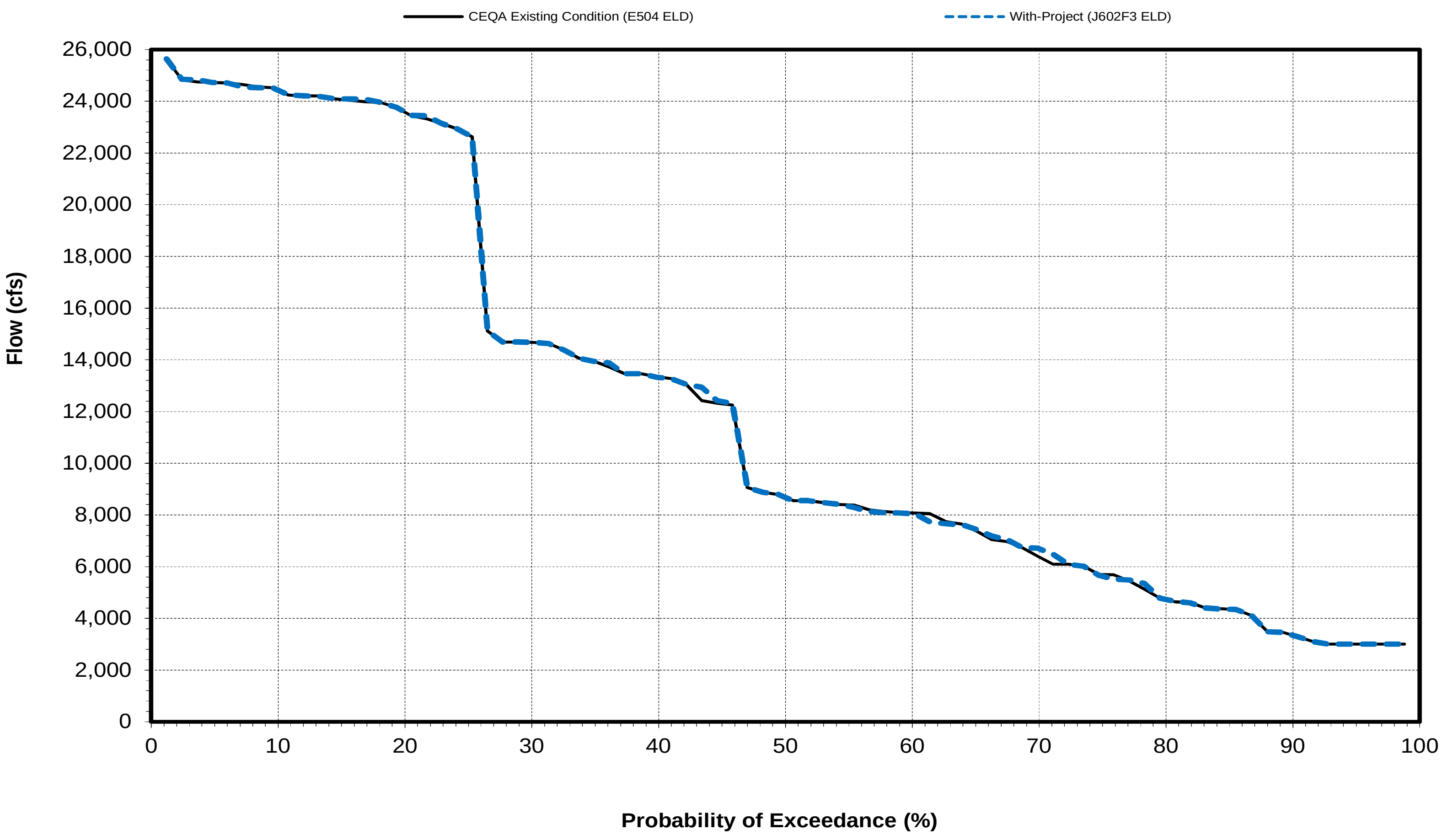
August



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Sacramento River Flow at Rio Vista **September**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Long-term and Water Year Type Average of Oroville Reservoir End of Month Storage Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Average Storage (TAF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period²												
CEQA Existing Condition (E504 ELD)	1,607	1,581	1,691	1,906	2,179	2,426	2,705	2,847	2,749	2,305	2,040	1,731
With-Project (J602F3 ELD)	1,606	1,580	1,690	1,905	2,178	2,425	2,704	2,844	2,745	2,302	2,038	1,730
Difference	-1	-1	-1	-1	-1	-1	-1	-3	-4	-3	-2	-1
Percent Difference³	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1
Water Year Types¹												
Wet												
CEQA Existing Condition (E504 ELD)	1,885	1,898	2,241	2,521	2,822	2,938	3,303	3,508	3,486	3,137	2,943	2,447
With-Project (J602F3 ELD)	1,884	1,897	2,241	2,519	2,822	2,938	3,303	3,508	3,486	3,137	2,943	2,447
Difference	-1	-1	0	-2	0	0	0	0	0	0	0	0
Percent Difference	-0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	1,521	1,526	1,606	2,016	2,437	2,903	3,271	3,486	3,391	2,825	2,411	1,964
With-Project (J602F3 ELD)	1,522	1,527	1,606	2,016	2,437	2,903	3,271	3,486	3,392	2,826	2,412	1,965
Difference	1	1	0	0	0	0	0	0	1	1	1	1
Percent Difference	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Below Normal												
CEQA Existing Condition (E504 ELD)	1,647	1,575	1,565	1,773	2,082	2,373	2,753	2,981	2,875	2,291	1,826	1,550
With-Project (J602F3 ELD)	1,640	1,571	1,559	1,767	2,075	2,366	2,746	2,963	2,858	2,275	1,812	1,544
Difference	-7	-4	-6	-6	-7	-7	-7	-18	-17	-16	-14	-6
Percent Difference	-0.4	-0.3	-0.4	-0.3	-0.3	-0.3	-0.3	-0.6	-0.6	-0.7	-0.8	-0.4
Dry												
CEQA Existing Condition (E504 ELD)	1,423	1,383	1,367	1,468	1,686	2,011	2,210	2,258	2,068	1,556	1,343	1,196
With-Project (J602F3 ELD)	1,425	1,386	1,370	1,470	1,690	2,015	2,214	2,261	2,068	1,557	1,346	1,196
Difference	2	3	3	2	4	4	4	3	0	1	3	0
Percent Difference	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.0	0.1	0.2	0.0
Critical												
CEQA Existing Condition (E504 ELD)	1,322	1,253	1,220	1,279	1,380	1,522	1,527	1,501	1,381	1,121	1,009	960
With-Project (J602F3 ELD)	1,318	1,249	1,216	1,275	1,379	1,519	1,523	1,498	1,379	1,118	1,006	958
Difference	-4	-4	-4	-4	-1	-3	-4	-3	-2	-3	-3	-2
Percent Difference	-0.3	-0.3	-0.3	-0.3	-0.1	-0.2	-0.3	-0.2	-0.1	-0.3	-0.3	-0.2

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

Oroville Reservoir End of Month Storage - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3163	3163	0	0.0
2.4	3154	3154	0	0.0
3.6	3097	3097	0	0.0
4.8	2941	2941	0	0.0
6.0	2785	2785	0	0.0
7.2	2737	2737	0	0.0
8.4	2581	2581	0	0.0
9.6	2574	2574	0	0.0
10.8	2502	2502	0	0.0
12.0	2493	2493	0	0.0
13.3	2396	2399	3	0.1
14.5	2312	2312	0	0.0
15.7	2293	2293	0	0.0
16.9	2289	2289	0	0.0
18.1	2271	2271	0	0.0
19.3	2249	2248	-1	0.0
20.5	2196	2196	0	0.0
21.7	2163	2164	1	0.0
22.9	2094	2094	0	0.0
24.1	2087	2087	0	0.0
25.3	2033	2033	0	0.0
26.5	2011	2009	-2	-0.1
27.7	2006	2006	0	0.0
28.9	1871	1870	-1	-0.1
30.1	1852	1819	-33	-1.8
31.3	1818	1818	0	0.0
32.5	1729	1729	0	0.0
33.7	1717	1717	0	0.0
34.9	1701	1710	9	0.5
36.1	1701	1686	-15	-0.9
37.3	1680	1675	-5	-0.3
38.6	1645	1642	-3	-0.2
39.8	1641	1641	0	0.0
41.0	1641	1637	-4	-0.2
42.2	1623	1624	1	0.1
43.4	1585	1584	-1	-0.1
44.6	1581	1580	-1	-0.1
45.8	1546	1546	0	0.0
47.0	1531	1530	-1	-0.1
48.2	1505	1515	10	0.7
49.4	1491	1493	2	0.1
50.6	1473	1479	6	0.4
51.8	1422	1390	-32	-2.3
53.0	1387	1375	-12	-0.9
54.2	1375	1363	-12	-0.9
55.4	1363	1358	-5	-0.4
56.6	1330	1311	-19	-1.4
57.8	1308	1308	0	0.0
59.0	1269	1299	30	2.4
60.2	1265	1266	1	0.1
61.4	1248	1248	0	0.0
62.7	1248	1248	0	0.0
63.9	1248	1248	0	0.0
65.1	1248	1248	0	0.0
66.3	1230	1228	-2	-0.2
67.5	1218	1209	-9	-0.7
68.7	1209	1166	-43	-3.6
69.9	1168	1163	-5	-0.4
71.1	1155	1155	0	0.0
72.3	1151	1151	0	0.0
73.5	1125	1131	6	0.5
74.7	1123	1123	0	0.0
75.9	1104	1104	0	0.0
77.1	1103	1102	-1	-0.1
78.3	1067	1092	25	2.3
79.5	1054	1068	14	1.3
80.7	1048	1048	0	0.0
81.9	1038	1036	-2	-0.2
83.1	1037	1035	-2	-0.2
84.3	1028	1028	0	0.0
85.5	1016	1018	2	0.2
86.7	989	990	1	0.1
88.0	953	953	0	0.0
89.2	932	936	4	0.4
90.4	930	930	0	0.0
91.6	924	924	0	0.0
92.8	878	860	-18	-2.1
94.0	873	848	-25	-2.9
95.2	799	799	0	0.0
96.4	791	791	0	0.0
97.6	756	756	0	0.0
98.8	637	640	3	0.5
Min	637	640	-43	-3.6
Max	3163	3163	30	2.4
Mean	1607	1606	-2	-0.1
Median	1482	1486	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3008	3008	0	0.0
2.4	2981	2981	0	0.0
3.6	2950	2950	0	0.0
4.8	2835	2835	0	0.0
6.0	2694	2694	0	0.0
7.2	2639	2639	0	0.0
8.4	2529	2529	0	0.0
9.6	2479	2479	0	0.0
10.8	2439	2439	0	0.0
12.0	2410	2410	0	0.0
13.3	2398	2398	0	0.0
14.5	2352	2355	3	0.1
15.7	2268	2269	1	0.0
16.9	2242	2242	0	0.0
18.1	2202	2202	0	0.0
19.3	2191	2191	0	0.0
20.5	2185	2186	1	0.0
21.7	2175	2156	-19	-0.9
22.9	2098	2098	0	0.0
24.1	2096	2096	0	0.0
25.3	2082	2082	0	0.0
26.5	2012	2012	0	0.0
27.7	1979	1979	0	0.0
28.9	1951	1953	2	0.1
30.1	1936	1934	-2	-0.1
31.3	1895	1895	0	0.0
32.5	1862	1829	-33	-1.8
33.7	1780	1789	9	0.5
34.9	1766	1765	-1	-0.1
36.1	1766	1763	-3	-0.2
37.3	1705	1704	-1	-0.1
38.6	1628	1628	0	0.0
39.8	1619	1615	-4	-0.2
41.0	1607	1607	0	0.0
42.2	1581	1576	-5	-0.3
43.4	1547	1553	6	0.4
44.6	1524	1524	0	0.0
45.8	1491	1490	-1	-0.1
47.0	1477	1475	-2	-0.1
48.2	1475	1461	-14	-0.9
49.4	1407	1413	6	0.4
50.6	1404	1407	3	0.2
51.8	1395	1395	0	0.0
53.0	1381	1379	-2	-0.1
54.2	1343	1346	3	0.2
55.4	1336	1335	-1	-0.1
56.6	1322	1322	0	0.0
57.8	1252	1251	-1	-0.1
59.0	1251	1251	0	0.0
60.2	1241	1247	6	0.5
61.4	1234	1241	7	0.6
62.7	1219	1234	15	1.2
63.9	1213	1213	0	0.0
65.1	1206	1211	5	0.4
66.3	1206	1206	0	0.0
67.5	1160	1162	2	0.2
68.7	1159	1159	0	0.0
69.9	1129	1130	1	0.1
71.1	1126	1087	-39	-3.5
72.3	1087	1087	0	0.0
73.5	1087	1078	-9	-0.8
74.7	1068	1067	-1	-0.1
75.9	1043	1038	-5	-0.5
77.1	1038	1036	-2	-0.2
78.3	1030	1031	1	0.1
79.5	1020	1020	0	0.0
80.7	1003	1004	1	0.1
81.9	982	982	0	0.0
83.1	962	962	0	0.0
84.3	962	961	-1	-0.1
85.5	957	960	3	0.3
86.7	942	959	17	1.8
88.0	941	942	1	0.1
89.2	936	941	5	0.5
90.4	924	938	14	1.5
91.6	922	910	-12	-1.3
92.8	910	904	-6	-0.7
94.0	900	883	-17	-1.9
95.2	865	863	-2	-0.2
96.4	788	788	0	0.0
97.6	778	778	0	0.0
98.8	662	665	3	0.5
Min	662	665	-39	-3.5
Max	3008	3008	17	1.8
Mean	1581	1580	-1	-0.1
Median	1406	1410	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	91.5
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3107	3107	0	0.0
2.4	2987	2987	0	0.0
3.6	2930	2930	0	0.0
4.8	2846	2846	0	0.0
6.0	2806	2806	0	0.0
7.2	2800	2800	0	0.0
8.4	2788	2788	0	0.0
9.6	2788	2788	0	0.0
10.8	2788	2788	0	0.0
12.0	2788	2788	0	0.0
13.3	2766	2768	2	0.1
14.5	2540	2540	0	0.0
15.7	2511	2511	0	0.0
16.9	2487	2487	0	0.0
18.1	2414	2414	0	0.0
19.3	2372	2410	38	1.6
20.5	2266	2266	0	0.0
21.7	2246	2246	0	0.0
22.9	2227	2227	0	0.0
24.1	2194	2197	3	0.1
25.3	2152	2139	-13	-0.6
26.5	2139	2119	-20	-0.9
27.7	2116	2116	0	0.0
28.9	2042	2043	1	0.0
30.1	1994	1999	5	0.3
31.3	1992	1988	-4	-0.2
32.5	1987	1985	-2	-0.1
33.7	1935	1935	0	0.0
34.9	1869	1869	0	0.0
36.1	1850	1849	-1	-0.1
37.3	1847	1844	-3	-0.2
38.6	1813	1813	0	0.0
39.8	1762	1760	-2	-0.1
41.0	1757	1760	3	0.2
42.2	1754	1757	3	0.2
43.4	1747	1756	9	0.5
44.6	1738	1734	-4	-0.2
45.8	1704	1701	-3	-0.2
47.0	1699	1697	-2	-0.1
48.2	1650	1649	-1	-0.1
49.4	1604	1603	-1	-0.1
50.6	1546	1547	1	0.1
51.8	1497	1497	0	0.0
53.0	1455	1455	0	0.0
54.2	1429	1438	9	0.6
55.4	1373	1373	0	0.0
56.6	1363	1365	2	0.1
57.8	1326	1325	-1	-0.1
59.0	1268	1268	0	0.0
60.2	1253	1253	0	0.0
61.4	1253	1253	0	0.0
62.7	1253	1253	0	0.0
63.9	1252	1252	0	0.0
65.1	1252	1252	0	0.0
66.3	1252	1252	0	0.0
67.5	1246	1247	1	0.1
68.7	1214	1214	0	0.0
69.9	1214	1214	0	0.0
71.1	1201	1201	0	0.0
72.3	1177	1182	5	0.4
73.5	1151	1161	10	0.9
74.7	1148	1149	1	0.1
75.9	1136	1136	0	0.0
77.1	1100	1100	0	0.0
78.3	1077	1081	4	0.4
79.5	1072	1069	-3	-0.3
80.7	1069	1040	-29	-2.7
81.9	1037	1031	-6	-0.6
83.1	1036	1020	-16	-1.5
84.3	1009	1009	0	0.0
85.5	1008	1009	1	0.1
86.7	1004	1005	1	0.1
88.0	990	990	0	0.0
89.2	986	978	-8	-0.8
90.4	978	951	-27	-2.8
91.6	951	928	-23	-2.4
92.8	929	927	-2	-0.2
94.0	910	908	-2	-0.2
95.2	896	898	2	0.2
96.4	884	889	5	0.6
97.6	867	870	3	0.3
98.8	805	818	13	1.6
Min	805	818	-29	-2.8
Max	3107	3107	38	1.6
Mean	1691	1690	-1	-0.1
Median	1575	1575	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	92.7
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3091	3091	0	0.0
2.4	2943	2943	0	0.0
3.6	2870	2870	0	0.0
4.8	2854	2854	0	0.0
6.0	2846	2846	0	0.0
7.2	2809	2809	0	0.0
8.4	2788	2788	0	0.0
9.6	2788	2788	0	0.0
10.8	2788	2788	0	0.0
12.0	2788	2788	0	0.0
13.3	2788	2788	0	0.0
14.5	2788	2788	0	0.0
15.7	2788	2788	0	0.0
16.9	2788	2788	0	0.0
18.1	2787	2787	0	0.0
19.3	2642	2642	0	0.0
20.5	2546	2547	1	0.0
21.7	2507	2507	0	0.0
22.9	2476	2472	-4	-0.2
24.1	2467	2451	-16	-0.6
25.3	2451	2434	-17	-0.7
26.5	2434	2434	0	0.0
27.7	2434	2429	-5	-0.2
28.9	2376	2377	1	0.0
30.1	2361	2367	6	0.3
31.3	2336	2336	0	0.0
32.5	2325	2325	0	0.0
33.7	2297	2297	0	0.0
34.9	2265	2268	3	0.1
36.1	2247	2253	6	0.3
37.3	2240	2240	0	0.0
38.6	2176	2177	1	0.0
39.8	2146	2144	-2	-0.1
41.0	2128	2128	0	0.0
42.2	2127	2128	1	0.0
43.4	2125	2123	-2	-0.1
44.6	2017	2017	0	0.0
45.8	2002	2000	-2	-0.1
47.0	1990	1990	0	0.0
48.2	1989	1989	0	0.0
49.4	1961	1961	0	0.0
50.6	1899	1896	-3	-0.2
51.8	1869	1878	9	0.5
53.0	1782	1782	0	0.0
54.2	1735	1737	2	0.1
55.4	1710	1706	-4	-0.2
56.6	1686	1686	0	0.0
57.8	1621	1605	-16	-1.0
59.0	1525	1535	10	0.7
60.2	1524	1524	0	0.0
61.4	1513	1513	0	0.0
62.7	1498	1498	0	0.0
63.9	1492	1492	0	0.0
65.1	1456	1456	0	0.0
66.3	1399	1397	-2	-0.1
67.5	1388	1390	2	0.1
68.7	1364	1362	-2	-0.1
69.9	1327	1327	0	0.0
71.1	1305	1305	0	0.0
72.3	1301	1296	-5	-0.4
73.5	1271	1271	0	0.0
74.7	1254	1256	2	0.2
75.9	1253	1253	0	0.0
77.1	1253	1253	0	0.0
78.3	1253	1253	0	0.0
79.5	1253	1253	0	0.0
80.7	1237	1237	0	0.0
81.9	1234	1234	0	0.0
83.1	1229	1228	-1	-0.1
84.3	1218	1185	-33	-2.7
85.5	1186	1159	-27	-2.3
86.7	1175	1155	-20	-1.7
88.0	1157	1153	-4	-0.3
89.2	1149	1123	-26	-2.3
90.4	1117	1117	0	0.0
91.6	1111	1113	2	0.2
92.8	1100	1104	4	0.4
94.0	1021	1021	0	0.0
95.2	999	1021	22	2.2
96.4	983	985	2	0.2
97.6	950	950	0	0.0
98.8	942	940	-2	-0.2
Min	942	940	-33	-2.7
Max	3091	3091	22	2.2
Mean	1906	1905	-1	-0.1
Median	1930	1929	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3078	3078	0	0.0
2.4	3059	3059	0	0.0
3.6	3057	3057	0	0.0
4.8	3009	3009	0	0.0
6.0	2997	2997	0	0.0
7.2	2987	2987	0	0.0
8.4	2962	2962	0	0.0
9.6	2952	2952	0	0.0
10.8	2925	2925	0	0.0
12.0	2890	2890	0	0.0
13.3	2839	2839	0	0.0
14.5	2832	2832	0	0.0
15.7	2813	2813	0	0.0
16.9	2806	2806	0	0.0
18.1	2788	2788	0	0.0
19.3	2788	2788	0	0.0
20.5	2788	2788	0	0.0
21.7	2788	2788	0	0.0
22.9	2788	2788	0	0.0
24.1	2788	2788	0	0.0
25.3	2788	2788	0	0.0
26.5	2788	2788	0	0.0
27.7	2788	2788	0	0.0
28.9	2788	2788	0	0.0
30.1	2788	2788	0	0.0
31.3	2788	2788	0	0.0
32.5	2788	2788	0	0.0
33.7	2787	2787	0	0.0
34.9	2736	2736	0	0.0
36.1	2606	2606	0	0.0
37.3	2576	2576	0	0.0
38.6	2569	2569	0	0.0
39.8	2466	2467	1	0.0
41.0	2444	2444	0	0.0
42.2	2420	2420	0	0.0
43.4	2416	2417	1	0.0
44.6	2409	2409	0	0.0
45.8	2396	2398	2	0.1
47.0	2395	2394	-1	0.0
48.2	2395	2378	-17	-0.7
49.4	2353	2351	-2	-0.1
50.6	2329	2328	-1	0.0
51.8	2328	2327	-1	0.0
53.0	2288	2288	0	0.0
54.2	2269	2267	-2	-0.1
55.4	2243	2245	2	0.1
56.6	2097	2097	0	0.0
57.8	2089	2086	-3	-0.1
59.0	2002	2005	3	0.1
60.2	1996	2002	6	0.3
61.4	1848	1846	-2	-0.1
62.7	1819	1816	-3	-0.2
63.9	1797	1797	0	0.0
65.1	1795	1795	0	0.0
66.3	1721	1755	34	2.0
67.5	1692	1692	0	0.0
68.7	1692	1692	0	0.0
69.9	1682	1682	0	0.0
71.1	1663	1666	3	0.2
72.3	1642	1644	2	0.1
73.5	1613	1622	9	0.6
74.7	1578	1580	2	0.1
75.9	1563	1561	-2	-0.1
77.1	1527	1527	0	0.0
78.3	1451	1451	0	0.0
79.5	1445	1445	0	0.0
80.7	1425	1411	-14	-1.0
81.9	1411	1410	-1	-0.1
83.1	1403	1403	0	0.0
84.3	1374	1359	-15	-1.1
85.5	1359	1354	-5	-0.4
86.7	1354	1348	-6	-0.4
88.0	1348	1310	-38	-2.8
89.2	1269	1269	0	0.0
90.4	1260	1248	-12	-1.0
91.6	1236	1241	5	0.4
92.8	1201	1204	3	0.2
94.0	1188	1199	11	0.9
95.2	1182	1192	10	0.8
96.4	1136	1136	0	0.0
97.6	966	969	3	0.3
98.8	964	965	1	0.1
Min	964	965	-38	-2.8
Max	3078	3078	34	2.0
Mean	2179	2178	0	0.0
Median	2341	2340	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	96.3
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3163	3163	0	0.0
2.4	3123	3123	0	0.0
3.6	3120	3120	0	0.0
4.8	3105	3105	0	0.0
6.0	3096	3096	0	0.0
7.2	3059	3059	0	0.0
8.4	3058	3058	0	0.0
9.6	3054	3054	0	0.0
10.8	3036	3036	0	0.0
12.0	3028	3028	0	0.0
13.3	3027	3027	0	0.0
14.5	3018	3018	0	0.0
15.7	2999	2999	0	0.0
16.9	2995	2995	0	0.0
18.1	2988	2988	0	0.0
19.3	2976	2973	-3	-0.1
20.5	2964	2964	0	0.0
21.7	2964	2964	0	0.0
22.9	2951	2951	0	0.0
24.1	2944	2944	0	0.0
25.3	2937	2937	0	0.0
26.5	2936	2936	0	0.0
27.7	2927	2927	0	0.0
28.9	2918	2918	0	0.0
30.1	2887	2887	0	0.0
31.3	2885	2885	0	0.0
32.5	2875	2875	0	0.0
33.7	2847	2847	0	0.0
34.9	2833	2833	0	0.0
36.1	2817	2817	0	0.0
37.3	2817	2817	0	0.0
38.6	2816	2814	-2	-0.1
39.8	2797	2797	0	0.0
41.0	2796	2788	-8	-0.3
42.2	2788	2788	0	0.0
43.4	2788	2788	0	0.0
44.6	2788	2788	0	0.0
45.8	2788	2788	0	0.0
47.0	2788	2788	0	0.0
48.2	2788	2788	0	0.0
49.4	2788	2779	-9	-0.3
50.6	2689	2690	1	0.0
51.8	2689	2690	1	0.0
53.0	2647	2646	-1	0.0
54.2	2635	2635	0	0.0
55.4	2622	2620	-2	-0.1
56.6	2569	2569	0	0.0
57.8	2550	2550	0	0.0
59.0	2506	2509	3	0.1
60.2	2466	2466	0	0.0
61.4	2359	2359	0	0.0
62.7	2323	2320	-3	-0.1
63.9	2145	2145	0	0.0
65.1	2141	2138	-3	-0.1
66.3	2122	2131	9	0.4
67.5	2017	2019	2	0.1
68.7	2006	2012	6	0.3
69.9	2001	2003	2	0.1
71.1	1992	2001	9	0.5
72.3	1986	1994	8	0.4
73.5	1977	1988	11	0.6
74.7	1961	1961	0	0.0
75.9	1806	1804	-2	-0.1
77.1	1776	1761	-15	-0.8
78.3	1738	1747	9	0.5
79.5	1706	1705	-1	-0.1
80.7	1677	1677	0	0.0
81.9	1674	1674	0	0.0
83.1	1645	1613	-32	-1.9
84.3	1613	1612	-1	-0.1
85.5	1612	1581	-31	-1.9
86.7	1556	1556	0	0.0
88.0	1544	1544	0	0.0
89.2	1479	1479	0	0.0
90.4	1454	1443	-11	-0.8
91.6	1422	1423	1	0.1
92.8	1418	1402	-16	-1.1
94.0	1401	1399	-2	-0.1
95.2	1309	1310	1	0.1
96.4	1251	1251	0	0.0
97.6	1205	1210	5	0.4
98.8	949	952	3	0.3
Min	949	952	-32	-1.9
Max	3163	3163	11	0.6
Mean	2426	2425	-1	-0.1
Median	2739	2735	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	96.3
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3470	3470	0	0.0
2.4	3456	3456	0	0.0
3.6	3452	3452	0	0.0
4.8	3427	3427	0	0.0
6.0	3417	3417	0	0.0
7.2	3416	3414	-2	-0.1
8.4	3396	3396	0	0.0
9.6	3362	3362	0	0.0
10.8	3362	3362	0	0.0
12.0	3357	3357	0	0.0
13.3	3354	3354	0	0.0
14.5	3352	3352	0	0.0
15.7	3350	3350	0	0.0
16.9	3334	3334	0	0.0
18.1	3305	3305	0	0.0
19.3	3303	3303	0	0.0
20.5	3298	3298	0	0.0
21.7	3295	3295	0	0.0
22.9	3294	3294	0	0.0
24.1	3292	3292	0	0.0
25.3	3292	3292	0	0.0
26.5	3284	3284	0	0.0
27.7	3281	3281	0	0.0
28.9	3277	3277	0	0.0
30.1	3277	3277	0	0.0
31.3	3240	3240	0	0.0
32.5	3238	3238	0	0.0
33.7	3236	3236	0	0.0
34.9	3235	3235	0	0.0
36.1	3234	3234	0	0.0
37.3	3218	3218	0	0.0
38.6	3208	3208	0	0.0
39.8	3208	3208	0	0.0
41.0	3203	3203	0	0.0
42.2	3196	3181	-15	-0.5
43.4	3181	3180	-1	0.0
44.6	3180	3180	0	0.0
45.8	3142	3142	0	0.0
47.0	3138	3138	0	0.0
48.2	3061	3061	0	0.0
49.4	3022	3022	0	0.0
50.6	2996	2997	1	0.0
51.8	2995	2995	0	0.0
53.0	2978	2976	-2	-0.1
54.2	2948	2946	-2	-0.1
55.4	2936	2936	0	0.0
56.6	2855	2856	1	0.0
57.8	2692	2692	0	0.0
59.0	2660	2638	-22	-0.8
60.2	2604	2596	-8	-0.3
61.4	2574	2571	-3	-0.1
62.7	2531	2526	-5	-0.2
63.9	2519	2519	0	0.0
65.1	2512	2514	2	0.1
66.3	2489	2491	2	0.1
67.5	2488	2488	0	0.0
68.7	2430	2433	3	0.1
69.9	2385	2383	-2	-0.1
71.1	2260	2260	0	0.0
72.3	2225	2234	9	0.4
73.5	2204	2204	0	0.0
74.7	2162	2162	0	0.0
75.9	2161	2151	-10	-0.5
77.1	2149	2145	-4	-0.2
78.3	1978	1975	-3	-0.2
79.5	1935	1933	-2	-0.1
80.7	1836	1836	0	0.0
81.9	1828	1828	0	0.0
83.1	1810	1819	9	0.5
84.3	1700	1713	13	0.8
85.5	1692	1700	8	0.5
86.7	1680	1680	0	0.0
88.0	1668	1668	0	0.0
89.2	1649	1649	0	0.0
90.4	1542	1540	-2	-0.1
91.6	1509	1509	0	0.0
92.8	1435	1440	5	0.3
94.0	1435	1435	0	0.0
95.2	1369	1317	-52	-3.8
96.4	1246	1246	0	0.0
97.6	1245	1245	0	0.0
98.8	821	824	3	0.4
Min	821	824	-52	-3.8
Max	3470	3470	13	0.8
Mean	2705	2704	-1	0.0
Median	3009	3010	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3538	3538	0	0.0
2.4	3538	3538	0	0.0
3.6	3538	3538	0	0.0
4.8	3538	3538	0	0.0
6.0	3538	3538	0	0.0
7.2	3538	3538	0	0.0
8.4	3538	3538	0	0.0
9.6	3538	3538	0	0.0
10.8	3538	3538	0	0.0
12.0	3538	3538	0	0.0
13.3	3538	3538	0	0.0
14.5	3538	3538	0	0.0
15.7	3538	3538	0	0.0
16.9	3538	3538	0	0.0
18.1	3538	3538	0	0.0
19.3	3538	3538	0	0.0
20.5	3538	3538	0	0.0
21.7	3538	3538	0	0.0
22.9	3538	3538	0	0.0
24.1	3538	3538	0	0.0
25.3	3538	3538	0	0.0
26.5	3538	3538	0	0.0
27.7	3538	3538	0	0.0
28.9	3538	3538	0	0.0
30.1	3538	3538	0	0.0
31.3	3536	3536	0	0.0
32.5	3531	3531	0	0.0
33.7	3527	3527	0	0.0
34.9	3506	3506	0	0.0
36.1	3504	3504	0	0.0
37.3	3493	3493	0	0.0
38.6	3481	3481	0	0.0
39.8	3413	3413	0	0.0
41.0	3389	3373	-16	-0.5
42.2	3362	3362	0	0.0
43.4	3355	3355	0	0.0
44.6	3346	3346	0	0.0
45.8	3295	3295	0	0.0
47.0	3266	3266	0	0.0
48.2	3233	3233	0	0.0
49.4	3203	3203	0	0.0
50.6	3163	3160	-3	-0.1
51.8	3144	3133	-11	-0.3
53.0	3133	3081	-52	-1.7
54.2	3080	3080	0	0.0
55.4	3060	3058	-2	-0.1
56.6	2978	2978	0	0.0
57.8	2843	2843	0	0.0
59.0	2842	2843	1	0.0
60.2	2815	2817	2	0.1
61.4	2680	2671	-9	-0.3
62.7	2670	2645	-25	-0.9
63.9	2647	2638	-9	-0.3
65.1	2638	2606	-32	-1.2
66.3	2612	2556	-56	-2.1
67.5	2530	2533	3	0.1
68.7	2504	2489	-15	-0.6
69.9	2479	2473	-6	-0.2
71.1	2404	2404	0	0.0
72.3	2403	2403	0	0.0
73.5	2331	2340	9	0.4
74.7	2317	2320	3	0.1
75.9	2221	2221	0	0.0
77.1	2163	2162	-1	0.0
78.3	2053	2054	1	0.0
79.5	2032	2053	21	1.0
80.7	2018	2017	-1	0.0
81.9	1991	2000	9	0.5
83.1	1949	1945	-4	-0.2
84.3	1918	1917	-1	-0.1
85.5	1689	1689	0	0.0
86.7	1667	1667	0	0.0
88.0	1642	1642	0	0.0
89.2	1642	1642	0	0.0
90.4	1524	1524	0	0.0
91.6	1423	1421	-2	-0.1
92.8	1357	1361	4	0.3
94.0	1351	1351	0	0.0
95.2	1318	1299	-19	-1.4
96.4	1294	1266	-28	-2.2
97.6	1244	1244	0	0.0
98.8	763	765	2	0.3
Min	763	765	-56	-2.2
Max	3538	3538	21	1.0
Mean	2847	2844	-3	-0.1
Median	3183	3182	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3538	3538	0	0.0
2.4	3538	3538	0	0.0
3.6	3538	3538	0	0.0
4.8	3538	3538	0	0.0
6.0	3538	3538	0	0.0
7.2	3538	3538	0	0.0
8.4	3538	3538	0	0.0
9.6	3538	3538	0	0.0
10.8	3538	3538	0	0.0
12.0	3538	3538	0	0.0
13.3	3538	3538	0	0.0
14.5	3538	3538	0	0.0
15.7	3538	3538	0	0.0
16.9	3538	3538	0	0.0
18.1	3538	3538	0	0.0
19.3	3538	3538	0	0.0
20.5	3538	3538	0	0.0
21.7	3538	3538	0	0.0
22.9	3538	3538	0	0.0
24.1	3538	3538	0	0.0
25.3	3538	3538	0	0.0
26.5	3538	3538	0	0.0
27.7	3538	3538	0	0.0
28.9	3538	3538	0	0.0
30.1	3538	3538	0	0.0
31.3	3517	3517	0	0.0
32.5	3466	3466	0	0.0
33.7	3426	3410	-16	-0.5
34.9	3396	3392	-4	-0.1
36.1	3381	3381	0	0.0
37.3	3337	3337	0	0.0
38.6	3314	3314	0	0.0
39.8	3297	3295	-2	-0.1
41.0	3293	3293	0	0.0
42.2	3266	3275	9	0.3
43.4	3211	3211	0	0.0
44.6	3208	3207	-1	0.0
45.8	3151	3112	-39	-1.2
47.0	3113	3107	-6	-0.2
48.2	3107	3093	-14	-0.5
49.4	3085	3087	2	0.1
50.6	3046	3049	3	0.1
51.8	3032	3032	0	0.0
53.0	2952	2952	0	0.0
54.2	2875	2877	2	0.1
55.4	2834	2835	1	0.0
56.6	2834	2834	0	0.0
57.8	2821	2822	1	0.0
59.0	2670	2670	0	0.0
60.2	2641	2629	-12	-0.5
61.4	2631	2565	-66	-2.5
62.7	2562	2541	-21	-0.8
63.9	2538	2506	-32	-1.3
65.1	2410	2410	0	0.0
66.3	2393	2389	-4	-0.2
67.5	2260	2269	9	0.4
68.7	2256	2255	-1	0.0
69.9	2224	2243	19	0.9
71.1	2214	2214	0	0.0
72.3	2212	2203	-9	-0.4
73.5	2198	2192	-6	-0.3
74.7	2127	2130	3	0.1
75.9	2089	2089	0	0.0
77.1	2070	2016	-54	-2.6
78.3	1985	1983	-2	-0.1
79.5	1887	1912	25	1.3
80.7	1882	1883	1	0.1
81.9	1814	1814	0	0.0
83.1	1800	1800	0	0.0
84.3	1763	1759	-4	-0.2
85.5	1622	1622	0	0.0
86.7	1506	1506	0	0.0
88.0	1486	1486	0	0.0
89.2	1411	1411	0	0.0
90.4	1249	1248	-1	-0.1
91.6	1248	1242	-6	-0.5
92.8	1242	1242	0	0.0
94.0	1242	1241	-1	-0.1
95.2	1242	1233	-9	-0.7
96.4	1228	1206	-22	-1.8
97.6	1153	1153	0	0.0
98.8	713	716	3	0.4
Min	713	716	-66	-2.6
Max	3538	3538	25	1.3
Mean	2749	2745	-3	-0.1
Median	3066	3068	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	92.7
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3538	3538	0	0.0
2.4	3538	3538	0	0.0
3.6	3538	3538	0	0.0
4.8	3538	3538	0	0.0
6.0	3538	3538	0	0.0
7.2	3413	3413	0	0.0
8.4	3400	3400	0	0.0
9.6	3399	3399	0	0.0
10.8	3327	3327	0	0.0
12.0	3252	3252	0	0.0
13.3	3209	3209	0	0.0
14.5	3207	3207	0	0.0
15.7	3166	3166	0	0.0
16.9	3131	3132	1	0.0
18.1	3131	3131	0	0.0
19.3	3069	3069	0	0.0
20.5	3040	3039	-1	0.0
21.7	3034	3034	0	0.0
22.9	3024	3024	0	0.0
24.1	3020	3020	0	0.0
25.3	3005	3005	0	0.0
26.5	2998	2998	0	0.0
27.7	2986	2985	-1	0.0
28.9	2983	2983	0	0.0
30.1	2966	2966	0	0.0
31.3	2923	2923	0	0.0
32.5	2897	2897	0	0.0
33.7	2862	2846	-16	-0.6
34.9	2782	2778	-4	-0.1
36.1	2775	2775	0	0.0
37.3	2720	2720	0	0.0
38.6	2700	2698	-2	-0.1
39.8	2688	2688	0	0.0
41.0	2677	2677	0	0.0
42.2	2651	2660	9	0.3
43.4	2635	2634	-1	0.0
44.6	2632	2632	0	0.0
45.8	2575	2559	-16	-0.6
47.0	2559	2511	-48	-1.9
48.2	2477	2479	2	0.1
49.4	2475	2473	-2	-0.1
50.6	2459	2467	8	0.3
51.8	2395	2394	-1	0.0
53.0	2321	2323	2	0.1
54.2	2306	2306	0	0.0
55.4	2302	2302	0	0.0
56.6	2205	2205	0	0.0
57.8	2204	2205	1	0.0
59.0	2112	2112	0	0.0
60.2	2077	2075	-2	-0.1
61.4	2024	1967	-57	-2.8
62.7	1967	1913	-54	-2.7
63.9	1937	1908	-29	-1.5
65.1	1904	1892	-12	-0.6
66.3	1832	1831	-1	-0.1
67.5	1803	1797	-6	-0.3
68.7	1675	1683	8	0.5
69.9	1651	1635	-16	-1.0
71.1	1644	1624	-20	-1.2
72.3	1620	1614	-6	-0.4
73.5	1593	1603	10	0.6
74.7	1572	1593	21	1.3
75.9	1562	1586	24	1.5
77.1	1523	1527	4	0.3
78.3	1484	1500	16	1.1
79.5	1408	1409	1	0.1
80.7	1282	1282	0	0.0
81.9	1272	1273	1	0.1
83.1	1242	1243	1	0.1
84.3	1240	1240	0	0.0
85.5	1238	1238	0	0.0
86.7	1235	1235	0	0.0
88.0	1230	1230	0	0.0
89.2	1222	1222	0	0.0
90.4	1110	1114	4	0.4
91.6	1084	1084	0	0.0
92.8	1076	1058	-18	-1.7
94.0	1054	1027	-27	-2.6
95.2	1027	1025	-2	-0.2
96.4	984	984	0	0.0
97.6	980	980	0	0.0
98.8	656	659	3	0.5
Min	656	659	-57	-2.8
Max	3538	3538	24	1.5
Mean	2305	2302	-3	-0.1
Median	2467	2470	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3538	3538	0	0.0
2.4	3538	3538	0	0.0
3.6	3525	3525	0	0.0
4.8	3487	3487	0	0.0
6.0	3468	3468	0	0.0
7.2	3370	3370	0	0.0
8.4	3328	3328	0	0.0
9.6	3222	3222	0	0.0
10.8	3214	3214	0	0.0
12.0	3192	3192	0	0.0
13.3	3058	3058	0	0.0
14.5	3044	3044	0	0.0
15.7	3040	3040	0	0.0
16.9	2977	2977	0	0.0
18.1	2932	2932	0	0.0
19.3	2885	2886	1	0.0
20.5	2866	2866	0	0.0
21.7	2852	2852	0	0.0
22.9	2805	2805	0	0.0
24.1	2756	2756	0	0.0
25.3	2717	2715	-2	-0.1
26.5	2624	2624	0	0.0
27.7	2536	2536	0	0.0
28.9	2513	2512	-1	0.0
30.1	2509	2509	0	0.0
31.3	2470	2470	0	0.0
32.5	2468	2468	0	0.0
33.7	2390	2390	0	0.0
34.9	2371	2355	-16	-0.7
36.1	2357	2355	-2	-0.1
37.3	2326	2326	0	0.0
38.6	2297	2295	-2	-0.1
39.8	2295	2292	-3	-0.1
41.0	2245	2245	0	0.0
42.2	2231	2231	0	0.0
43.4	2223	2223	0	0.0
44.6	2183	2192	9	0.4
45.8	2079	2079	0	0.0
47.0	2071	2018	-53	-2.6
48.2	2020	2008	-12	-0.6
49.4	1992	1994	2	0.1
50.6	1968	1967	-1	-0.1
51.8	1951	1957	6	0.3
53.0	1855	1857	2	0.1
54.2	1815	1815	0	0.0
55.4	1792	1792	0	0.0
56.6	1733	1732	-1	-0.1
57.8	1729	1728	-1	-0.1
59.0	1709	1709	0	0.0
60.2	1665	1642	-23	-1.4
61.4	1627	1605	-22	-1.4
62.7	1605	1603	-2	-0.1
63.9	1535	1568	33	2.1
65.1	1533	1504	-29	-1.9
66.3	1503	1467	-36	-2.4
67.5	1460	1456	-4	-0.3
68.7	1459	1456	-3	-0.2
69.9	1455	1445	-10	-0.7
71.1	1450	1402	-48	-3.3
72.3	1387	1401	14	1.0
73.5	1386	1396	10	0.7
74.7	1381	1390	9	0.7
75.9	1317	1323	6	0.5
77.1	1268	1280	12	0.9
78.3	1242	1267	25	2.0
79.5	1242	1242	0	0.0
80.7	1237	1234	-3	-0.2
81.9	1174	1175	1	0.1
83.1	1150	1151	1	0.1
84.3	1142	1142	0	0.0
85.5	1127	1125	-2	-0.2
86.7	1124	1124	0	0.0
88.0	1117	1117	0	0.0
89.2	1113	1113	0	0.0
90.4	1001	1006	5	0.5
91.6	970	970	0	0.0
92.8	944	940	-4	-0.4
94.0	932	892	-40	-4.3
95.2	865	865	0	0.0
96.4	847	847	0	0.0
97.6	832	832	0	0.0
98.8	656	659	3	0.5
Min	656	659	-53	-4.3
Max	3538	3538	33	2.1
Mean	2040	2038	-2	-0.1
Median	1980	1981	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Oroville Reservoir End of Month Storage - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Storage (TAF)	With-Project (J602F3 ELD) Storage (TAF)	Absolute Difference	Relative Difference (%)
1.2	3351	3351	0	0.0
2.4	3351	3351	0	0.0
3.6	3169	3169	0	0.0
4.8	3057	3057	0	0.0
6.0	3004	3004	0	0.0
7.2	2939	2939	0	0.0
8.4	2805	2805	0	0.0
9.6	2702	2702	0	0.0
10.8	2701	2701	0	0.0
12.0	2662	2662	0	0.0
13.3	2523	2523	0	0.0
14.5	2500	2500	0	0.0
15.7	2482	2482	0	0.0
16.9	2482	2482	0	0.0
18.1	2439	2439	0	0.0
19.3	2375	2375	0	0.0
20.5	2339	2340	1	0.0
21.7	2308	2308	0	0.0
22.9	2274	2274	0	0.0
24.1	2268	2268	0	0.0
25.3	2200	2200	0	0.0
26.5	2172	2171	-1	0.0
27.7	2055	2054	-1	0.0
28.9	2029	2013	-16	-0.8
30.1	1994	1994	0	0.0
31.3	1944	1944	0	0.0
32.5	1914	1915	1	0.1
33.7	1899	1899	0	0.0
34.9	1887	1887	0	0.0
36.1	1873	1873	0	0.0
37.3	1853	1848	-5	-0.3
38.6	1837	1833	-4	-0.2
39.8	1812	1809	-3	-0.2
41.0	1806	1806	0	0.0
42.2	1784	1784	0	0.0
43.4	1784	1784	0	0.0
44.6	1771	1771	0	0.0
45.8	1728	1737	9	0.5
47.0	1708	1655	-53	-3.1
48.2	1654	1644	-10	-0.6
49.4	1627	1626	-1	-0.1
50.6	1590	1596	6	0.4
51.8	1573	1573	0	0.0
53.0	1548	1550	2	0.1
54.2	1529	1529	0	0.0
55.4	1517	1517	0	0.0
56.6	1478	1476	-2	-0.1
57.8	1457	1463	6	0.4
59.0	1404	1413	9	0.6
60.2	1379	1380	1	0.1
61.4	1377	1372	-5	-0.4
62.7	1345	1349	4	0.3
63.9	1344	1345	1	0.1
65.1	1301	1299	-2	-0.2
66.3	1296	1245	-51	-3.9
67.5	1245	1245	0	0.0
68.7	1245	1244	-1	-0.1
69.9	1244	1244	0	0.0
71.1	1244	1244	0	0.0
72.3	1244	1244	0	0.0
73.5	1244	1244	0	0.0
74.7	1244	1244	0	0.0
75.9	1244	1244	0	0.0
77.1	1233	1239	6	0.5
78.3	1212	1232	20	1.7
79.5	1151	1149	-2	-0.2
80.7	1124	1126	2	0.2
81.9	1105	1103	-2	-0.2
83.1	1079	1080	1	0.1
84.3	1063	1064	1	0.1
85.5	1059	1060	1	0.1
86.7	1050	1050	0	0.0
88.0	1022	1022	0	0.0
89.2	982	982	0	0.0
90.4	972	977	5	0.5
91.6	934	934	0	0.0
92.8	912	901	-11	-1.2
94.0	893	861	-32	-3.6
95.2	820	820	0	0.0
96.4	762	762	0	0.0
97.6	755	755	0	0.0
98.8	664	667	3	0.5
Min	664	667	-53	-3.9
Max	3351	3351	20	1.7
Mean	1731	1730	-2	-0.1
Median	1609	1611	0	0.0

Entire 82-Year Simulation Period

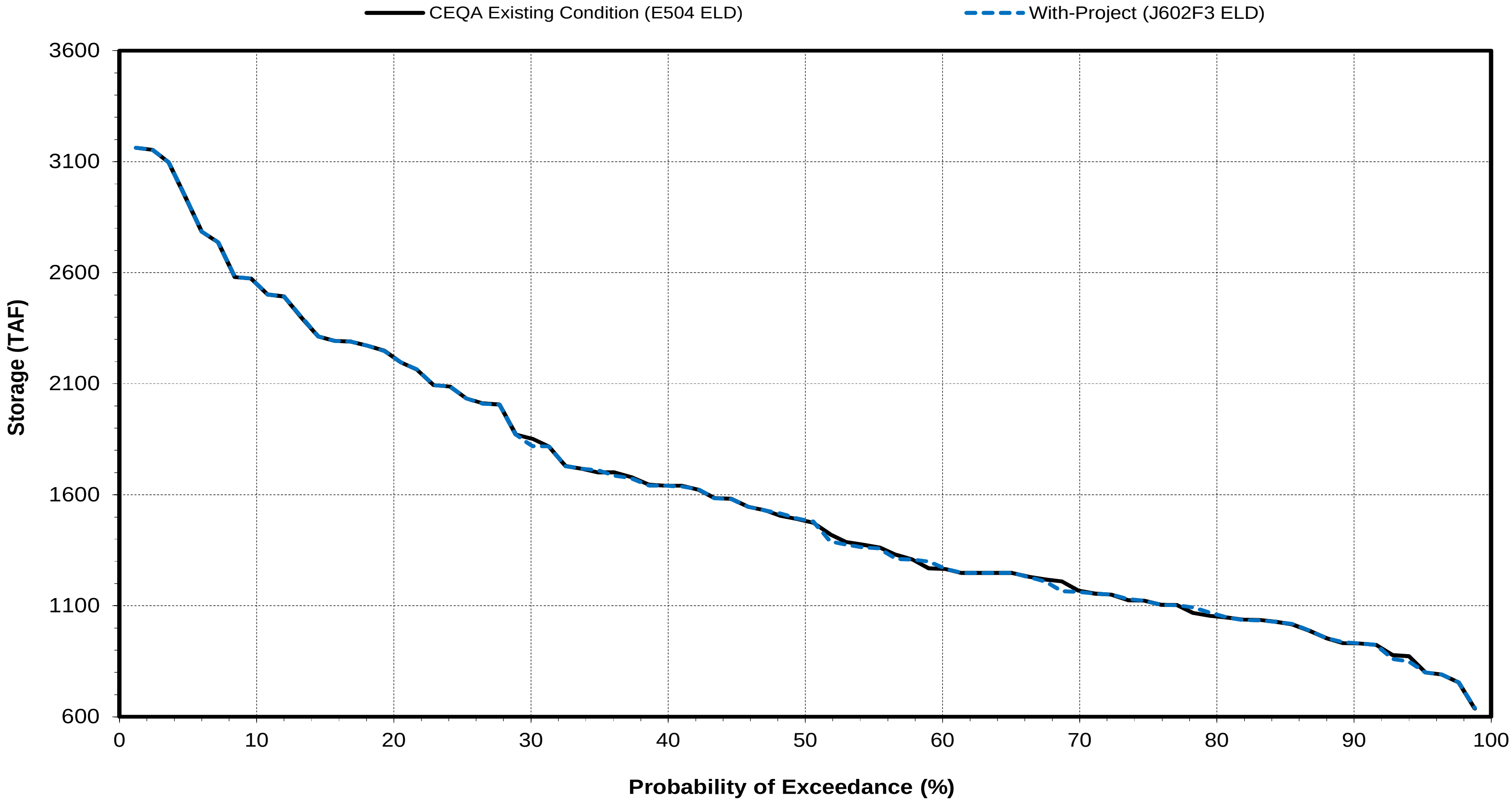
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

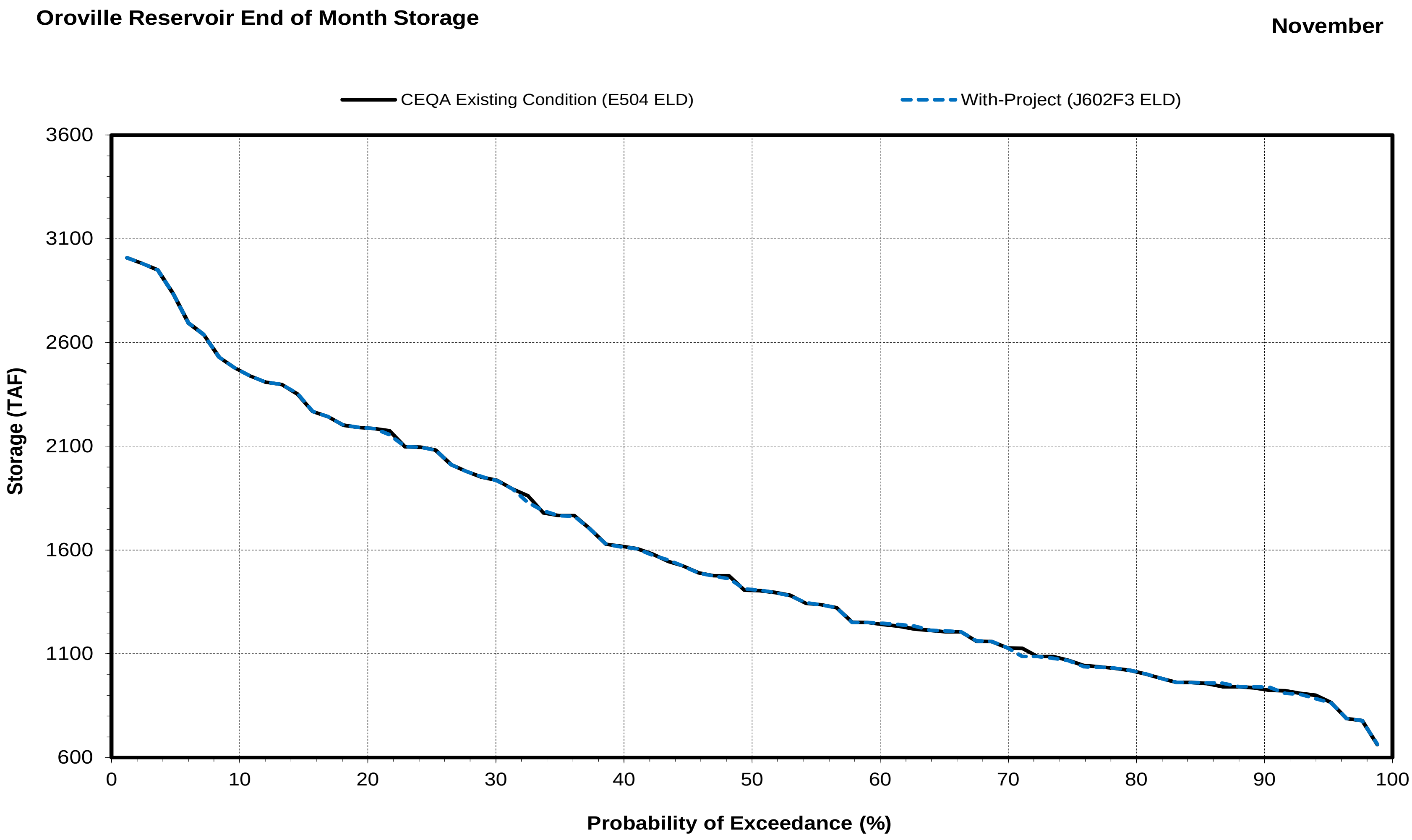
Oroville Reservoir End of Month Storage

October



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

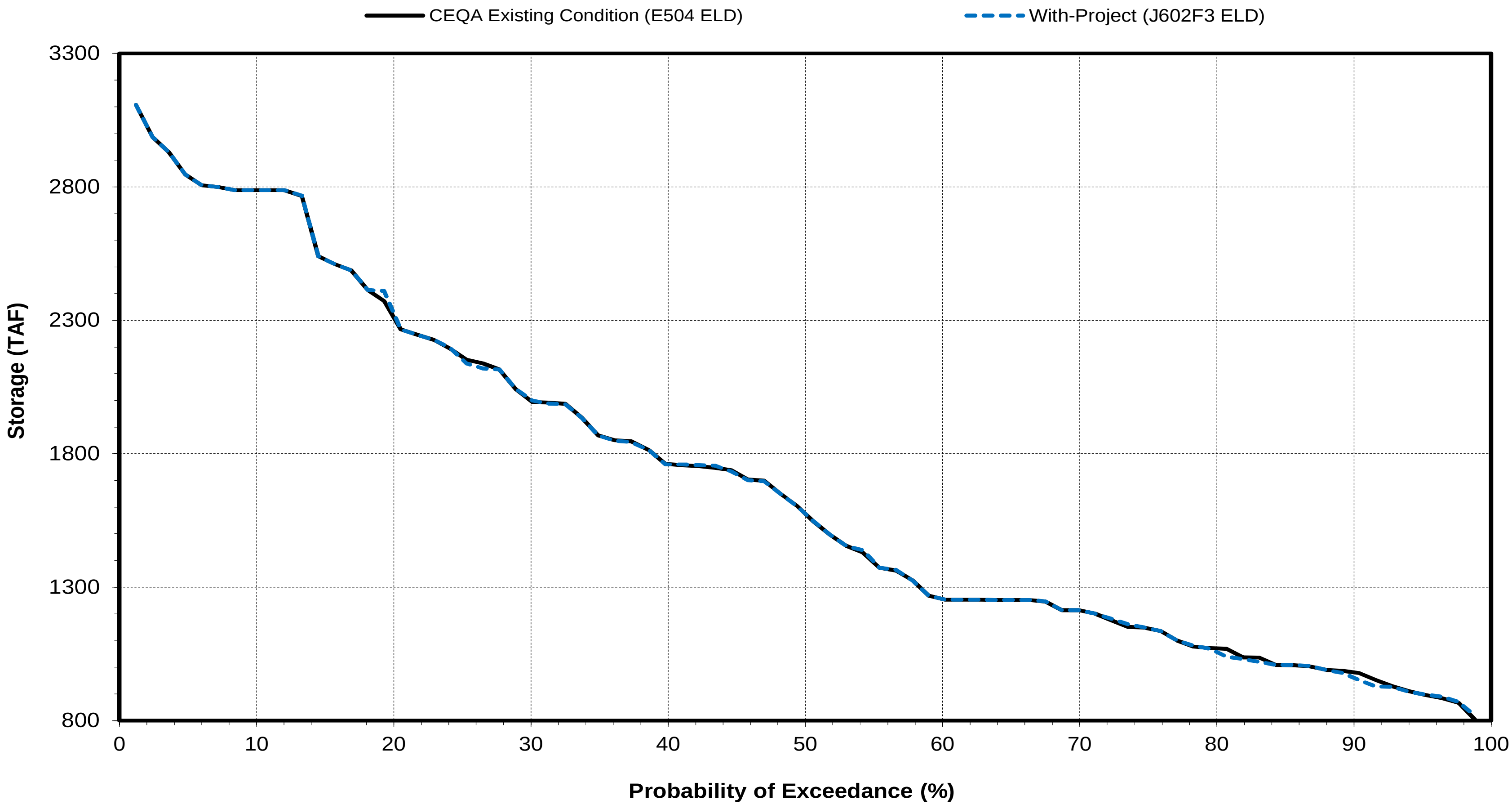
Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Oroville Reservoir End of Month Storage

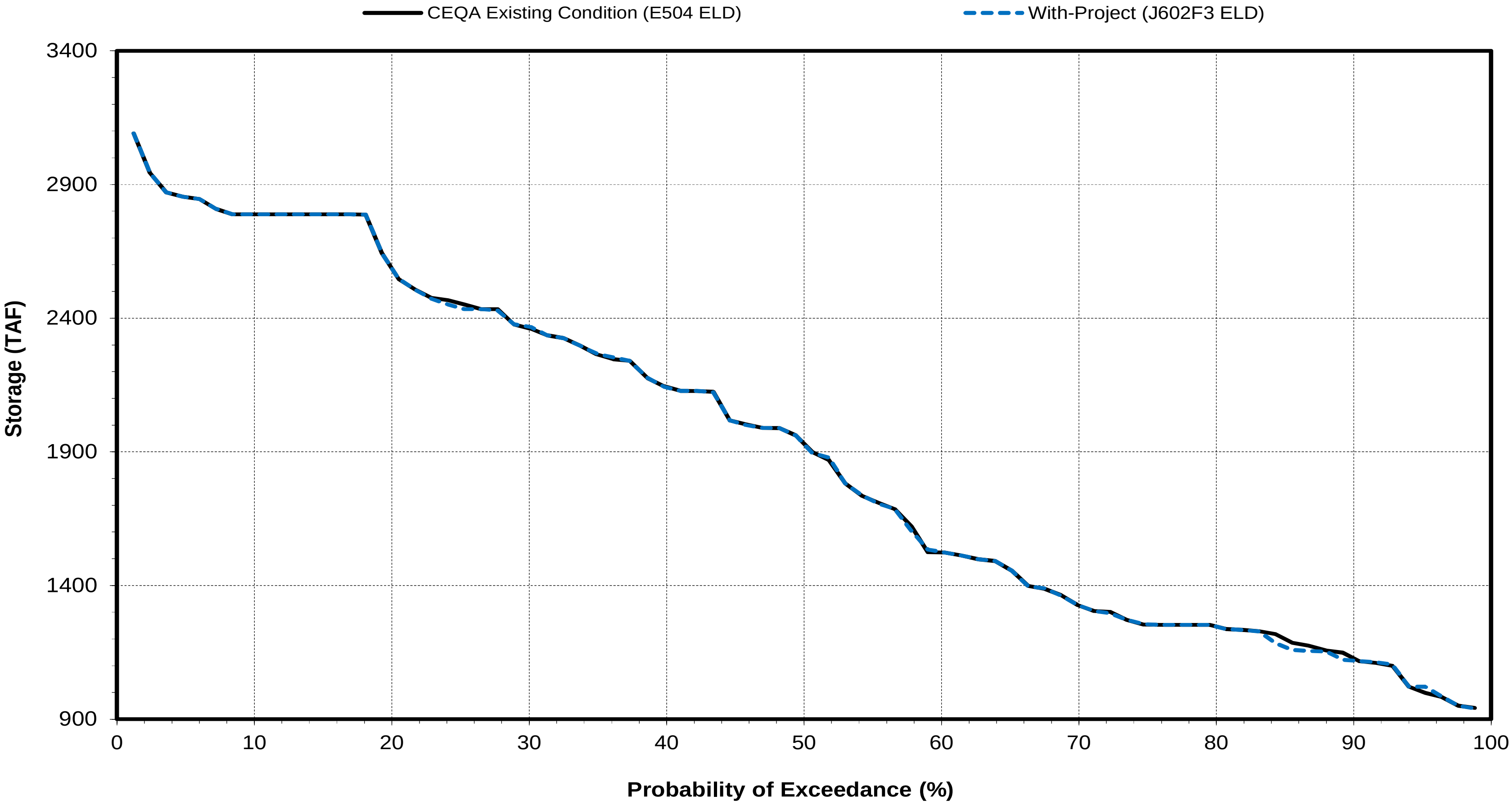
December



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Oroville Reservoir End of Month Storage

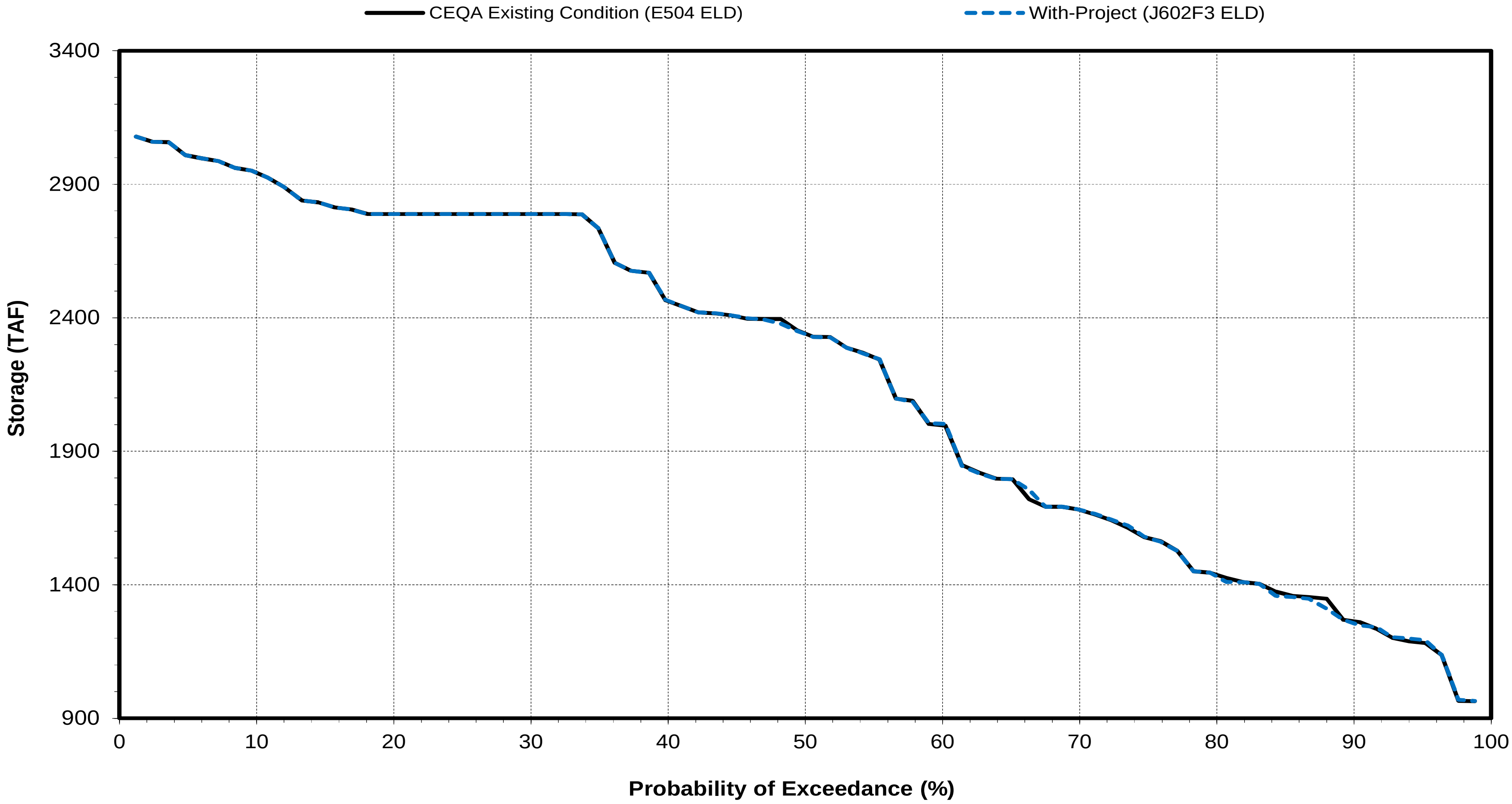
January



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Oroville Reservoir End of Month Storage

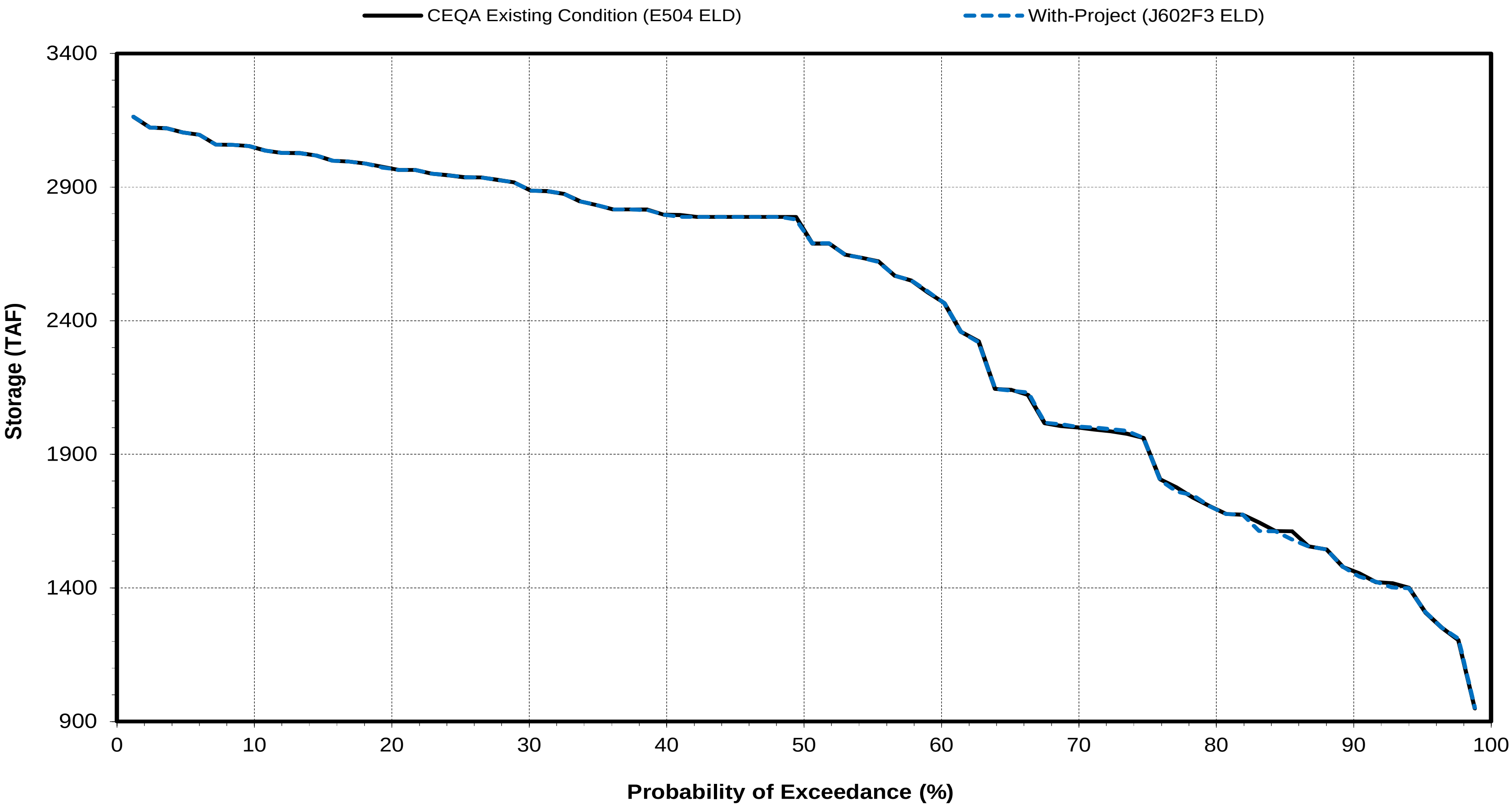
February



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Oroville Reservoir End of Month Storage

March

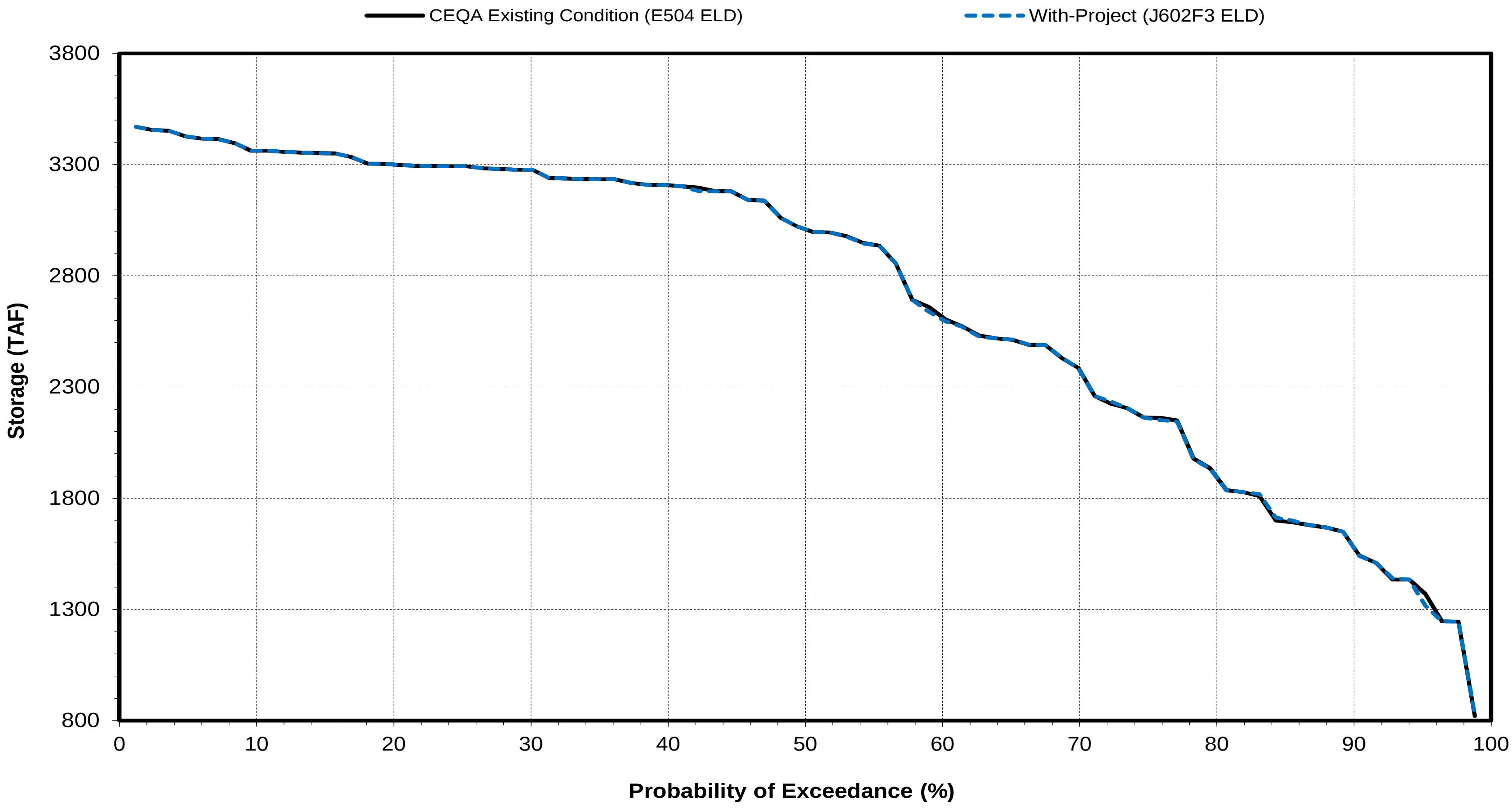


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

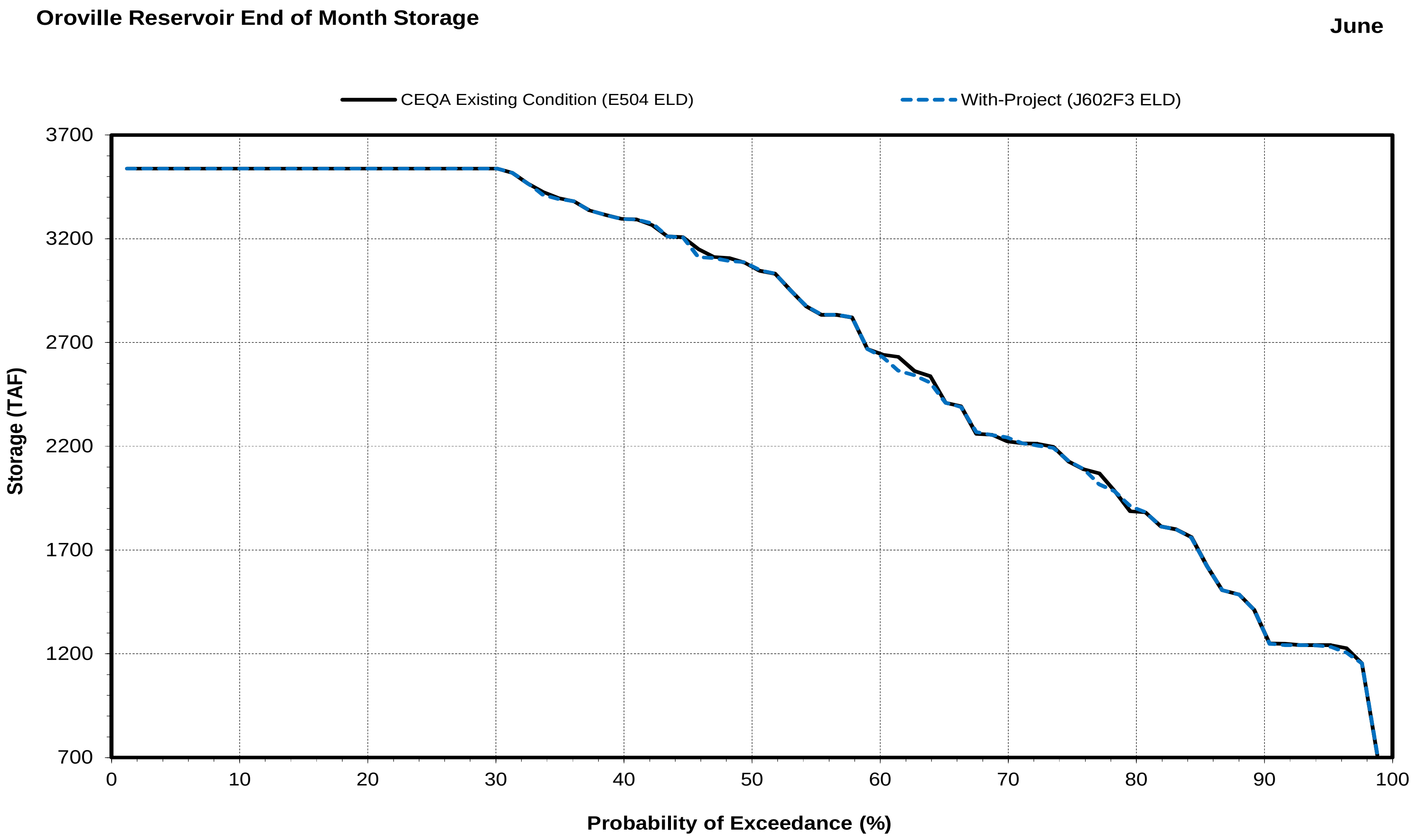
Oroville Reservoir End of Month Storage

April



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

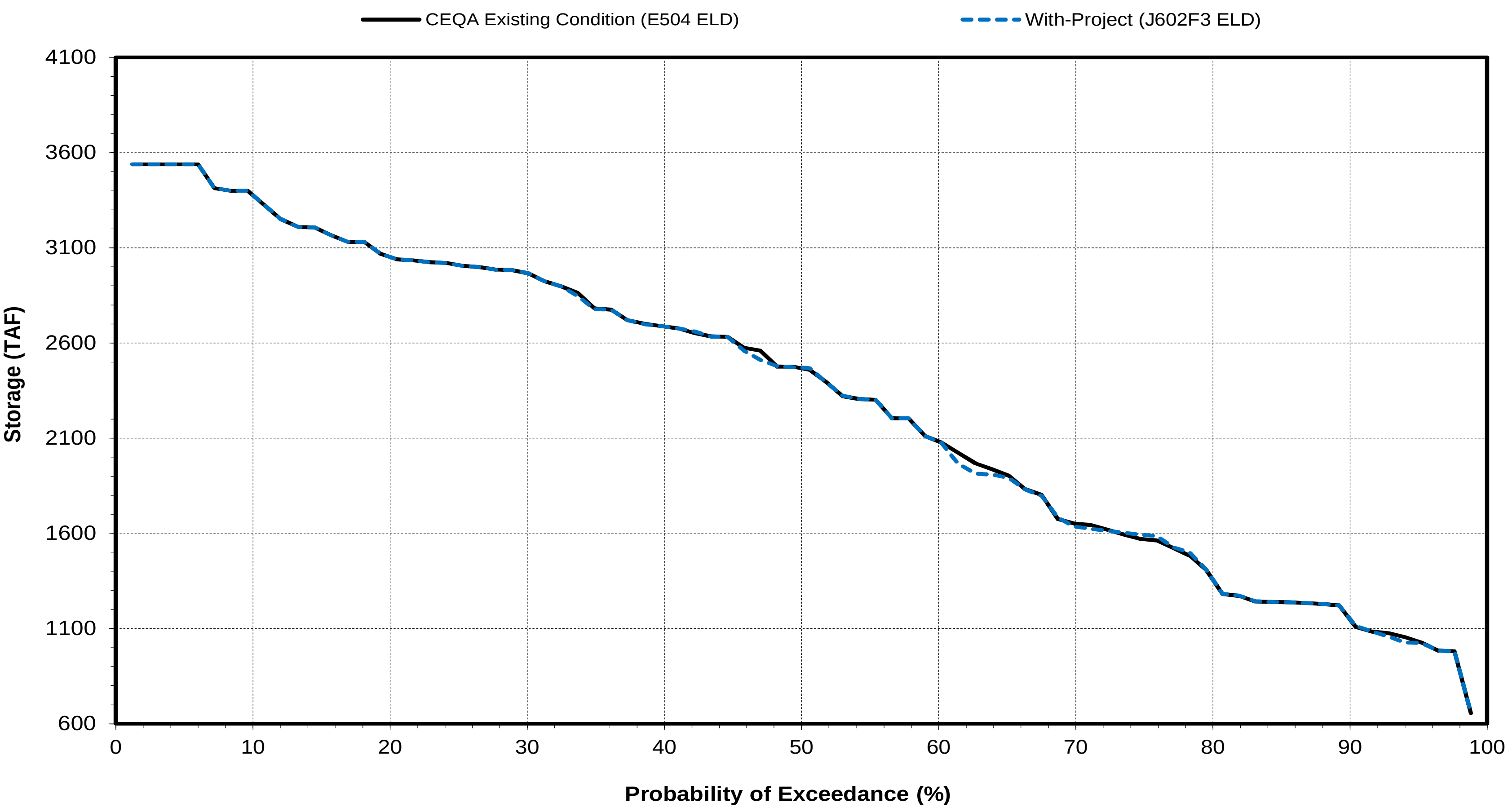
Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Oroville Reservoir End of Month Storage

July

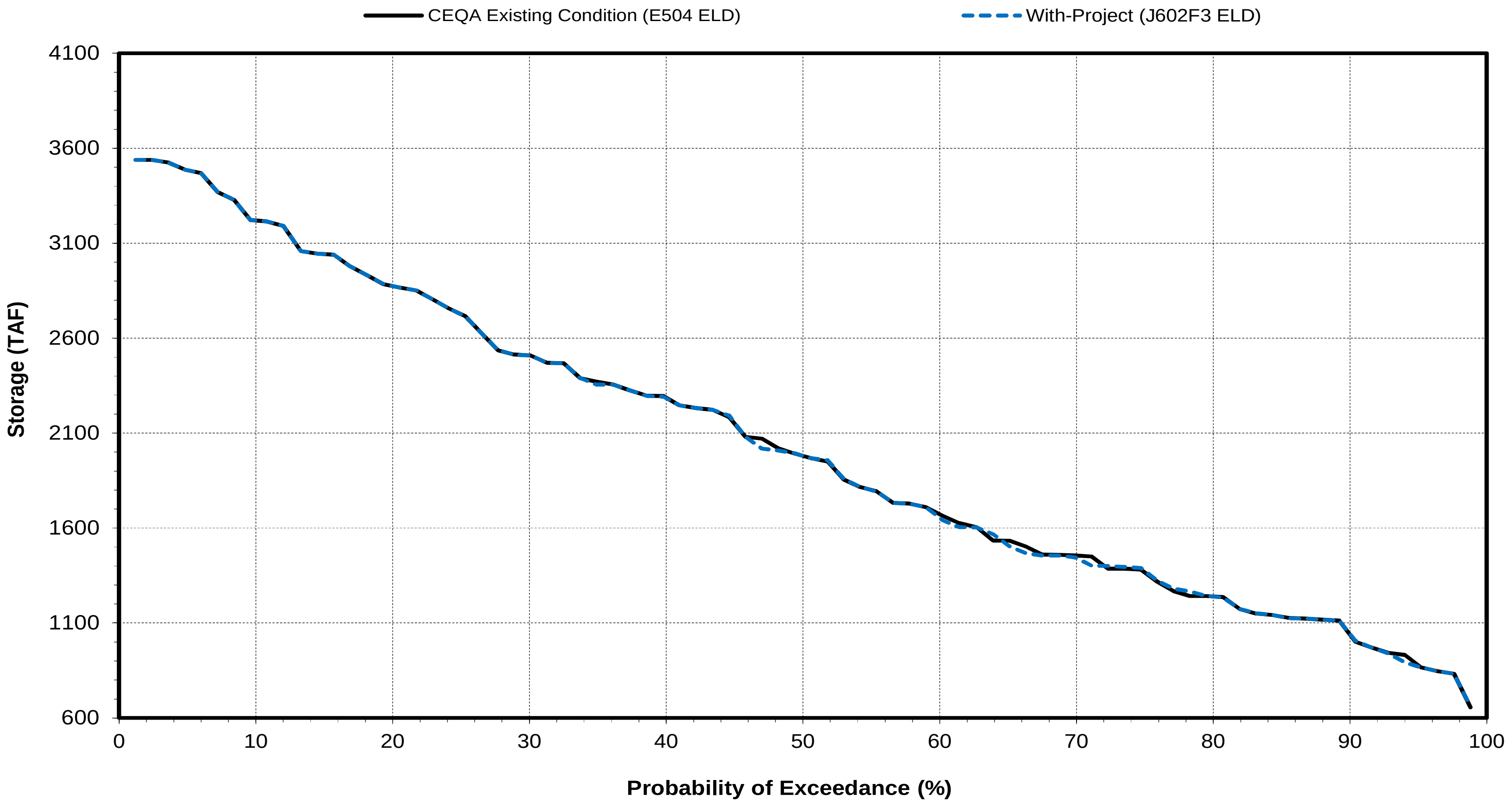


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Oroville Reservoir End of Month Storage

August



Long-term and Water Year Type Average Feather River Flow below Thermalito Afterbay Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
						Long-term						
Full Simulation Period²												
CEQA Existing Condition (E504 ELD)	2,676	2,077	2,914	4,035	4,376	5,293	3,009	3,575	3,535	7,090	4,383	5,553
With-Project (J602F3 ELD)	2,672	2,068	2,910	4,043	4,369	5,294	3,011	3,606	3,542	7,082	4,374	5,546
Difference	-4	-9	-4	8	-7	1	2	31	7	-8	-9	-7
Percent Difference³	-0.1	-0.4	-0.1	0.2	-0.2	0.0	0.1	0.9	0.2	-0.1	-0.2	-0.1
						Water Year Types¹						
Wet												
CEQA Existing Condition (E504 ELD)	2,923	2,801	3,888	9,371	9,375	11,892	6,403	7,532	5,102	6,616	3,876	9,122
With-Project (J602F3 ELD)	2,914	2,801	3,876	9,394	9,347	11,892	6,404	7,531	5,105	6,615	3,876	9,123
Difference	-9	0	-12	23	-28	0	1	-1	3	-1	0	1
Percent Difference³	-0.3	0.0	-0.3	0.2	-0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	2,807	1,904	2,725	2,295	3,680	4,654	2,154	3,084	3,231	9,027	6,829	7,897
With-Project (J602F3 ELD)	2,807	1,904	2,725	2,297	3,690	4,655	2,154	3,084	3,212	9,027	6,832	7,899
Difference	0	0	0	2	10	1	0	0	-19	0	3	2
Percent Difference³	0.0	0.0	0.0	0.1	0.3	0.0	0.0	0.0	-0.6	0.0	0.0	0.0
Below Normal												
CEQA Existing Condition (E504 ELD)	2,840	1,950	2,544	1,465	1,845	1,801	1,122	1,058	2,808	8,961	7,360	4,500
With-Project (J602F3 ELD)	2,841	1,893	2,544	1,465	1,845	1,801	1,122	1,230	2,792	8,956	7,336	4,375
Difference	1	-57	0	0	0	0	0	172	-16	-5	-24	-125
Percent Difference³	0.0	-2.9	0.0	0.0	0.0	0.0	0.0	16.3	-0.6	-0.1	-0.3	-2.8
Dry												
CEQA Existing Condition (E504 ELD)	2,680	1,643	2,626	1,395	1,566	1,471	1,257	1,545	3,022	7,296	3,034	2,463
With-Project (J602F3 ELD)	2,675	1,643	2,625	1,395	1,566	1,471	1,262	1,555	3,074	7,268	3,013	2,527
Difference	-5	0	-1	0	0	0	5	10	52	-28	-21	64
Percent Difference³	-0.2	0.0	0.0	0.0	0.0	0.0	0.4	0.6	1.7	-0.4	-0.7	2.6
Critical												
CEQA Existing Condition (E504 ELD)	1,809	1,481	1,856	1,176	1,409	1,443	1,344	1,475	2,064	3,689	1,585	1,340
With-Project (J602F3 ELD)	1,813	1,481	1,860	1,176	1,409	1,443	1,344	1,475	2,062	3,685	1,583	1,340
Difference	4	0	4	0	0	0	0	0	-2	-4	-2	0
Percent Difference³	0.2	0.0	0.2	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0

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

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	4000	4000	0	0.0
2.4	4000	4000	0	0.0
3.6	4000	4000	0	0.0
4.8	4000	4000	0	0.0
6.0	4000	4000	0	0.0
7.2	4000	4000	0	0.0
8.4	4000	4000	0	0.0
9.6	4000	4000	0	0.0
10.8	4000	4000	0	0.0
12.0	4000	4000	0	0.0
13.3	4000	4000	0	0.0
14.5	4000	4000	0	0.0
15.7	4000	4000	0	0.0
16.9	4000	4000	0	0.0
18.1	4000	4000	0	0.0
19.3	4000	4000	0	0.0
20.5	4000	4000	0	0.0
21.7	4000	4000	0	0.0
22.9	4000	4000	0	0.0
24.1	4000	4000	0	0.0
25.3	4000	4000	0	0.0
26.5	4000	4000	0	0.0
27.7	4000	4000	0	0.0
28.9	4000	4000	0	0.0
30.1	4000	4000	0	0.0
31.3	4000	4000	0	0.0
32.5	4000	4000	0	0.0
33.7	4000	4000	0	0.0
34.9	4000	4000	0	0.0
36.1	4000	4000	0	0.0
37.3	4000	4000	0	0.0
38.6	4000	4000	0	0.0
39.8	4000	3945	-55	-1.4
41.0	3945	3925	-20	-0.5
42.2	3871	3884	13	0.3
43.4	3786	3767	-19	-0.5
44.6	3608	3608	0	0.0
45.8	3468	3450	-18	-0.5
47.0	3311	3261	-50	-1.5
48.2	2970	3061	91	3.1
49.4	2492	2496	4	0.2
50.6	2437	2437	0	0.0
51.8	2434	2369	-65	-2.7
53.0	2369	2208	-161	-6.8
54.2	2156	2158	2	0.1
55.4	2148	2150	2	0.1
56.6	2132	2132	0	0.0
57.8	2101	2103	2	0.1
59.0	2027	2027	0	0.0
60.2	1936	1936	0	0.0
61.4	1762	1763	1	0.1
62.7	1730	1730	0	0.0
63.9	1724	1725	1	0.1
65.1	1700	1700	0	0.0
66.3	1700	1700	0	0.0
67.5	1700	1700	0	0.0
68.7	1700	1700	0	0.0
69.9	1700	1700	0	0.0
71.1	1700	1700	0	0.0
72.3	1700	1700	0	0.0
73.5	1700	1700	0	0.0
74.7	1268	1267	-1	-0.1
75.9	1256	1260	4	0.3
77.1	1200	1200	0	0.0
78.3	1200	1200	0	0.0
79.5	1200	1200	0	0.0
80.7	1200	1200	0	0.0
81.9	1196	1196	0	0.0
83.1	1061	1061	0	0.0
84.3	1001	1001	0	0.0
85.5	900	900	0	0.0
86.7	900	900	0	0.0
88.0	900	900	0	0.0
89.2	900	900	0	0.0
90.4	900	900	0	0.0
91.6	900	900	0	0.0
92.8	900	900	0	0.0
94.0	900	900	0	0.0
95.2	900	900	0	0.0
96.4	900	900	0	0.0
97.6	900	900	0	0.0
98.8	900	900	0	0.0
Min	900	900	-161	-6.8
Max	4000	4000	91	3.1
Mean	2675	2672	-3	-0.1
Median	2465	2467	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	13178	13178	0	0.0
2.4	6672	6672	0	0.0
3.6	6310	6312	2	0.0
4.8	3115	3114	-1	0.0
6.0	3053	3053	0	0.0
7.2	2732	2732	0	0.0
8.4	2645	2645	0	0.0
9.6	2500	2500	0	0.0
10.8	2500	2500	0	0.0
12.0	2500	2500	0	0.0
13.3	2500	2500	0	0.0
14.5	2500	2500	0	0.0
15.7	2500	2500	0	0.0
16.9	2500	2500	0	0.0
18.1	2500	2500	0	0.0
19.3	2500	2500	0	0.0
20.5	2500	2500	0	0.0
21.7	2500	2500	0	0.0
22.9	2500	2500	0	0.0
24.1	2500	2500	0	0.0
25.3	2500	2500	0	0.0
26.5	2500	2500	0	0.0
27.7	2500	2500	0	0.0
28.9	2500	2500	0	0.0
30.1	2500	2500	0	0.0
31.3	2500	2500	0	0.0
32.5	2500	2500	0	0.0
33.7	2500	2500	0	0.0
34.9	2500	2500	0	0.0
36.1	2500	2500	0	0.0
37.3	2500	2500	0	0.0
38.6	2500	2500	0	0.0
39.8	2500	2500	0	0.0
41.0	2500	2388	-112	-4.5
42.2	2388	2118	-270	-11.3
43.4	2118	2084	-34	-1.6
44.6	2083	1866	-217	-10.4
45.8	1866	1772	-94	-5.0
47.0	1772	1700	-72	-4.1
48.2	1700	1700	0	0.0
49.4	1700	1700	0	0.0
50.6	1700	1700	0	0.0
51.8	1700	1700	0	0.0
53.0	1700	1700	0	0.0
54.2	1700	1700	0	0.0
55.4	1700	1700	0	0.0
56.6	1700	1700	0	0.0
57.8	1700	1700	0	0.0
59.0	1700	1700	0	0.0
60.2	1700	1700	0	0.0
61.4	1700	1700	0	0.0
62.7	1700	1700	0	0.0
63.9	1700	1700	0	0.0
65.1	1700	1700	0	0.0
66.3	1700	1700	0	0.0
67.5	1222	1221	-1	-0.1
68.7	1200	1200	0	0.0
69.9	1200	1200	0	0.0
71.1	1200	1200	0	0.0
72.3	1200	1200	0	0.0
73.5	1200	1200	0	0.0
74.7	1200	1200	0	0.0
75.9	1200	1200	0	0.0
77.1	1200	1200	0	0.0
78.3	1200	1200	0	0.0
79.5	1200	1200	0	0.0
80.7	956	956	0	0.0
81.9	921	921	0	0.0
83.1	900	900	0	0.0
84.3	900	900	0	0.0
85.5	900	900	0	0.0
86.7	900	900	0	0.0
88.0	900	900	0	0.0
89.2	900	900	0	0.0
90.4	900	900	0	0.0
91.6	900	900	0	0.0
92.8	900	900	0	0.0
94.0	900	900	0	0.0
95.2	900	900	0	0.0
96.4	900	900	0	0.0
97.6	900	900	0	0.0
98.8	900	900	0	0.0
Min	900	900	-270	-11.3
Max	13178	13178	2	0.0
Mean	2077	2067	-10	-0.5
Median	1700	1700	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	92.7
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		3.7
X<=-10.0		2.4
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	23709	23709	0	0.0
2.4	10297	10298	1	0.0
3.6	9719	9719	0	0.0
4.8	8081	7771	-310	-3.8
6.0	6182	6181	-1	0.0
7.2	5804	5804	0	0.0
8.4	5620	5620	0	0.0
9.6	5580	5580	0	0.0
10.8	5419	5419	0	0.0
12.0	5235	5235	0	0.0
13.3	5148	5148	0	0.0
14.5	5114	5114	0	0.0
15.7	4979	4998	19	0.4
16.9	4752	4752	0	0.0
18.1	4741	4730	-11	-0.2
19.3	4500	4500	0	0.0
20.5	4339	4338	-1	0.0
21.7	4338	4338	0	0.0
22.9	4145	4144	-1	0.0
24.1	3975	3975	0	0.0
25.3	3807	3807	0	0.0
26.5	3778	3773	-5	-0.1
27.7	3432	3477	45	1.3
28.9	3394	3371	-23	-0.7
30.1	3234	3234	0	0.0
31.3	3090	3090	0	0.0
32.5	2855	2855	0	0.0
33.7	2753	2754	1	0.0
34.9	2688	2688	0	0.0
36.1	2232	2232	0	0.0
37.3	2208	2208	0	0.0
38.6	2041	2041	0	0.0
39.8	1884	1884	0	0.0
41.0	1770	1770	0	0.0
42.2	1702	1703	1	0.1
43.4	1700	1700	0	0.0
44.6	1700	1700	0	0.0
45.8	1700	1700	0	0.0
47.0	1700	1700	0	0.0
48.2	1700	1700	0	0.0
49.4	1700	1700	0	0.0
50.6	1700	1700	0	0.0
51.8	1700	1700	0	0.0
53.0	1700	1700	0	0.0
54.2	1700	1700	0	0.0
55.4	1700	1700	0	0.0
56.6	1700	1700	0	0.0
57.8	1700	1700	0	0.0
59.0	1700	1700	0	0.0
60.2	1700	1700	0	0.0
61.4	1700	1700	0	0.0
62.7	1700	1700	0	0.0
63.9	1700	1700	0	0.0
65.1	1700	1700	0	0.0
66.3	1700	1700	0	0.0
67.5	1700	1700	0	0.0
68.7	1700	1700	0	0.0
69.9	1700	1700	0	0.0
71.1	1700	1700	0	0.0
72.3	1700	1700	0	0.0
73.5	1700	1700	0	0.0
74.7	1329	1329	0	0.0
75.9	1314	1315	1	0.1
77.1	1200	1200	0	0.0
78.3	1200	1200	0	0.0
79.5	1200	1200	0	0.0
80.7	1200	1200	0	0.0
81.9	1200	1200	0	0.0
83.1	1200	1200	0	0.0
84.3	1200	1200	0	0.0
85.5	1200	1200	0	0.0
86.7	926	926	0	0.0
88.0	919	919	0	0.0
89.2	900	900	0	0.0
90.4	900	900	0	0.0
91.6	900	900	0	0.0
92.8	900	900	0	0.0
94.0	900	900	0	0.0
95.2	900	900	0	0.0
96.4	900	900	0	0.0
97.6	900	900	0	0.0
98.8	900	900	0	0.0
Min	900	900	-310	-3.8
Max	23709	23709	45	1.3
Mean	2914	2910	-3	0.0
Median	1700	1700	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	97.6
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	40899	40899	0	0.0
2.4	35844	35844	0	0.0
3.6	20194	20194	0	0.0
4.8	19356	19356	0	0.0
6.0	14798	14800	2	0.0
7.2	14147	14766	619	4.4
8.4	13909	13909	0	0.0
9.6	13317	13317	0	0.0
10.8	12503	12503	0	0.0
12.0	11087	11087	0	0.0
13.3	9696	9727	31	0.3
14.5	9436	9437	1	0.0
15.7	8100	8100	0	0.0
16.9	6044	6020	-24	-0.4
18.1	4878	4878	0	0.0
19.3	2939	2939	0	0.0
20.5	2232	2232	0	0.0
21.7	1700	1700	0	0.0
22.9	1700	1700	0	0.0
24.1	1700	1700	0	0.0
25.3	1700	1700	0	0.0
26.5	1700	1700	0	0.0
27.7	1700	1700	0	0.0
28.9	1700	1700	0	0.0
30.1	1700	1700	0	0.0
31.3	1700	1700	0	0.0
32.5	1700	1700	0	0.0
33.7	1700	1700	0	0.0
34.9	1700	1700	0	0.0
36.1	1700	1700	0	0.0
37.3	1700	1700	0	0.0
38.6	1700	1700	0	0.0
39.8	1700	1700	0	0.0
41.0	1700	1700	0	0.0
42.2	1700	1700	0	0.0
43.4	1700	1700	0	0.0
44.6	1700	1700	0	0.0
45.8	1700	1700	0	0.0
47.0	1700	1700	0	0.0
48.2	1700	1700	0	0.0
49.4	1700	1700	0	0.0
50.6	1700	1700	0	0.0
51.8	1700	1700	0	0.0
53.0	1700	1700	0	0.0
54.2	1700	1700	0	0.0
55.4	1700	1700	0	0.0
56.6	1700	1700	0	0.0
57.8	1700	1700	0	0.0
59.0	1700	1700	0	0.0
60.2	1700	1700	0	0.0
61.4	1700	1700	0	0.0
62.7	1700	1700	0	0.0
63.9	1700	1700	0	0.0
65.1	1700	1700	0	0.0
66.3	1304	1304	0	0.0
67.5	1200	1200	0	0.0
68.7	1200	1200	0	0.0
69.9	1200	1200	0	0.0
71.1	1200	1200	0	0.0
72.3	1200	1200	0	0.0
73.5	1200	1200	0	0.0
74.7	1200	1200	0	0.0
75.9	1200	1200	0	0.0
77.1	1200	1200	0	0.0
78.3	1200	1200	0	0.0
79.5	908	906	-2	-0.2
80.7	906	906	0	0.0
81.9	900	900	0	0.0
83.1	900	900	0	0.0
84.3	900	900	0	0.0
85.5	900	900	0	0.0
86.7	900	900	0	0.0
88.0	900	900	0	0.0
89.2	900	900	0	0.0
90.4	900	900	0	0.0
91.6	900	900	0	0.0
92.8	900	900	0	0.0
94.0	900	900	0	0.0
95.2	900	900	0	0.0
96.4	900	900	0	0.0
97.6	900	900	0	0.0
98.8	900	900	0	0.0
Min	900	900	-24	-0.4
Max	40899	40899	619	4.4
Mean	4035	4043	8	0.1
Median	1700	1700	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	21724	21724	0	0.0
2.4	21203	21203	0	0.0
3.6	17991	17990	-1	0.0
4.8	17642	17642	0	0.0
6.0	16586	16586	0	0.0
7.2	16014	15924	-90	-0.6
8.4	13035	12963	-72	-0.6
9.6	12825	12824	-1	0.0
10.8	12476	12476	0	0.0
12.0	11343	11343	0	0.0
13.3	11257	11254	-3	0.0
14.5	10847	10847	0	0.0
15.7	10665	10665	0	0.0
16.9	10501	10496	-5	0.0
18.1	10293	10293	0	0.0
19.3	8601	8601	0	0.0
20.5	7880	7498	-382	-4.8
21.7	7498	7295	-203	-2.7
22.9	6926	6927	1	0.0
24.1	5999	5904	-95	-1.6
25.3	5797	5797	0	0.0
26.5	4871	4871	0	0.0
27.7	4408	4408	0	0.0
28.9	3994	3994	0	0.0
30.1	3843	3843	0	0.0
31.3	3709	3709	0	0.0
32.5	2439	2552	113	4.6
33.7	2324	2438	114	4.9
34.9	2232	2232	0	0.0
36.1	1829	1828	-1	-0.1
37.3	1820	1820	0	0.0
38.6	1777	1777	0	0.0
39.8	1700	1700	0	0.0
41.0	1700	1700	0	0.0
42.2	1700	1700	0	0.0
43.4	1700	1700	0	0.0
44.6	1700	1700	0	0.0
45.8	1700	1700	0	0.0
47.0	1700	1700	0	0.0
48.2	1700	1700	0	0.0
49.4	1700	1700	0	0.0
50.6	1700	1700	0	0.0
51.8	1700	1700	0	0.0
53.0	1700	1700	0	0.0
54.2	1700	1700	0	0.0
55.4	1700	1700	0	0.0
56.6	1700	1700	0	0.0
57.8	1700	1700	0	0.0
59.0	1700	1700	0	0.0
60.2	1700	1700	0	0.0
61.4	1700	1700	0	0.0
62.7	1700	1700	0	0.0
63.9	1700	1700	0	0.0
65.1	1700	1700	0	0.0
66.3	1700	1700	0	0.0
67.5	1700	1700	0	0.0
68.7	1700	1700	0	0.0
69.9	1700	1700	0	0.0
71.1	1200	1200	0	0.0
72.3	1200	1200	0	0.0
73.5	1200	1200	0	0.0
74.7	1200	1200	0	0.0
75.9	1200	1200	0	0.0
77.1	1200	1200	0	0.0
78.3	1200	1200	0	0.0
79.5	1200	1200	0	0.0
80.7	1200	1200	0	0.0
81.9	900	900	0	0.0
83.1	900	900	0	0.0
84.3	900	900	0	0.0
85.5	900	900	0	0.0
86.7	900	900	0	0.0
88.0	900	900	0	0.0
89.2	900	900	0	0.0
90.4	900	900	0	0.0
91.6	900	900	0	0.0
92.8	900	900	0	0.0
94.0	900	900	0	0.0
95.2	900	900	0	0.0
96.4	900	900	0	0.0
97.6	900	900	0	0.0
98.8	900	900	0	0.0
Min	900	900	-382	-4.8
Max	21724	21724	114	4.9
Mean	4376	4369	-8	0.0
Median	1700	1700	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	34035	34035	0	0.0
2.4	31808	31808	0	0.0
3.6	26269	26269	0	0.0
4.8	21860	21860	0	0.0
6.0	19369	19369	0	0.0
7.2	16076	16076	0	0.0
8.4	14279	14279	0	0.0
9.6	14024	13995	-29	-0.2
10.8	13407	13406	-1	0.0
12.0	11911	11911	0	0.0
13.3	11760	11761	1	0.0
14.5	11445	11445	0	0.0
15.7	11353	11353	0	0.0
16.9	10144	10144	0	0.0
18.1	9037	9037	0	0.0
19.3	8310	8312	2	0.0
20.5	8192	8194	2	0.0
21.7	7439	7432	-7	-0.1
22.9	7085	7085	0	0.0
24.1	6647	6647	0	0.0
25.3	6455	6455	0	0.0
26.5	6416	6415	-1	0.0
27.7	6169	6169	0	0.0
28.9	6113	6113	0	0.0
30.1	5315	5315	0	0.0
31.3	5298	5298	0	0.0
32.5	5241	5241	0	0.0
33.7	4665	4665	0	0.0
34.9	4529	4529	0	0.0
36.1	4321	4322	1	0.0
37.3	4130	4127	-3	-0.1
38.6	4127	4127	0	0.0
39.8	3663	3689	26	0.7
41.0	3643	3667	24	0.7
42.2	2787	2787	0	0.0
43.4	2702	2702	0	0.0
44.6	2262	2262	0	0.0
45.8	2232	2232	0	0.0
47.0	2019	2019	0	0.0
48.2	1700	1700	0	0.0
49.4	1700	1700	0	0.0
50.6	1700	1700	0	0.0
51.8	1700	1700	0	0.0
53.0	1700	1700	0	0.0
54.2	1700	1700	0	0.0
55.4	1700	1700	0	0.0
56.6	1700	1700	0	0.0
57.8	1700	1700	0	0.0
59.0	1700	1700	0	0.0
60.2	1700	1700	0	0.0
61.4	1700	1700	0	0.0
62.7	1700	1700	0	0.0
63.9	1700	1700	0	0.0
65.1	1700	1700	0	0.0
66.3	1700	1700	0	0.0
67.5	1700	1700	0	0.0
68.7	1700	1700	0	0.0
69.9	1700	1700	0	0.0
71.1	1700	1700	0	0.0
72.3	1700	1700	0	0.0
73.5	1700	1700	0	0.0
74.7	1700	1700	0	0.0
75.9	1329	1326	-3	-0.2
77.1	1236	1236	0	0.0
78.3	1048	1049	1	0.1
79.5	1000	1000	0	0.0
80.7	1000	1000	0	0.0
81.9	1000	1000	0	0.0
83.1	1000	1000	0	0.0
84.3	1000	1000	0	0.0
85.5	1000	1000	0	0.0
86.7	800	800	0	0.0
88.0	800	800	0	0.0
89.2	800	800	0	0.0
90.4	800	800	0	0.0
91.6	800	800	0	0.0
92.8	800	800	0	0.0
94.0	800	800	0	0.0
95.2	800	800	0	0.0
96.4	800	800	0	0.0
97.6	800	800	0	0.0
98.8	800	800	0	0.0
Min	800	800	-29	-0.2
Max	34035	34035	26	0.7
Mean	5293	5293	0	0.0
Median	1700	1700	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	18991	18991	0	0.0
2.4	17588	17588	0	0.0
3.6	13116	13118	2	0.0
4.8	13107	13116	9	0.1
6.0	12890	12890	0	0.0
7.2	10561	10561	0	0.0
8.4	8758	8758	0	0.0
9.6	8458	8458	0	0.0
10.8	7815	7815	0	0.0
12.0	7679	7679	0	0.0
13.3	7560	7560	0	0.0
14.5	6711	6711	0	0.0
15.7	5304	5305	1	0.0
16.9	5100	5100	0	0.0
18.1	4796	4796	0	0.0
19.3	4551	4551	0	0.0
20.5	4220	4220	0	0.0
21.7	3850	3850	0	0.0
22.9	3799	3799	0	0.0
24.1	3591	3591	0	0.0
25.3	3243	3243	0	0.0
26.5	2971	2995	24	0.8
27.7	2852	2851	-1	0.0
28.9	2703	2703	0	0.0
30.1	2430	2521	91	3.7
31.3	2225	2224	-1	0.0
32.5	2160	2160	0	0.0
33.7	2010	2010	0	0.0
34.9	1918	1918	0	0.0
36.1	1905	1905	0	0.0
37.3	1903	1903	0	0.0
38.6	1819	1819	0	0.0
39.8	1662	1662	0	0.0
41.0	1500	1500	0	0.0
42.2	1395	1395	0	0.0
43.4	1246	1246	0	0.0
44.6	1238	1238	0	0.0
45.8	1234	1235	1	0.1
47.0	1132	1132	0	0.0
48.2	1000	1000	0	0.0
49.4	1000	1000	0	0.0
50.6	1000	1000	0	0.0
51.8	1000	1000	0	0.0
53.0	1000	1000	0	0.0
54.2	1000	1000	0	0.0
55.4	1000	1000	0	0.0
56.6	1000	1000	0	0.0
57.8	1000	1000	0	0.0
59.0	1000	1000	0	0.0
60.2	1000	1000	0	0.0
61.4	1000	1000	0	0.0
62.7	1000	1000	0	0.0
63.9	1000	1000	0	0.0
65.1	1000	1000	0	0.0
66.3	1000	1000	0	0.0
67.5	1000	1000	0	0.0
68.7	1000	1000	0	0.0
69.9	1000	1000	0	0.0
71.1	1000	1000	0	0.0
72.3	1000	1000	0	0.0
73.5	1000	1000	0	0.0
74.7	1000	1000	0	0.0
75.9	1000	1000	0	0.0
77.1	1000	1000	0	0.0
78.3	1000	1000	0	0.0
79.5	1000	1000	0	0.0
80.7	1000	1000	0	0.0
81.9	1000	1000	0	0.0
83.1	1000	1000	0	0.0
84.3	1000	1000	0	0.0
85.5	1000	1000	0	0.0
86.7	1000	1000	0	0.0
88.0	951	951	0	0.0
89.2	790	790	0	0.0
90.4	788	788	0	0.0
91.6	750	750	0	0.0
92.8	750	750	0	0.0
94.0	750	750	0	0.0
95.2	750	750	0	0.0
96.4	750	750	0	0.0
97.6	750	750	0	0.0
98.8	750	750	0	0.0
Min	750	750	-1	0.0
Max	18991	18991	91	3.7
Mean	3009	3011	2	0.1
Median	1000	1000	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	20399	20399	0	0.0
2.4	18238	18238	0	0.0
3.6	17333	17333	0	0.0
4.8	16320	16320	0	0.0
6.0	12825	12825	0	0.0
7.2	11871	11871	0	0.0
8.4	10837	10837	0	0.0
9.6	10507	10507	0	0.0
10.8	10438	10438	0	0.0
12.0	9253	9250	-3	0.0
13.3	9236	9236	0	0.0
14.5	8523	8526	3	0.0
15.7	8393	8393	0	0.0
16.9	8316	8280	-36	-0.4
18.1	8006	8006	0	0.0
19.3	7774	7774	0	0.0
20.5	5847	5847	0	0.0
21.7	5789	5789	0	0.0
22.9	4055	4056	1	0.0
24.1	3509	3777	268	7.6
25.3	3299	3509	210	6.4
26.5	3160	3299	139	4.4
27.7	2885	3161	276	9.6
28.9	2841	3011	170	6.0
30.1	2719	2840	121	4.5
31.3	2658	2768	110	4.1
32.5	2620	2658	38	1.5
33.7	2220	2620	400	18.0
34.9	2193	2219	26	1.2
36.1	2066	2176	110	5.3
37.3	2060	2076	16	0.8
38.6	2049	2066	17	0.8
39.8	2023	2049	26	1.3
41.0	1946	2022	76	3.9
42.2	1775	1942	167	9.4
43.4	1534	1775	241	15.7
44.6	1529	1534	5	0.3
45.8	1523	1529	6	0.4
47.0	1425	1523	98	6.9
48.2	1360	1426	66	4.9
49.4	1228	1228	0	0.0
50.6	1206	1206	0	0.0
51.8	1179	1179	0	0.0
53.0	1144	1144	0	0.0
54.2	1107	1107	0	0.0
55.4	1100	1100	0	0.0
56.6	1083	1084	1	0.1
57.8	1059	1059	0	0.0
59.0	1000	1000	0	0.0
60.2	1000	1000	0	0.0
61.4	1000	1000	0	0.0
62.7	1000	1000	0	0.0
63.9	1000	1000	0	0.0
65.1	1000	1000	0	0.0
66.3	1000	1000	0	0.0
67.5	1000	1000	0	0.0
68.7	1000	1000	0	0.0
69.9	1000	1000	0	0.0
71.1	1000	1000	0	0.0
72.3	1000	1000	0	0.0
73.5	1000	1000	0	0.0
74.7	1000	1000	0	0.0
75.9	1000	1000	0	0.0
77.1	1000	1000	0	0.0
78.3	1000	1000	0	0.0
79.5	1000	1000	0	0.0
80.7	1000	1000	0	0.0
81.9	1000	1000	0	0.0
83.1	1000	1000	0	0.0
84.3	1000	1000	0	0.0
85.5	1000	1000	0	0.0
86.7	1000	1000	0	0.0
88.0	1000	1000	0	0.0
89.2	1000	1000	0	0.0
90.4	1000	1000	0	0.0
91.6	987	987	0	0.0
92.8	924	922	-2	-0.2
94.0	799	799	0	0.0
95.2	750	750	0	0.0
96.4	750	750	0	0.0
97.6	750	750	0	0.0
98.8	750	750	0	0.0
Min	750	750	-36	-0.4
Max	20399	20399	400	18.0
Mean	3575	3606	31	1.4
Median	1217	1217	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	79.3
1.1<=X<10.0		18.3
X>=5.0		11.0
X>=10.0		2.4
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	11681	11681	0	0.0
2.4	11335	11326	-9	-0.1
3.6	10959	10959	0	0.0
4.8	9080	9080	0	0.0
6.0	8492	8492	0	0.0
7.2	8203	8203	0	0.0
8.4	6741	6741	0	0.0
9.6	6543	6621	78	1.2
10.8	6528	6543	15	0.2
12.0	6153	6153	0	0.0
13.3	6065	6065	0	0.0
14.5	5632	5632	0	0.0
15.7	5552	5552	0	0.0
16.9	4926	4928	2	0.0
18.1	4771	4789	18	0.4
19.3	4754	4639	-115	-2.4
20.5	4701	4547	-154	-3.3
21.7	4591	4514	-77	-1.7
22.9	4475	4475	0	0.0
24.1	4377	4377	0	0.0
25.3	4368	4368	0	0.0
26.5	4284	4249	-35	-0.8
27.7	4081	4087	6	0.1
28.9	4064	4061	-3	-0.1
30.1	4056	4056	0	0.0
31.3	3968	3963	-5	-0.1
32.5	3936	3936	0	0.0
33.7	3930	3930	0	0.0
34.9	3794	3757	-37	-1.0
36.1	3782	3752	-30	-0.8
37.3	3741	3741	0	0.0
38.6	3733	3733	0	0.0
39.8	3732	3732	0	0.0
41.0	3570	3568	-2	-0.1
42.2	3401	3397	-4	-0.1
43.4	3280	3342	62	1.9
44.6	3240	3240	0	0.0
45.8	3091	3173	82	2.7
47.0	3059	3091	32	1.0
48.2	2960	2967	7	0.2
49.4	2939	2851	-88	-3.0
50.6	2849	2812	-37	-1.3
51.8	2818	2765	-53	-1.9
53.0	2758	2754	-4	-0.1
54.2	2754	2714	-40	-1.5
55.4	2713	2705	-8	-0.3
56.6	2705	2670	-35	-1.3
57.8	2671	2638	-33	-1.2
59.0	2617	2625	8	0.3
60.2	2616	2617	1	0.0
61.4	2586	2583	-3	-0.1
62.7	2370	2371	1	0.0
63.9	2365	2365	0	0.0
65.1	2326	2331	5	0.2
66.3	2316	2326	10	0.4
67.5	2293	2292	-1	0.0
68.7	2249	2265	16	0.7
69.9	2195	2195	0	0.0
71.1	2055	2057	2	0.1
72.3	2027	2047	20	1.0
73.5	2022	2027	5	0.2
74.7	1978	1997	19	1.0
75.9	1924	1978	54	2.8
77.1	1838	1924	86	4.7
78.3	1823	1838	15	0.8
79.5	1766	1824	58	3.3
80.7	1660	1765	105	6.3
81.9	1575	1660	85	5.4
83.1	1510	1575	65	4.3
84.3	1467	1509	42	2.9
85.5	1374	1467	93	6.8
86.7	1353	1352	-1	-0.1
88.0	1152	1152	0	0.0
89.2	1110	1110	0	0.0
90.4	1000	1050	50	5.0
91.6	1000	1000	0	0.0
92.8	1000	1000	0	0.0
94.0	1000	1000	0	0.0
95.2	1000	1000	0	0.0
96.4	1000	1000	0	0.0
97.6	750	1000	250	33.3
98.8	750	750	0	0.0
Min	750	750	-154	-3.3
Max	11681	11681	250	33.3
Mean	3535	3542	6	0.8
Median	2894	2832	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	73.2
1.1<=X<10.0		14.6
X>=5.0		6.1
X>=10.0		1.2
-10.0<X<=-1.1		11.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		45.0
X>=5.0		25.0
X>=10.0		5.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**5.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	10000	10000	0	0.0
2.4	10000	10000	0	0.0
3.6	10000	10000	0	0.0
4.8	10000	10000	0	0.0
6.0	10000	10000	0	0.0
7.2	10000	10000	0	0.0
8.4	10000	10000	0	0.0
9.6	10000	10000	0	0.0
10.8	10000	10000	0	0.0
12.0	9897	9898	1	0.0
13.3	9816	9816	0	0.0
14.5	9675	9675	0	0.0
15.7	9640	9648	8	0.1
16.9	9591	9591	0	0.0
18.1	9565	9572	7	0.1
19.3	9511	9515	4	0.0
20.5	9486	9514	28	0.3
21.7	9438	9380	-58	-0.6
22.9	9335	9343	8	0.1
24.1	9310	9312	2	0.0
25.3	9124	9124	0	0.0
26.5	9096	9096	0	0.0
27.7	9083	9091	8	0.1
28.9	9053	9053	0	0.0
30.1	8989	9010	21	0.2
31.3	8862	8865	3	0.0
32.5	8854	8854	0	0.0
33.7	8807	8842	35	0.4
34.9	8767	8835	68	0.8
36.1	8754	8772	18	0.2
37.3	8741	8750	9	0.1
38.6	8712	8735	23	0.3
39.8	8691	8691	0	0.0
41.0	8656	8687	31	0.4
42.2	8524	8656	132	1.5
43.4	8508	8525	17	0.2
44.6	8476	8510	34	0.4
45.8	8456	8453	-3	0.0
47.0	8437	8445	8	0.1
48.2	8324	8432	108	1.3
49.4	8293	8381	88	1.1
50.6	8287	8346	59	0.7
51.8	8279	8290	11	0.1
53.0	8236	8225	-11	-0.1
54.2	8157	8210	53	0.6
55.4	8081	8157	76	0.9
56.6	8018	8086	68	0.8
57.8	7950	7950	0	0.0
59.0	7937	7945	8	0.1
60.2	7739	7684	-55	-0.7
61.4	7705	7628	-77	-1.0
62.7	7628	7561	-67	-0.9
63.9	7561	7352	-209	-2.8
65.1	7353	7256	-97	-1.3
66.3	7257	6946	-311	-4.3
67.5	6946	6864	-82	-1.2
68.7	6864	5852	-1012	-14.7
69.9	5741	5741	0	0.0
71.1	5534	5534	0	0.0
72.3	5289	5289	0	0.0
73.5	5284	5286	2	0.0
74.7	4324	4509	185	4.3
75.9	4159	4424	265	6.4
77.1	4043	4163	120	3.0
78.3	3673	3673	0	0.0
79.5	3591	3591	0	0.0
80.7	3373	3373	0	0.0
81.9	3093	3099	6	0.2
83.1	2877	2877	0	0.0
84.3	2739	2665	-74	-2.7
85.5	2636	2635	-1	0.0
86.7	2584	2587	3	0.1
88.0	2547	2547	0	0.0
89.2	2378	2378	0	0.0
90.4	2366	2366	0	0.0
91.6	2358	2358	0	0.0
92.8	2278	2164	-114	-5.0
94.0	1849	1850	1	0.1
95.2	1703	1703	0	0.0
96.4	1598	1598	0	0.0
97.6	1483	1483	0	0.0
98.8	1417	1417	0	0.0
Min	1417	1417	-1012	-14.7
Max	10000	10000	265	6.4
Mean	7090	7082	-8	-0.1
Median	8290	8364	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		7.3
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		2.4
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		10.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	8252	8253	1	0.0
2.4	8191	8195	4	0.0
3.6	8176	8193	17	0.2
4.8	8067	8079	12	0.1
6.0	8056	8070	14	0.2
7.2	8039	8042	3	0.0
8.4	8028	8030	2	0.0
9.6	7888	7888	0	0.0
10.8	7817	7820	3	0.0
12.0	7807	7807	0	0.0
13.3	7778	7781	3	0.0
14.5	7777	7771	-6	-0.1
15.7	7770	7770	0	0.0
16.9	7732	7744	12	0.2
18.1	7606	7609	3	0.0
19.3	7604	7609	5	0.1
20.5	7515	7515	0	0.0
21.7	7457	7458	1	0.0
22.9	7449	7455	6	0.1
24.1	7449	7451	2	0.0
25.3	7441	7446	5	0.1
26.5	7421	7426	5	0.1
27.7	7374	7378	4	0.1
28.9	7210	7208	-2	0.0
30.1	7173	7173	0	0.0
31.3	6440	6440	0	0.0
32.5	6439	6439	0	0.0
33.7	6419	6433	14	0.2
34.9	6205	6205	0	0.0
36.1	5881	5881	0	0.0
37.3	5461	5461	0	0.0
38.6	5173	5173	0	0.0
39.8	5045	4954	-91	-1.8
41.0	4983	4805	-178	-3.6
42.2	4954	4652	-302	-6.1
43.4	4773	4618	-155	-3.2
44.6	4387	4387	0	0.0
45.8	4372	4341	-31	-0.7
47.0	4341	4341	0	0.0
48.2	4341	4210	-131	-3.0
49.4	4325	4152	-173	-4.0
50.6	4153	4001	-152	-3.7
51.8	3943	3942	-1	0.0
53.0	3937	3940	3	0.1
54.2	3571	3824	253	7.1
55.4	3534	3297	-237	-6.7
56.6	3301	3217	-84	-2.5
57.8	3225	3181	-44	-1.4
59.0	3118	3056	-62	-2.0
60.2	3026	2959	-67	-2.2
61.4	2906	2903	-3	-0.1
62.7	2487	2499	12	0.5
63.9	2452	2452	0	0.0
65.1	2318	2318	0	0.0
66.3	2278	2283	5	0.2
67.5	2158	2157	-1	0.0
68.7	2150	2094	-56	-2.6
69.9	1938	2060	122	6.3
71.1	1915	1963	48	2.5
72.3	1862	1903	41	2.2
73.5	1829	1869	40	2.2
74.7	1783	1819	36	2.0
75.9	1753	1783	30	1.7
77.1	1654	1757	103	6.2
78.3	1501	1656	155	10.3
79.5	1478	1501	23	1.6
80.7	1474	1478	4	0.3
81.9	1350	1473	123	9.1
83.1	1349	1319	-30	-2.2
84.3	1319	1305	-14	-1.1
85.5	1305	1291	-14	-1.1
86.7	1202	1217	15	1.2
88.0	1180	1184	4	0.3
89.2	1156	1179	23	2.0
90.4	1116	1115	-1	-0.1
91.6	1045	1045	0	0.0
92.8	1020	1016	-4	-0.4
94.0	1000	1000	0	0.0
95.2	1000	1000	0	0.0
96.4	1000	1000	0	0.0
97.6	1000	1000	0	0.0
98.8	973	962	-11	-1.1
Min	973	962	-302	-6.7
Max	8252	8253	253	10.3
Mean	4383	4374	-8	0.1
Median	4239	4077	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	63.4
1.1<=X<10.0		14.6
X>=5.0		6.1
X>=10.0		1.2
-10.0<X<=-1.1		20.7
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	45.0
1.1<=X<10.0		30.0
X>=5.0		15.0
X>=10.0		5.0
-10.0<X<=-1.1		20.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**5.0**

Feather River Flow below Thermalito Afterbay - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	10000	10000	0	0.0
2.4	10000	10000	0	0.0
3.6	10000	10000	0	0.0
4.8	10000	10000	0	0.0
6.0	10000	10000	0	0.0
7.2	10000	10000	0	0.0
8.4	10000	10000	0	0.0
9.6	10000	10000	0	0.0
10.8	10000	10000	0	0.0
12.0	10000	10000	0	0.0
13.3	9963	9966	3	0.0
14.5	9899	9866	-33	-0.3
15.7	9834	9850	16	0.2
16.9	9750	9750	0	0.0
18.1	9748	9748	0	0.0
19.3	9703	9703	0	0.0
20.5	9498	9498	0	0.0
21.7	9418	9436	18	0.2
22.9	9409	9418	9	0.1
24.1	9379	9409	30	0.3
25.3	9200	9200	0	0.0
26.5	8996	8996	0	0.0
27.7	8843	8843	0	0.0
28.9	8333	8333	0	0.0
30.1	8233	8234	1	0.0
31.3	8150	8150	0	0.0
32.5	8137	8133	-4	0.0
33.7	7990	7990	0	0.0
34.9	7969	7980	11	0.1
36.1	7802	7814	12	0.2
37.3	7594	7594	0	0.0
38.6	7369	7379	10	0.1
39.8	7354	7354	0	0.0
41.0	6987	6987	0	0.0
42.2	6826	6856	30	0.4
43.4	6109	6121	12	0.2
44.6	5825	5825	0	0.0
45.8	5641	5651	10	0.2
47.0	5558	5558	0	0.0
48.2	5432	5432	0	0.0
49.4	5290	5290	0	0.0
50.6	5237	5239	2	0.0
51.8	5232	5232	0	0.0
53.0	5082	5146	64	1.3
54.2	5003	5082	79	1.6
55.4	4720	5003	283	6.0
56.6	4675	4718	43	0.9
57.8	4626	4582	-44	-1.0
59.0	4591	4523	-68	-1.5
60.2	4521	4183	-338	-7.5
61.4	4062	4043	-19	-0.5
62.7	3925	3930	5	0.1
63.9	3856	3872	16	0.4
65.1	3853	3622	-231	-6.0
66.3	3712	3574	-138	-3.7
67.5	3567	3457	-110	-3.1
68.7	3209	3064	-145	-4.5
69.9	3067	3018	-49	-1.6
71.1	2462	2668	206	8.4
72.3	2408	2342	-66	-2.7
73.5	2281	2281	0	0.0
74.7	1918	1918	0	0.0
75.9	1558	1530	-28	-1.8
77.1	1530	1487	-43	-2.8
78.3	1502	1469	-33	-2.2
79.5	1487	1425	-62	-4.2
80.7	1371	1371	0	0.0
81.9	1306	1306	0	0.0
83.1	1270	1270	0	0.0
84.3	1256	1256	0	0.0
85.5	1117	1117	0	0.0
86.7	1073	1080	7	0.7
88.0	1058	1061	3	0.3
89.2	1008	1008	0	0.0
90.4	1002	1000	-2	-0.2
91.6	1000	1000	0	0.0
92.8	1000	1000	0	0.0
94.0	1000	1000	0	0.0
95.2	1000	1000	0	0.0
96.4	1000	1000	0	0.0
97.6	773	773	0	0.0
98.8	773	773	0	0.0
Min	773	773	-338	-7.5
Max	10000	10000	283	8.4
Mean	5553	5546	-7	-0.3
Median	5264	5265	0	0.0

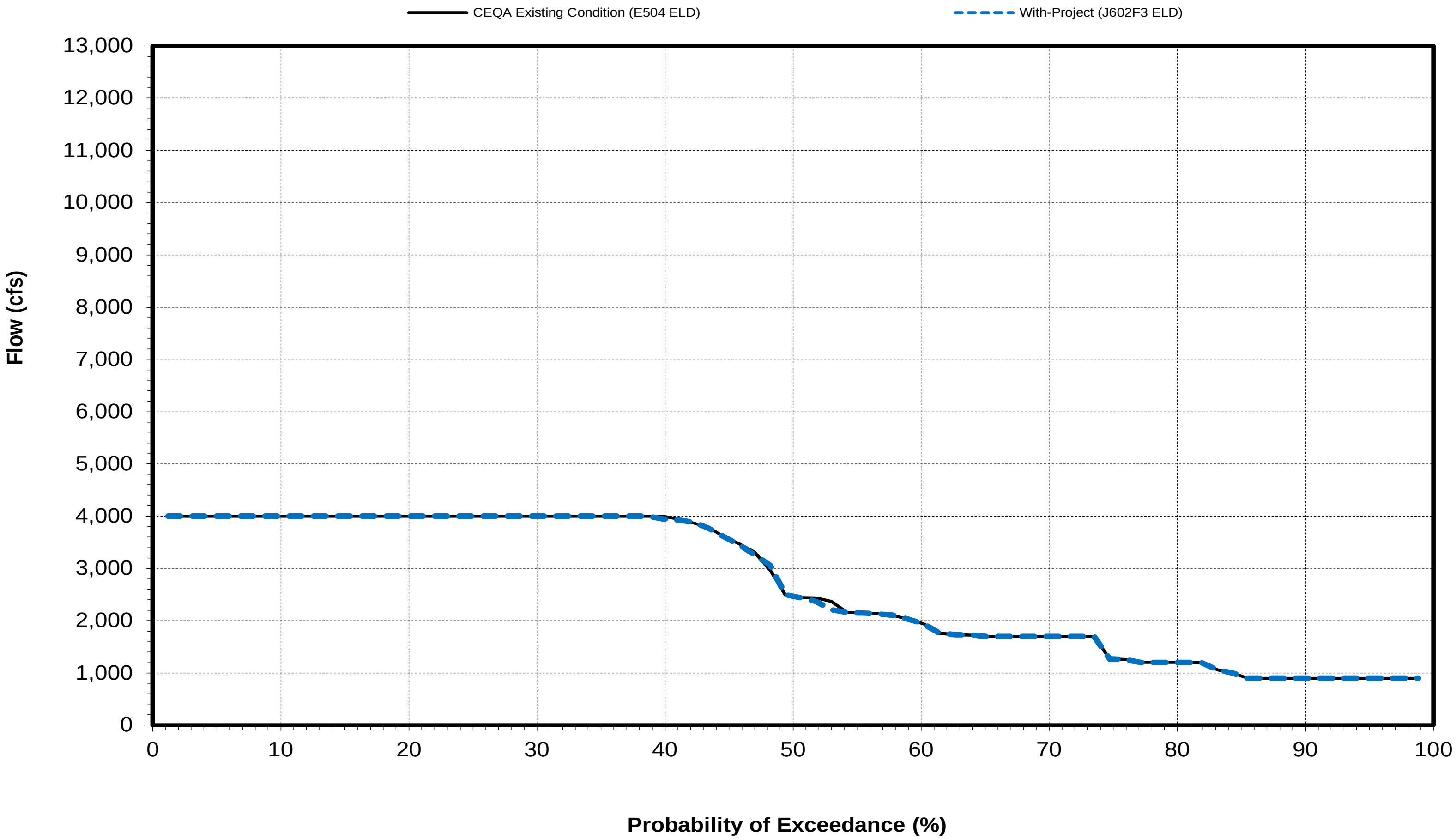
Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	80.5
1.1<=X<10.0		4.9
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		14.6
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

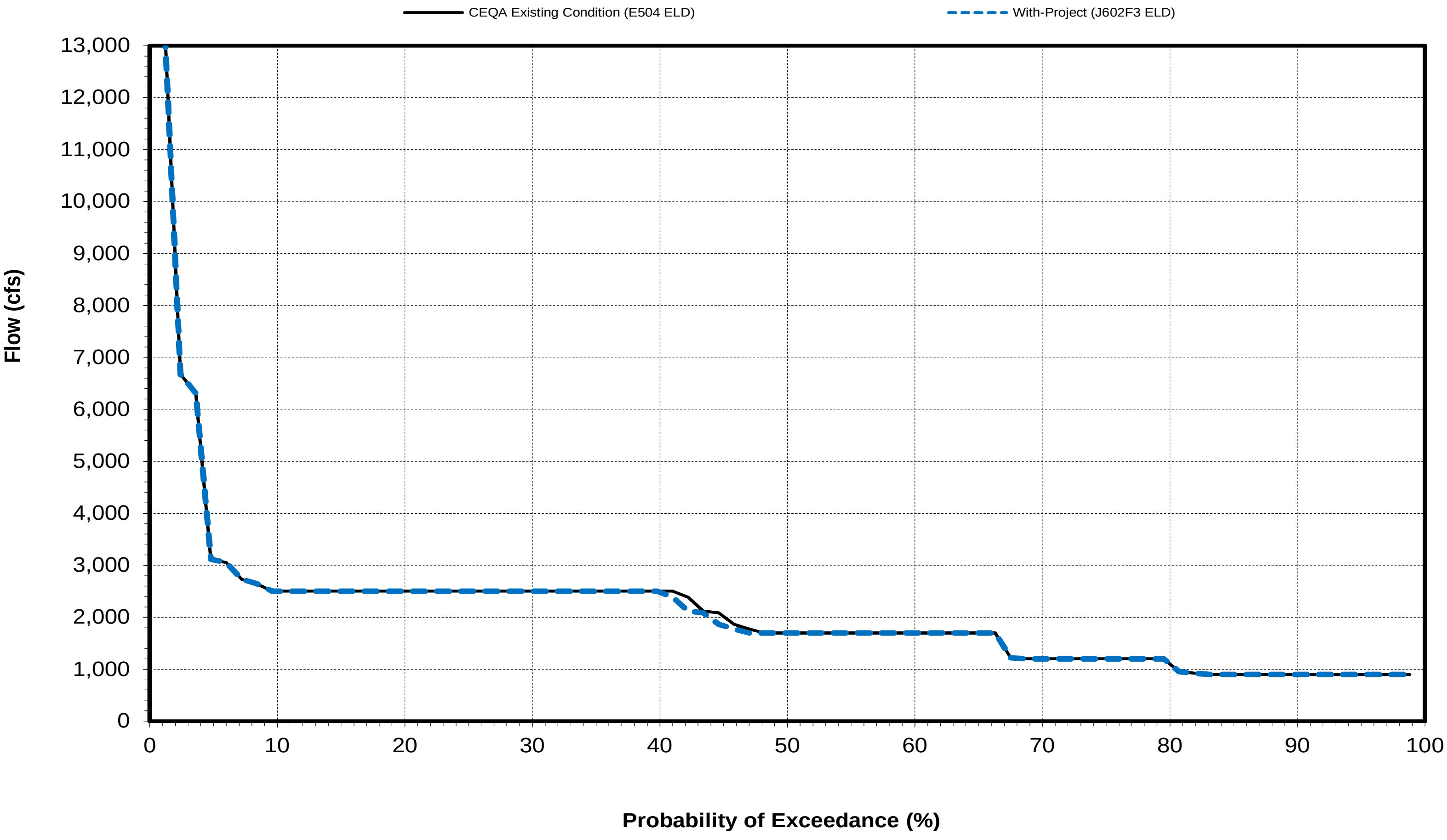
Feather River Flow below Thermalito Afterbay **October**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

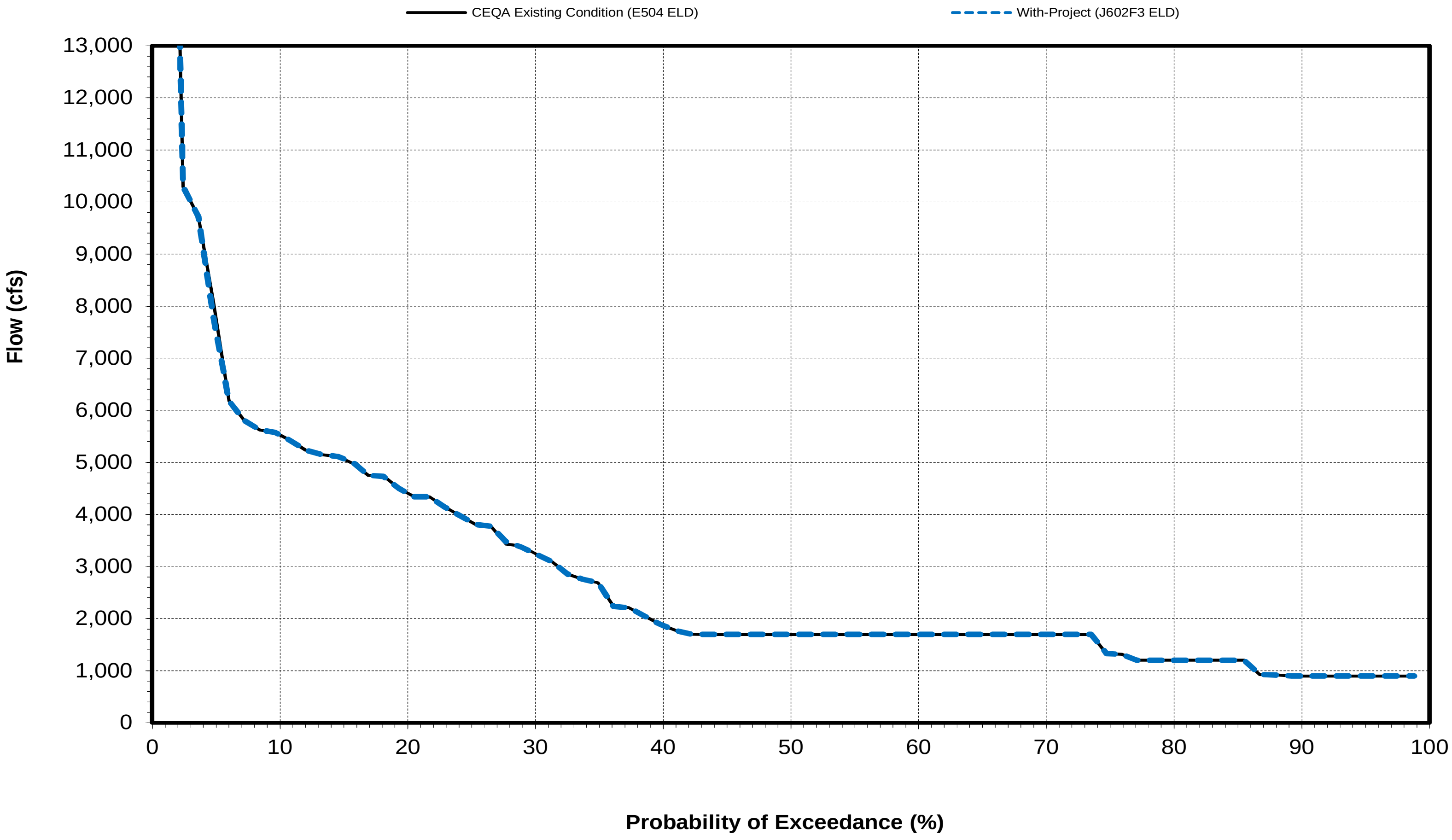
Feather River Flow below Thermalito Afterbay **November**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

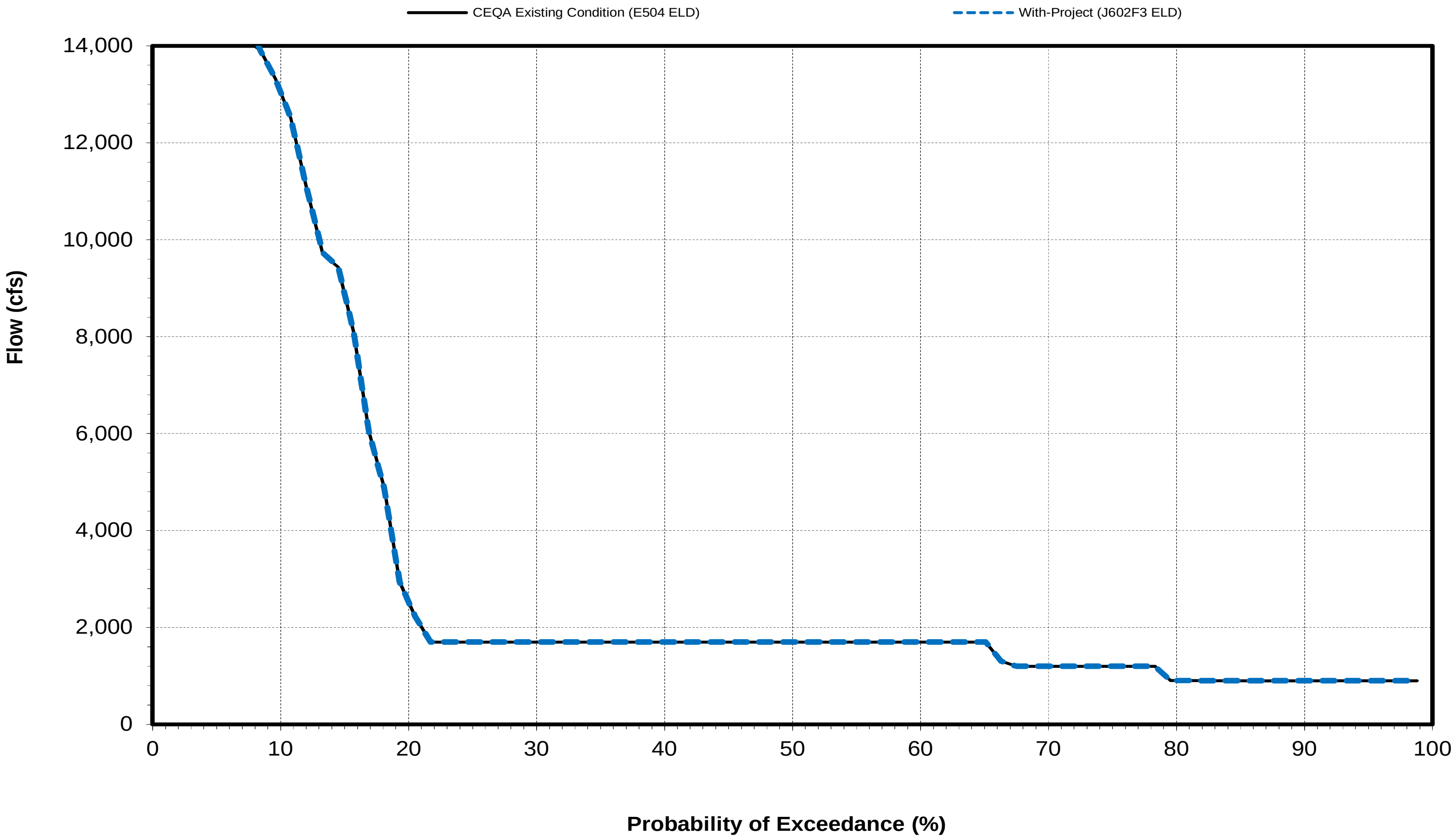
Feather River Flow below Thermalito Afterbay

December



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Feather River Flow below Thermalito Afterbay **January**

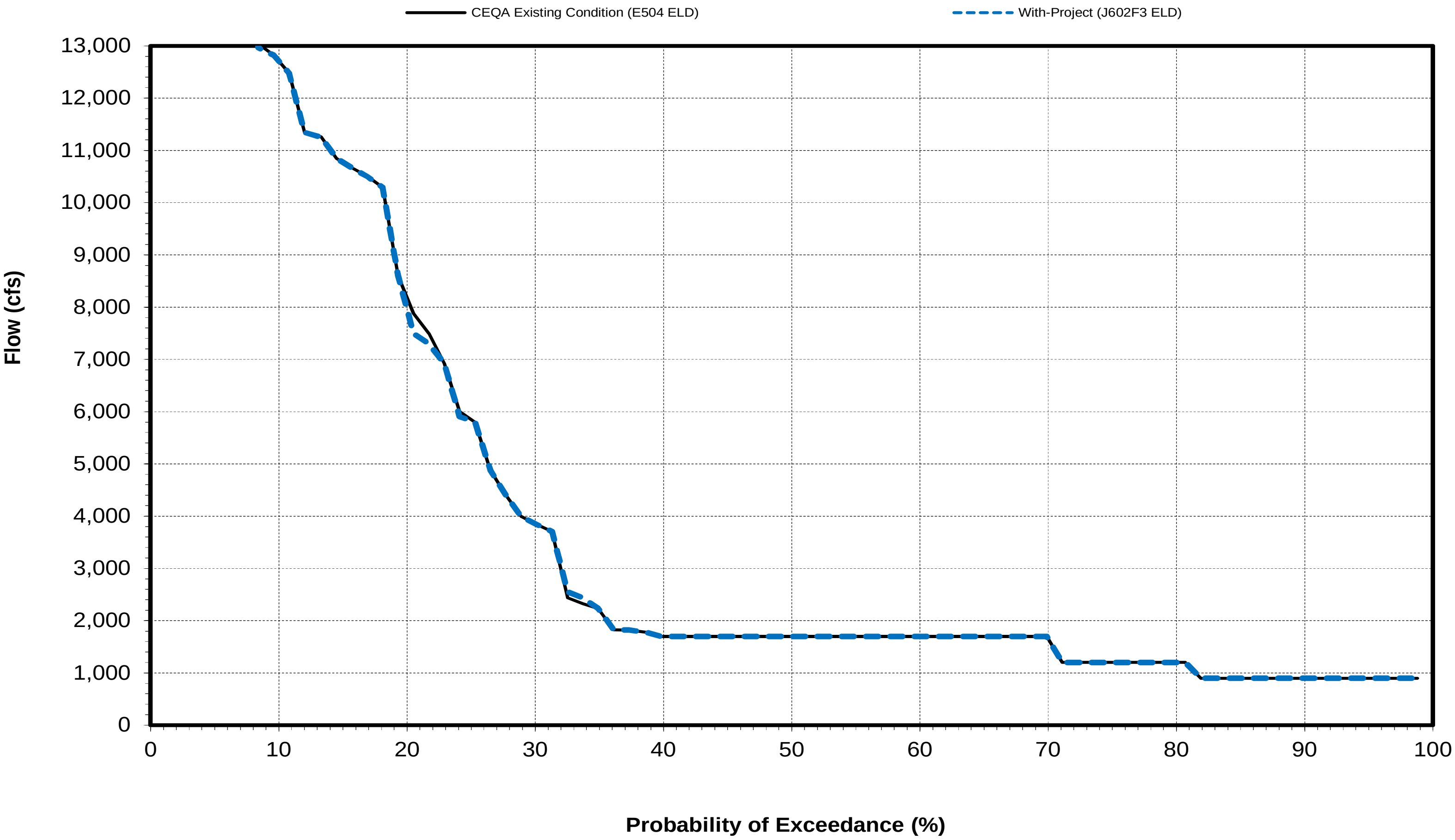


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Feather River Flow below Thermalito Afterbay

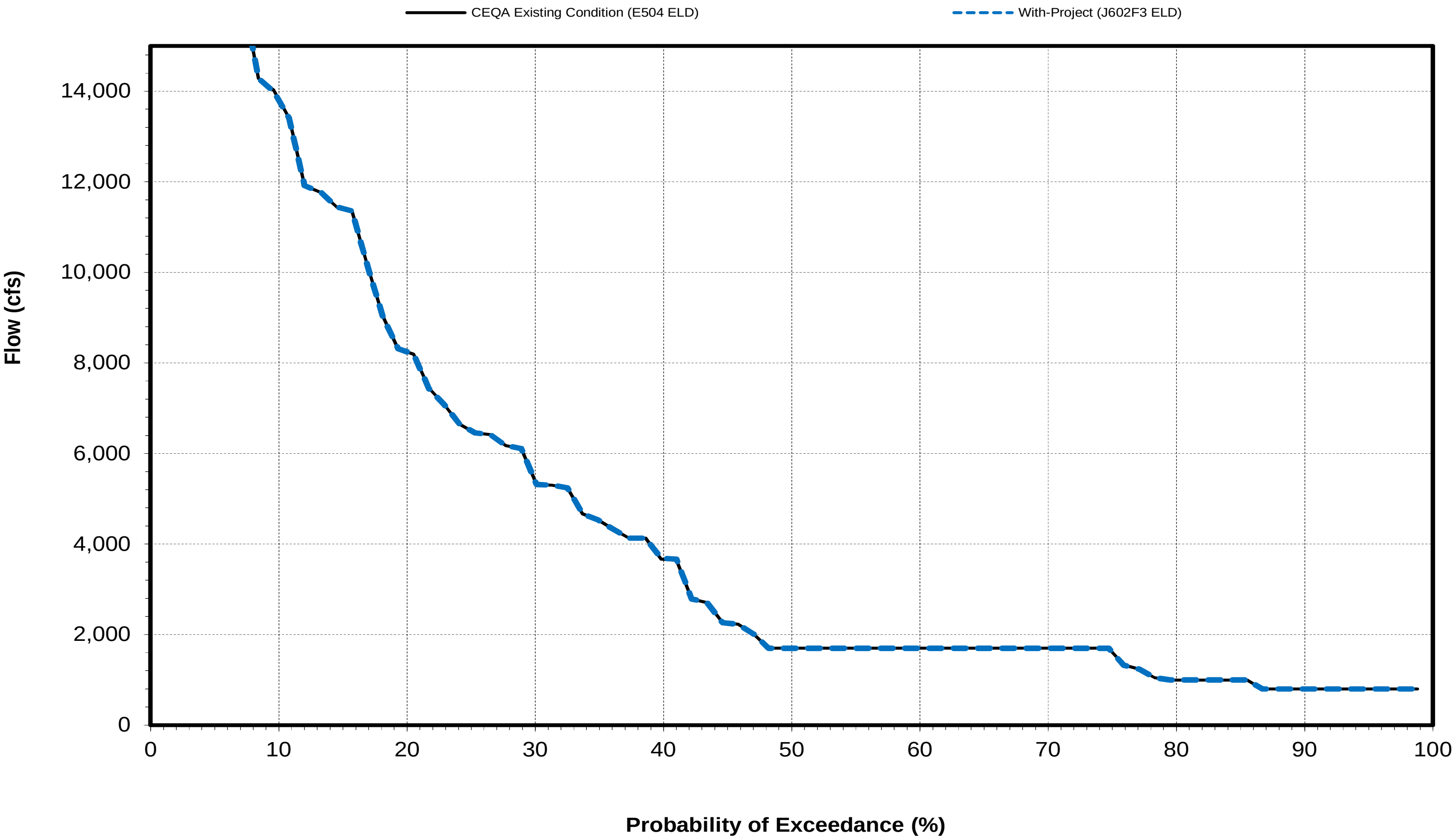
February



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Feather River Flow below Thermalito Afterbay **March**

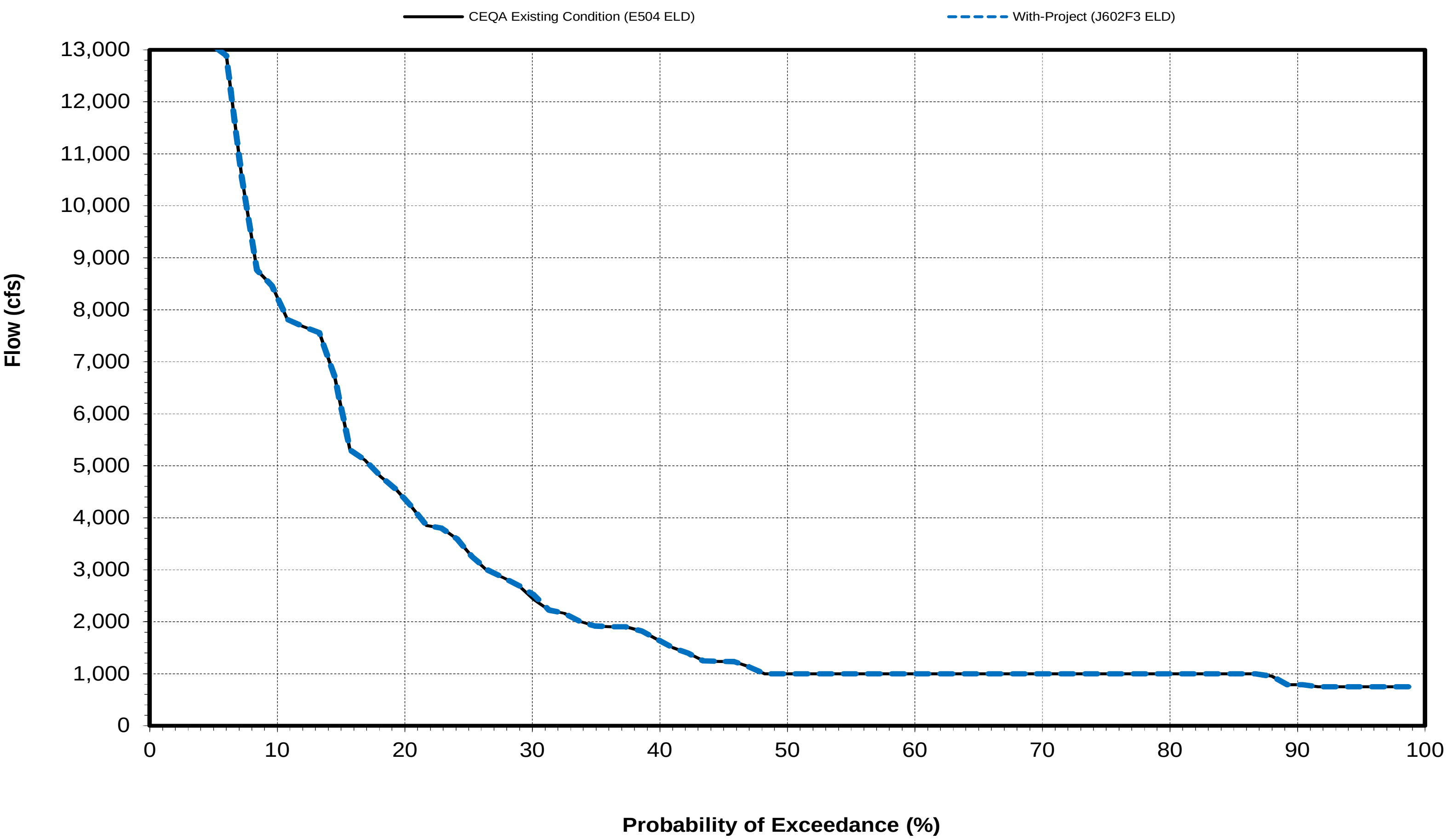


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Feather River Flow below Thermalito Afterbay

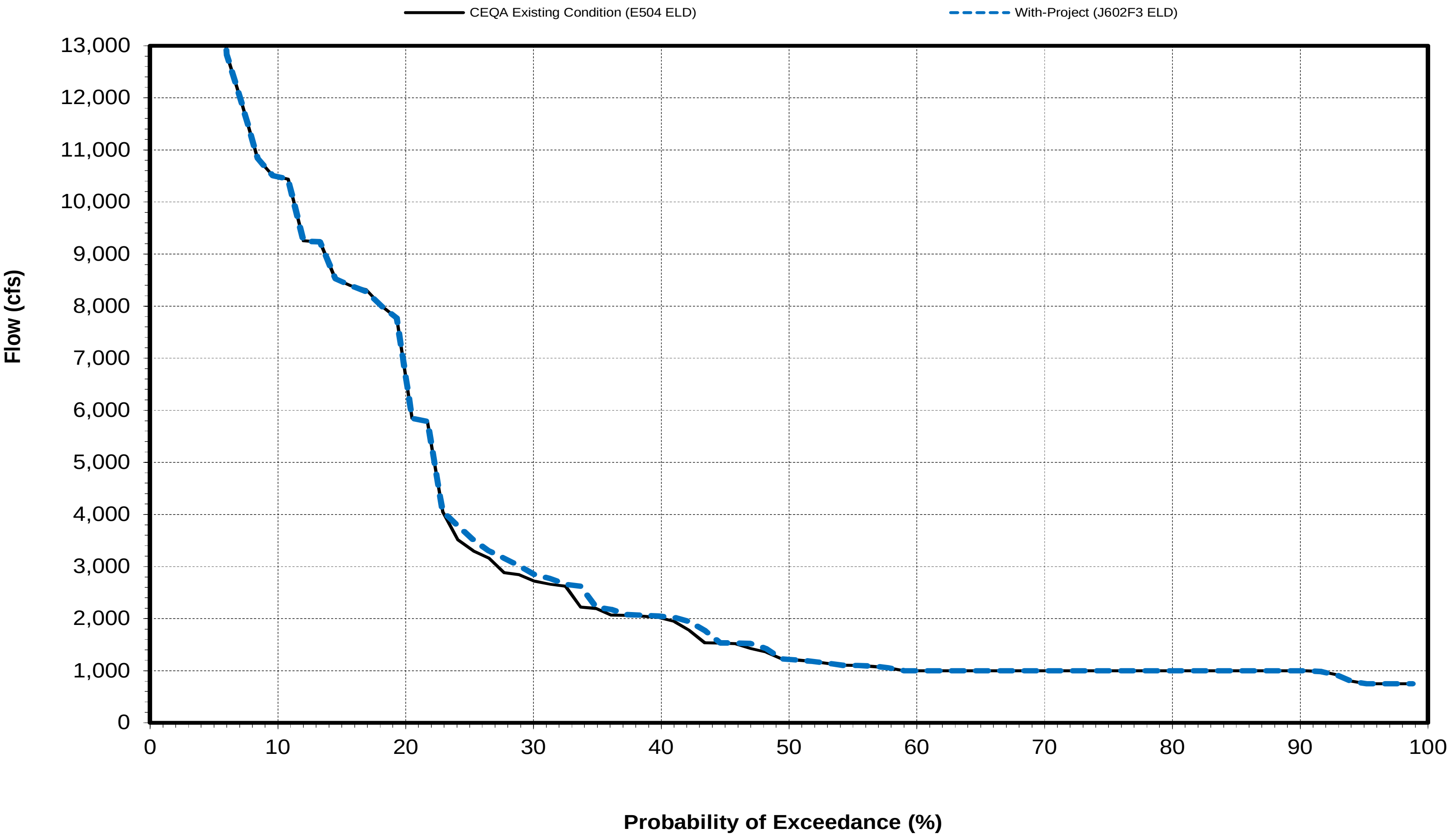
April



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

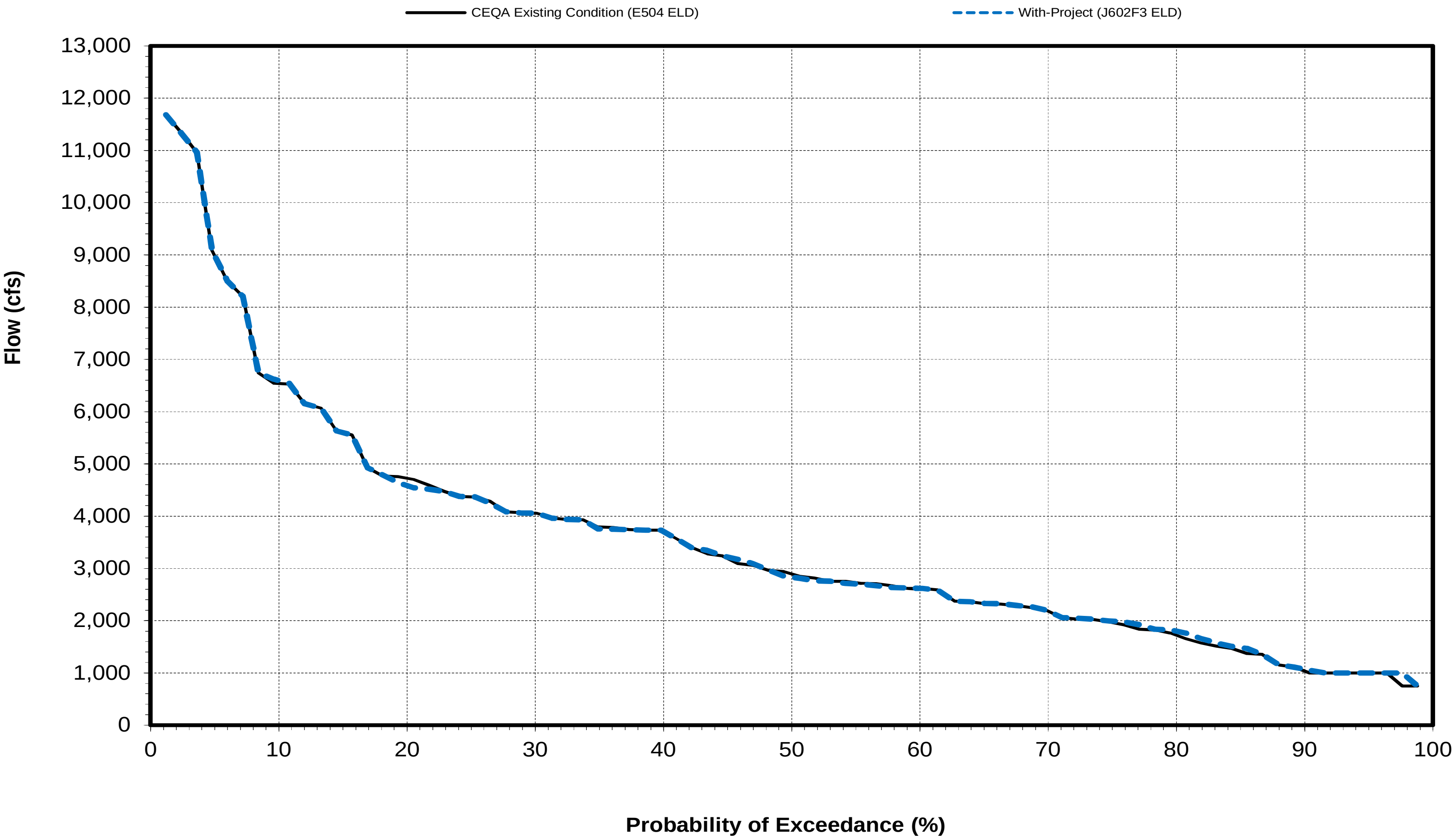
Feather River Flow below Thermalito Afterbay

May



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

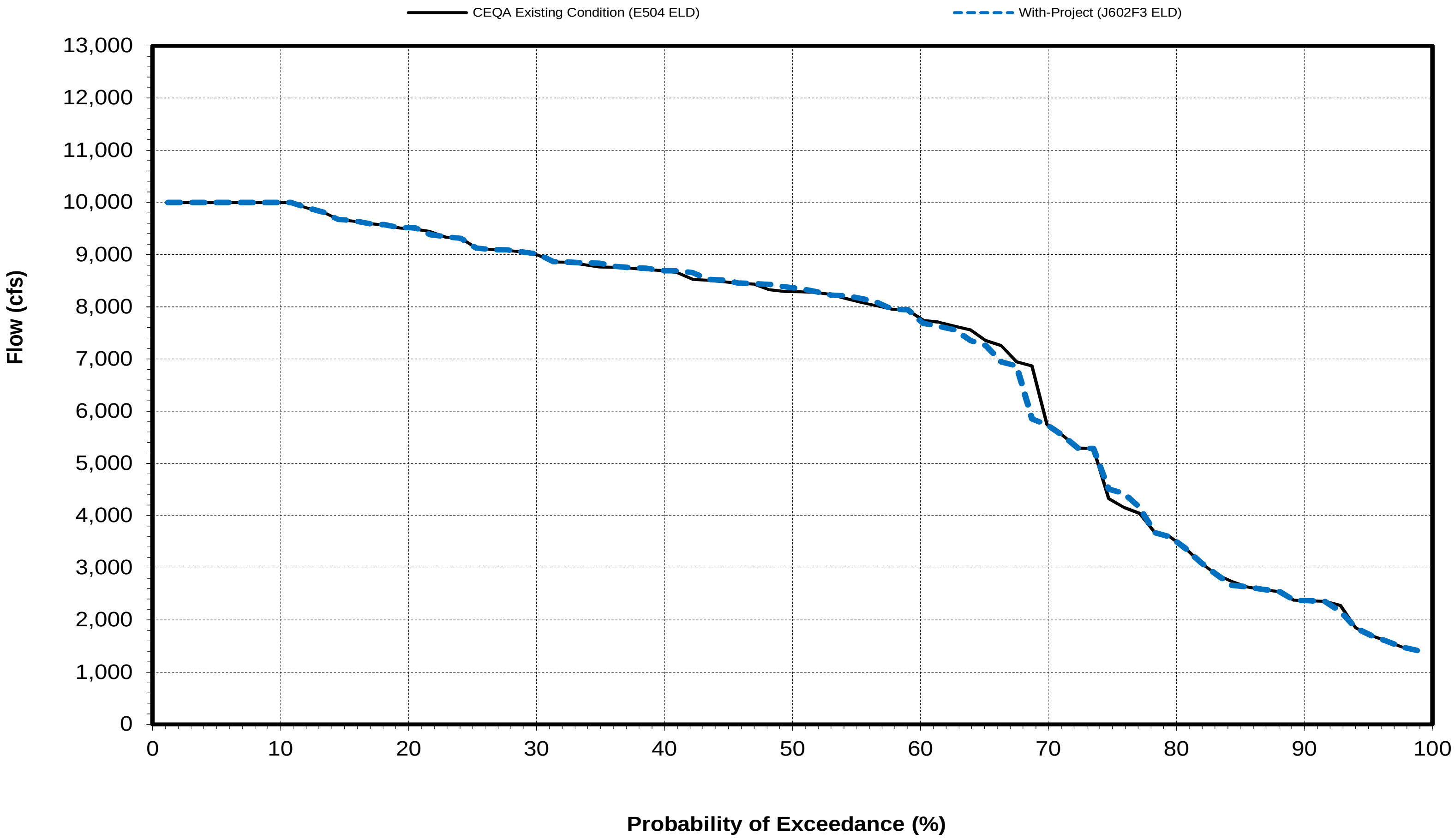
Feather River Flow below Thermalito Afterbay **June**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

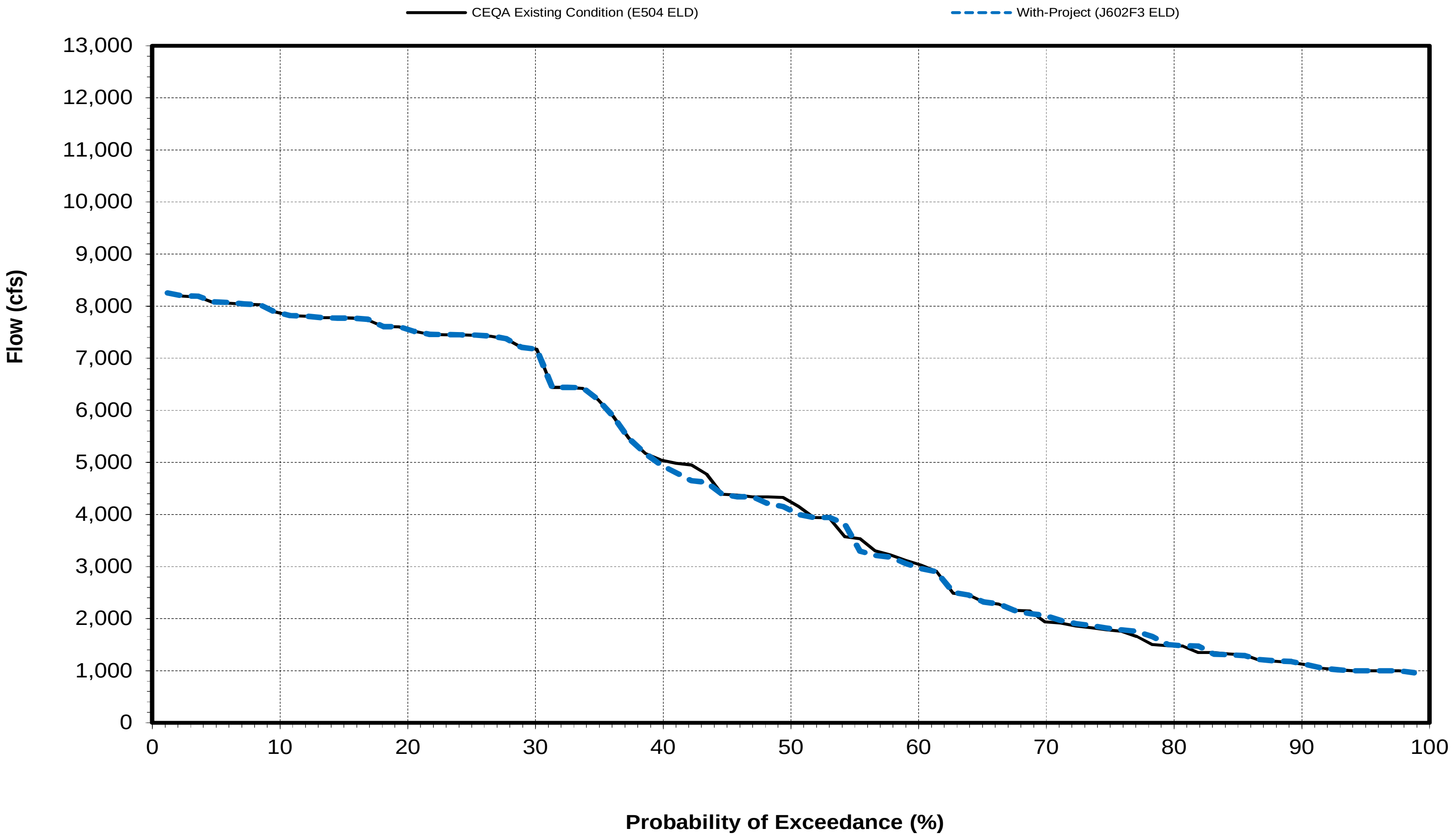
Feather River Flow below Thermalito Afterbay

July



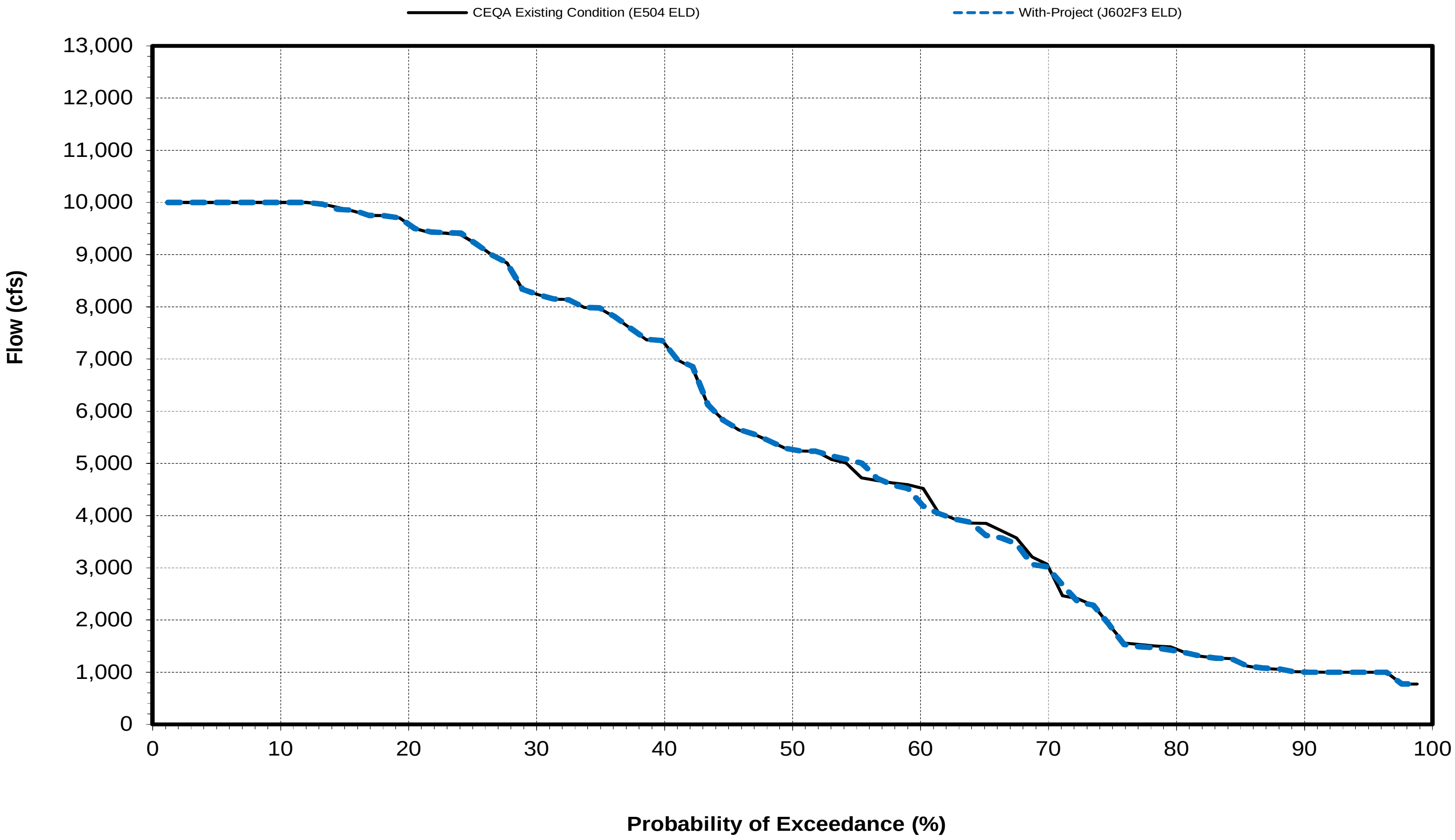
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Feather River Flow below Thermalito Afterbay **August**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Feather River Flow below Thermalito Afterbay **September**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Long-term and Water Year Type Average Feather River Flow at Mouth Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	3,159	2,966	5,241	10,724	11,814	12,383	8,735	7,596	6,082	7,715	5,338	7,287
With-Project (J602F3 ELD)	3,156	2,956	5,238	10,731	11,806	12,383	8,736	7,627	6,088	7,708	5,330	7,281
Difference	-3	-10	-3	7	-8	0	1	31	6	-7	-8	-6
Percent Difference[3]	-0.1	-0.3	-0.1	0.1	-0.1	0.0	0.0	0.4	0.1	-0.1	-0.1	-0.1
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	3,625	4,242	9,168	21,677	23,970	23,213	15,836	14,370	10,224	8,256	5,429	11,212
With-Project (J602F3 ELD)	3,617	4,242	9,156	21,700	23,942	23,213	15,836	14,368	10,227	8,257	5,430	11,213
Difference	-8	0	-12	23	-28	0	0	-2	3	1	1	1
Percent Difference[3]	-0.2	0.0	-0.1	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
CEQA Existing Condition (E504 ELD)	3,029	3,151	4,994	10,306	11,114	16,947	9,746	7,800	6,290	9,563	7,833	9,838
With-Project (J602F3 ELD)	3,029	3,151	4,994	10,309	11,124	16,948	9,746	7,800	6,271	9,564	7,837	9,841
Difference	0	0	0	3	10	1	0	0	-19	1	4	3
Percent Difference[3]	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	-0.3	0.0	0.1	0.0
Below Normal												
CEQA Existing Condition (E504 ELD)	3,375	2,554	3,465	5,356	7,118	6,624	5,323	4,542	4,573	9,334	8,249	6,289
With-Project (J602F3 ELD)	3,376	2,496	3,465	5,354	7,116	6,623	5,323	4,715	4,556	9,329	8,225	6,164
Difference	1	-58	0	-2	-2	-1	0	173	-17	-5	-24	-125
Percent Difference[3]	0.0	-2.3	0.0	0.0	0.0	0.0	0.0	3.8	-0.4	-0.1	-0.3	-2.0
Dry												
CEQA Existing Condition (E504 ELD)	3,004	2,144	3,119	4,240	4,203	4,606	4,120	3,595	3,720	7,254	3,653	4,283
With-Project (J602F3 ELD)	2,999	2,144	3,118	4,240	4,202	4,606	4,125	3,604	3,770	7,229	3,633	4,347
Difference	-5	0	-1	0	-1	0	5	9	50	-25	-20	64
Percent Difference[3]	-0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.3	1.3	-0.3	-0.5	1.5
Critical												
CEQA Existing Condition (E504 ELD)	2,260	1,728	2,236	3,399	3,072	2,742	3,240	2,281	2,205	3,494	1,774	1,902
With-Project (J602F3 ELD)	2,263	1,728	2,240	3,397	3,071	2,741	3,240	2,281	2,203	3,490	1,772	1,902
Difference	3	0	4	-2	-1	-1	0	0	-2	-4	-2	0
Percent Difference[3]	0.1	0.0	0.2	-0.1	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0

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

Feather River Flow at Mouth - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	11089	11098	9	0.1
2.4	5216	5216	0	0.0
3.6	5148	5148	0	0.0
4.8	5130	5130	0	0.0
6.0	5129	5129	0	0.0
7.2	5126	5126	0	0.0
8.4	4993	4993	0	0.0
9.6	4901	4901	0	0.0
10.8	4854	4854	0	0.0
12.0	4852	4852	0	0.0
13.3	4759	4759	0	0.0
14.5	4722	4722	0	0.0
15.7	4710	4710	0	0.0
16.9	4626	4593	-33	-0.7
18.1	4580	4547	-33	-0.7
19.3	4527	4527	0	0.0
20.5	4517	4517	0	0.0
21.7	4503	4503	0	0.0
22.9	4501	4501	0	0.0
24.1	4453	4453	0	0.0
25.3	4424	4424	0	0.0
26.5	4418	4418	0	0.0
27.7	4330	4330	0	0.0
28.9	4311	4311	0	0.0
30.1	4300	4300	0	0.0
31.3	4154	4105	-49	-1.2
32.5	4106	4094	-12	-0.3
33.7	4094	4088	-6	-0.1
34.9	3988	3988	0	0.0
36.1	3982	3982	0	0.0
37.3	3954	3954	0	0.0
38.6	3943	3943	0	0.0
39.8	3942	3942	0	0.0
41.0	3894	3930	36	0.9
42.2	3877	3894	17	0.4
43.4	3839	3876	37	1.0
44.6	3798	3798	0	0.0
45.8	3630	3630	0	0.0
47.0	3621	3621	0	0.0
48.2	3449	3451	2	0.1
49.4	3448	3449	1	0.0
50.6	3027	3027	0	0.0
51.8	2926	2804	-122	-4.2
53.0	2804	2776	-28	-1.0
54.2	2776	2700	-76	-2.7
55.4	2591	2591	0	0.0
56.6	2526	2526	0	0.0
57.8	2477	2479	2	0.1
59.0	2473	2473	0	0.0
60.2	2287	2287	0	0.0
61.4	2193	2193	0	0.0
62.7	2065	2065	0	0.0
63.9	1987	1986	-1	-0.1
65.1	1934	1934	0	0.0
66.3	1917	1917	0	0.0
67.5	1904	1902	-2	-0.1
68.7	1832	1832	0	0.0
69.9	1816	1815	-1	-0.1
71.1	1789	1791	2	0.1
72.3	1760	1764	4	0.2
73.5	1739	1739	0	0.0
74.7	1700	1700	0	0.0
75.9	1700	1700	0	0.0
77.1	1627	1627	0	0.0
78.3	1603	1605	2	0.1
79.5	1569	1568	-1	-0.1
80.7	1540	1532	-8	-0.5
81.9	1524	1524	0	0.0
83.1	1508	1508	0	0.0
84.3	1478	1483	5	0.3
85.5	1460	1461	1	0.1
86.7	1389	1388	-1	-0.1
88.0	1350	1350	0	0.0
89.2	1304	1304	0	0.0
90.4	1231	1231	0	0.0
91.6	1200	1200	0	0.0
92.8	1200	1200	0	0.0
94.0	1149	1149	0	0.0
95.2	1062	1062	0	0.0
96.4	980	980	0	0.0
97.6	906	906	0	0.0
98.8	900	900	0	0.0
Min	900	900	-122	-4.2
Max	11089	11098	37	1.0
Mean	3159	3156	-3	-0.1
Median	3238	3238	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	96.3
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	21694	21694	0	0.0
2.4	11672	11672	0	0.0
3.6	9558	9561	3	0.0
4.8	7413	7413	0	0.0
6.0	6867	6867	0	0.0
7.2	5885	5886	1	0.0
8.4	4923	4922	-1	0.0
9.6	4599	4599	0	0.0
10.8	4577	4578	1	0.0
12.0	4272	4272	0	0.0
13.3	4142	4143	1	0.0
14.5	3882	3882	0	0.0
15.7	3658	3658	0	0.0
16.9	3609	3609	0	0.0
18.1	3437	3437	0	0.0
19.3	3194	3194	0	0.0
20.5	3143	3143	0	0.0
21.7	3098	3098	0	0.0
22.9	3082	3051	-31	-1.0
24.1	3051	2979	-72	-2.4
25.3	2979	2969	-10	-0.3
26.5	2969	2958	-11	-0.4
27.7	2958	2947	-11	-0.4
28.9	2947	2939	-8	-0.3
30.1	2940	2937	-3	-0.1
31.3	2937	2886	-51	-1.7
32.5	2886	2884	-2	-0.1
33.7	2884	2879	-5	-0.2
34.9	2879	2871	-8	-0.3
36.1	2871	2859	-12	-0.4
37.3	2859	2748	-111	-3.9
38.6	2748	2745	-3	-0.1
39.8	2745	2676	-69	-2.5
41.0	2676	2665	-11	-0.4
42.2	2664	2634	-30	-1.1
43.4	2634	2610	-24	-0.9
44.6	2610	2592	-18	-0.7
45.8	2592	2576	-16	-0.6
47.0	2576	2531	-45	-1.7
48.2	2531	2529	-2	-0.1
49.4	2529	2526	-3	-0.1
50.6	2526	2435	-91	-3.6
51.8	2435	2414	-21	-0.9
53.0	2414	2412	-2	-0.1
54.2	2412	2404	-8	-0.3
55.4	2404	2309	-95	-4.0
56.6	2308	2282	-26	-1.1
57.8	2272	2272	0	0.0
59.0	2257	2257	0	0.0
60.2	2250	2250	0	0.0
61.4	2235	2235	0	0.0
62.7	2185	2185	0	0.0
63.9	2108	2108	0	0.0
65.1	2073	2073	0	0.0
66.3	2067	2067	0	0.0
67.5	2064	2064	0	0.0
68.7	2010	2010	0	0.0
69.9	1865	1865	0	0.0
71.1	1839	1839	0	0.0
72.3	1835	1835	0	0.0
73.5	1700	1700	0	0.0
74.7	1629	1629	0	0.0
75.9	1549	1549	0	0.0
77.1	1538	1540	2	0.1
78.3	1510	1510	0	0.0
79.5	1359	1359	0	0.0
80.7	1342	1342	0	0.0
81.9	1332	1332	0	0.0
83.1	1325	1325	0	0.0
84.3	1316	1316	0	0.0
85.5	1314	1314	0	0.0
86.7	1280	1280	0	0.0
88.0	1278	1278	0	0.0
89.2	1249	1248	-1	-0.1
90.4	1162	1161	-1	-0.1
91.6	1059	1059	0	0.0
92.8	964	964	0	0.0
94.0	939	939	0	0.0
95.2	900	900	0	0.0
96.4	900	900	0	0.0
97.6	900	900	0	0.0
98.8	900	900	0	0.0
Min	900	900	-111	-4.0
Max	21694	21694	3	0.1
Mean	2966	2956	-10	-0.4
Median	2528	2481	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		11.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	47781	47781	0	0.0
2.4	24671	24361	-310	-1.3
3.6	21728	21728	0	0.0
4.8	19900	19900	0	0.0
6.0	16561	16562	1	0.0
7.2	13068	13068	0	0.0
8.4	12933	12933	0	0.0
9.6	11874	11874	0	0.0
10.8	11211	11211	0	0.0
12.0	9138	9138	0	0.0
13.3	7556	7556	0	0.0
14.5	7332	7332	0	0.0
15.7	6934	6934	0	0.0
16.9	6824	6824	0	0.0
18.1	6511	6511	0	0.0
19.3	6359	6359	0	0.0
20.5	6205	6204	-1	0.0
21.7	6066	6066	0	0.0
22.9	5945	5945	0	0.0
24.1	5917	5936	19	0.3
25.3	5788	5788	0	0.0
26.5	5628	5628	0	0.0
27.7	5410	5410	0	0.0
28.9	5335	5324	-11	-0.2
30.1	5186	5186	0	0.0
31.3	5139	5138	-1	0.0
32.5	5052	5052	0	0.0
33.7	4896	4896	0	0.0
34.9	4861	4861	0	0.0
36.1	4832	4832	0	0.0
37.3	4821	4821	0	0.0
38.6	4804	4804	0	0.0
39.8	4501	4495	-6	-0.1
41.0	3959	3936	-23	-0.6
42.2	3887	3887	0	0.0
43.4	3803	3803	0	0.0
44.6	3721	3726	5	0.1
45.8	3680	3721	41	1.1
47.0	3665	3665	0	0.0
48.2	3588	3588	0	0.0
49.4	3557	3557	0	0.0
50.6	3373	3373	0	0.0
51.8	3323	3323	0	0.0
53.0	3311	3311	0	0.0
54.2	3215	3215	0	0.0
55.4	3131	3132	1	0.0
56.6	2875	2875	0	0.0
57.8	2860	2860	0	0.0
59.0	2847	2847	0	0.0
60.2	2785	2785	0	0.0
61.4	2733	2733	0	0.0
62.7	2708	2708	0	0.0
63.9	2663	2663	0	0.0
65.1	2370	2370	0	0.0
66.3	2048	2048	0	0.0
67.5	2006	2006	0	0.0
68.7	1985	1989	4	0.2
69.9	1872	1872	0	0.0
71.1	1848	1848	0	0.0
72.3	1824	1824	0	0.0
73.5	1790	1789	-1	-0.1
74.7	1700	1700	0	0.0
75.9	1700	1700	0	0.0
77.1	1700	1700	0	0.0
78.3	1700	1700	0	0.0
79.5	1699	1700	1	0.1
80.7	1674	1674	0	0.0
81.9	1654	1654	0	0.0
83.1	1648	1648	0	0.0
84.3	1644	1644	0	0.0
85.5	1520	1520	0	0.0
86.7	1324	1324	0	0.0
88.0	1200	1200	0	0.0
89.2	1145	1145	0	0.0
90.4	978	978	0	0.0
91.6	900	900	0	0.0
92.8	900	900	0	0.0
94.0	900	900	0	0.0
95.2	900	900	0	0.0
96.4	900	900	0	0.0
97.6	900	900	0	0.0
98.8	900	900	0	0.0
Min	900	900	-310	-1.3
Max	47781	47781	41	1.1
Mean	5241	5238	-3	0.0
Median	3465	3465	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	97.6
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	98395	98395	0	0.0
2.4	67174	67174	0	0.0
3.6	38493	38494	1	0.0
4.8	33795	33798	3	0.0
6.0	31312	31477	165	0.5
7.2	30858	31314	456	1.5
8.4	25292	25268	-24	-0.1
9.6	23248	23248	0	0.0
10.8	21273	21273	0	0.0
12.0	20109	20109	0	0.0
13.3	20053	20084	31	0.2
14.5	19349	19350	1	0.0
15.7	18345	18345	0	0.0
16.9	17622	17622	0	0.0
18.1	17602	17602	0	0.0
19.3	17280	17280	0	0.0
20.5	16235	16235	0	0.0
21.7	16175	16175	0	0.0
22.9	16005	16005	0	0.0
24.1	15147	15148	1	0.0
25.3	13209	13209	0	0.0
26.5	13006	13006	0	0.0
27.7	11503	11502	-1	0.0
28.9	11319	11319	0	0.0
30.1	10899	10899	0	0.0
31.3	10303	10303	0	0.0
32.5	9688	9688	0	0.0
33.7	9482	9481	-1	0.0
34.9	9291	9291	0	0.0
36.1	9209	9209	0	0.0
37.3	9079	9079	0	0.0
38.6	9035	9035	0	0.0
39.8	8438	8438	0	0.0
41.0	7623	7623	0	0.0
42.2	6534	6534	0	0.0
43.4	6250	6250	0	0.0
44.6	5822	5822	0	0.0
45.8	5640	5640	0	0.0
47.0	5580	5580	0	0.0
48.2	5549	5549	0	0.0
49.4	5348	5348	0	0.0
50.6	5100	5100	0	0.0
51.8	4984	4984	0	0.0
53.0	4729	4729	0	0.0
54.2	4707	4707	0	0.0
55.4	4637	4637	0	0.0
56.6	4617	4617	0	0.0
57.8	4569	4569	0	0.0
59.0	4567	4567	0	0.0
60.2	4445	4445	0	0.0
61.4	4406	4406	0	0.0
62.7	4170	4170	0	0.0
63.9	4009	4009	0	0.0
65.1	4000	4000	0	0.0
66.3	3993	3993	0	0.0
67.5	3832	3818	-14	-0.4
68.7	3730	3730	0	0.0
69.9	3653	3653	0	0.0
71.1	3637	3637	0	0.0
72.3	3570	3570	0	0.0
73.5	3217	3217	0	0.0
74.7	3039	3039	0	0.0
75.9	2983	2983	0	0.0
77.1	2921	2921	0	0.0
78.3	2911	2911	0	0.0
79.5	2834	2834	0	0.0
80.7	2812	2812	0	0.0
81.9	2794	2794	0	0.0
83.1	2657	2657	0	0.0
84.3	2633	2633	0	0.0
85.5	2621	2621	0	0.0
86.7	2397	2397	0	0.0
88.0	2326	2326	0	0.0
89.2	2174	2174	0	0.0
90.4	1958	1958	0	0.0
91.6	1864	1865	1	0.1
92.8	1853	1836	-17	-0.9
94.0	1733	1732	-1	-0.1
95.2	1700	1700	0	0.0
96.4	1551	1551	0	0.0
97.6	1248	1247	-1	-0.1
98.8	1200	1200	0	0.0
Min	1200	1200	-24	-0.9
Max	98395	98395	456	1.5
Mean	10724	10731	7	0.0
Median	5224	5224	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	72241	72169	-72	-0.1
2.4	42482	42392	-90	-0.2
3.6	36324	36324	0	0.0
4.8	35642	35642	0	0.0
6.0	35401	35401	0	0.0
7.2	35059	35059	0	0.0
8.4	33614	33614	0	0.0
9.6	31525	31525	0	0.0
10.8	31072	31072	0	0.0
12.0	30135	30135	0	0.0
13.3	25880	25881	1	0.0
14.5	23295	23295	0	0.0
15.7	21346	21346	0	0.0
16.9	21170	21168	-2	0.0
18.1	20603	20603	0	0.0
19.3	19801	19216	-585	-3.0
20.5	18709	18706	-3	0.0
21.7	18039	18039	0	0.0
22.9	16440	16454	14	0.1
24.1	16415	16440	25	0.2
25.3	16341	16415	74	0.5
26.5	15760	15760	0	0.0
27.7	15279	15184	-95	-0.6
28.9	15160	15160	0	0.0
30.1	14539	14533	-6	0.0
31.3	13597	13596	-1	0.0
32.5	13029	13142	113	0.9
33.7	12829	12830	1	0.0
34.9	12499	12499	0	0.0
36.1	12133	12133	0	0.0
37.3	11104	11104	0	0.0
38.6	10950	10951	1	0.0
39.8	10566	10566	0	0.0
41.0	10515	10515	0	0.0
42.2	10000	10000	0	0.0
43.4	8773	8773	0	0.0
44.6	8402	8402	0	0.0
45.8	7740	7741	1	0.0
47.0	7402	7402	0	0.0
48.2	7182	7156	-26	-0.4
49.4	6820	6820	0	0.0
50.6	6701	6701	0	0.0
51.8	6650	6650	0	0.0
53.0	6507	6507	0	0.0
54.2	5955	5955	0	0.0
55.4	5942	5943	1	0.0
56.6	5615	5615	0	0.0
57.8	4899	4899	0	0.0
59.0	4779	4779	0	0.0
60.2	4699	4699	0	0.0
61.4	4612	4612	0	0.0
62.7	4572	4572	0	0.0
63.9	4517	4517	0	0.0
65.1	4308	4308	0	0.0
66.3	4247	4247	0	0.0
67.5	4220	4220	0	0.0
68.7	4170	4170	0	0.0
69.9	4128	4128	0	0.0
71.1	4085	4085	0	0.0
72.3	4065	4065	0	0.0
73.5	4008	4008	0	0.0
74.7	3741	3741	0	0.0
75.9	3523	3523	0	0.0
77.1	2919	2919	0	0.0
78.3	2652	2652	0	0.0
79.5	2612	2612	0	0.0
80.7	2601	2601	0	0.0
81.9	2487	2473	-14	-0.6
83.1	2254	2254	0	0.0
84.3	2222	2222	0	0.0
85.5	2214	2214	0	0.0
86.7	2170	2170	0	0.0
88.0	1866	1866	0	0.0
89.2	1774	1774	0	0.0
90.4	1700	1700	0	0.0
91.6	1700	1700	0	0.0
92.8	1686	1686	0	0.0
94.0	1632	1632	0	0.0
95.2	1515	1515	0	0.0
96.4	1193	1192	-1	-0.1
97.6	900	900	0	0.0
98.8	900	900	0	0.0
Min	900	900	-585	-3.0
Max	72241	72169	113	0.9
Mean	11814	11806	-8	0.0
Median	6761	6761	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	58613	58613	0	0.0
2.4	58315	58315	0	0.0
3.6	47767	47767	0	0.0
4.8	37274	37244	-30	-0.1
6.0	36180	36180	0	0.0
7.2	34661	34661	0	0.0
8.4	32127	32121	-6	0.0
9.6	30947	30947	0	0.0
10.8	29373	29373	0	0.0
12.0	29101	29101	0	0.0
13.3	27678	27678	0	0.0
14.5	26105	26105	0	0.0
15.7	23888	23888	0	0.0
16.9	23777	23781	4	0.0
18.1	22308	22308	0	0.0
19.3	21898	21898	0	0.0
20.5	19944	19943	-1	0.0
21.7	18566	18566	0	0.0
22.9	17923	17925	2	0.0
24.1	16979	16980	1	0.0
25.3	16226	16227	1	0.0
26.5	15997	15993	-4	0.0
27.7	14848	14848	0	0.0
28.9	14793	14793	0	0.0
30.1	13988	13987	-1	0.0
31.3	13929	13929	0	0.0
32.5	13704	13706	2	0.0
33.7	12911	12911	0	0.0
34.9	12405	12450	45	0.4
36.1	12281	12283	2	0.0
37.3	11871	11871	0	0.0
38.6	11590	11590	0	0.0
39.8	9879	9880	1	0.0
41.0	9818	9818	0	0.0
42.2	9790	9794	4	0.0
43.4	9719	9719	0	0.0
44.6	9717	9717	0	0.0
45.8	8981	8981	0	0.0
47.0	8387	8387	0	0.0
48.2	8162	8162	0	0.0
49.4	7757	7757	0	0.0
50.6	7364	7364	0	0.0
51.8	7182	7182	0	0.0
53.0	7167	7166	-1	0.0
54.2	6752	6752	0	0.0
55.4	6136	6136	0	0.0
56.6	5569	5569	0	0.0
57.8	5518	5518	0	0.0
59.0	5383	5383	0	0.0
60.2	5242	5242	0	0.0
61.4	5235	5235	0	0.0
62.7	5213	5213	0	0.0
63.9	5177	5177	0	0.0
65.1	4747	4747	0	0.0
66.3	4727	4727	0	0.0
67.5	4521	4521	0	0.0
68.7	4221	4221	0	0.0
69.9	4127	4127	0	0.0
71.1	4036	4037	1	0.0
72.3	3946	3946	0	0.0
73.5	3921	3921	0	0.0
74.7	3742	3742	0	0.0
75.9	3623	3623	0	0.0
77.1	3583	3570	-13	-0.4
78.3	3290	3290	0	0.0
79.5	3226	3226	0	0.0
80.7	3162	3162	0	0.0
81.9	2938	2938	0	0.0
83.1	2613	2613	0	0.0
84.3	2564	2564	0	0.0
85.5	2452	2453	1	0.0
86.7	2359	2359	0	0.0
88.0	2291	2290	-1	0.0
89.2	2276	2276	0	0.0
90.4	2227	2227	0	0.0
91.6	2075	2075	0	0.0
92.8	1648	1648	0	0.0
94.0	1510	1493	-17	-1.1
95.2	1000	1000	0	0.0
96.4	1000	1000	0	0.0
97.6	750	750	0	0.0
98.8	750	750	0	0.0
Min	750	750	-30	-1.1
Max	58613	58613	45	0.4
Mean	12383	12383	0	0.0
Median	7561	7561	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	49206	49206	0	0.0
2.4	30341	30341	0	0.0
3.6	28597	28597	0	0.0
4.8	27658	27658	0	0.0
6.0	27269	27269	0	0.0
7.2	27119	27118	-1	0.0
8.4	25720	25720	0	0.0
9.6	25461	25461	0	0.0
10.8	21662	21662	0	0.0
12.0	18833	18833	0	0.0
13.3	17888	17888	0	0.0
14.5	14908	14908	0	0.0
15.7	14825	14825	0	0.0
16.9	14510	14511	1	0.0
18.1	13757	13757	0	0.0
19.3	13303	13303	0	0.0
20.5	13014	13014	0	0.0
21.7	11265	11265	0	0.0
22.9	10311	10311	0	0.0
24.1	9911	9911	0	0.0
25.3	9865	9865	0	0.0
26.5	8992	8992	0	0.0
27.7	8888	8887	-1	0.0
28.9	8860	8860	0	0.0
30.1	8393	8393	0	0.0
31.3	8114	8115	1	0.0
32.5	7380	7380	0	0.0
33.7	7268	7268	0	0.0
34.9	7008	7008	0	0.0
36.1	7004	7005	1	0.0
37.3	6985	6985	0	0.0
38.6	6926	6926	0	0.0
39.8	6907	6907	0	0.0
41.0	6722	6722	0	0.0
42.2	6698	6698	0	0.0
43.4	6628	6628	0	0.0
44.6	6464	6464	0	0.0
45.8	6326	6326	0	0.0
47.0	6295	6295	0	0.0
48.2	6199	6199	0	0.0
49.4	5815	5815	0	0.0
50.6	5670	5670	0	0.0
51.8	5634	5634	0	0.0
53.0	5333	5333	0	0.0
54.2	5299	5299	0	0.0
55.4	4987	4987	0	0.0
56.6	4867	4867	0	0.0
57.8	4779	4779	0	0.0
59.0	4371	4371	0	0.0
60.2	4366	4366	0	0.0
61.4	4155	4155	0	0.0
62.7	4136	4135	-1	0.0
63.9	4083	4083	0	0.0
65.1	4031	4031	0	0.0
66.3	4004	4015	11	0.3
67.5	3924	4004	80	2.0
68.7	3821	3821	0	0.0
69.9	3770	3770	0	0.0
71.1	3619	3619	0	0.0
72.3	3594	3594	0	0.0
73.5	3543	3543	0	0.0
74.7	3444	3444	0	0.0
75.9	3335	3335	0	0.0
77.1	3305	3305	0	0.0
78.3	3260	3260	0	0.0
79.5	3229	3228	-1	0.0
80.7	2800	2800	0	0.0
81.9	2800	2800	0	0.0
83.1	2800	2800	0	0.0
84.3	2800	2800	0	0.0
85.5	2800	2800	0	0.0
86.7	2800	2800	0	0.0
88.0	2800	2800	0	0.0
89.2	2800	2800	0	0.0
90.4	2800	2800	0	0.0
91.6	2800	2800	0	0.0
92.8	2800	2800	0	0.0
94.0	2800	2800	0	0.0
95.2	2685	2686	1	0.0
96.4	2571	2571	0	0.0
97.6	2186	2186	0	0.0
98.8	1355	1355	0	0.0
Min	1355	1355	-1	0.0
Max	49206	49206	80	2.0
Mean	8735	8736	1	0.0
Median	5743	5743	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	34939	34939	0	0.0
2.4	32835	32835	0	0.0
3.6	30058	30058	0	0.0
4.8	25939	25939	0	0.0
6.0	23962	23962	0	0.0
7.2	21979	21979	0	0.0
8.4	19429	19429	0	0.0
9.6	19190	19190	0	0.0
10.8	17926	17926	0	0.0
12.0	17374	17374	0	0.0
13.3	16017	16017	0	0.0
14.5	15933	15933	0	0.0
15.7	14141	14141	0	0.0
16.9	13530	13530	0	0.0
18.1	13151	13114	-37	-0.3
19.3	12779	12780	1	0.0
20.5	11824	11824	0	0.0
21.7	10615	10616	1	0.0
22.9	9917	9917	0	0.0
24.1	9702	9702	0	0.0
25.3	8931	8931	0	0.0
26.5	8577	8577	0	0.0
27.7	8564	8564	0	0.0
28.9	8512	8512	0	0.0
30.1	7025	7025	0	0.0
31.3	6006	6006	0	0.0
32.5	6003	6003	0	0.0
33.7	5911	5911	0	0.0
34.9	5431	5469	38	0.7
36.1	5410	5431	21	0.4
37.3	5343	5410	67	1.3
38.6	5174	5216	42	0.8
39.8	5167	5174	7	0.1
41.0	4851	5167	316	6.5
42.2	4848	4900	52	1.1
43.4	4836	4848	12	0.2
44.6	4739	4836	97	2.0
45.8	4730	4739	9	0.2
47.0	4690	4730	40	0.9
48.2	4663	4690	27	0.6
49.4	4529	4662	133	2.9
50.6	4518	4529	11	0.2
51.8	4494	4518	24	0.5
53.0	4368	4494	126	2.9
54.2	4366	4366	0	0.0
55.4	4243	4351	108	2.5
56.6	4202	4239	37	0.9
57.8	4082	4202	120	2.9
59.0	4058	4082	24	0.6
60.2	3992	4058	66	1.7
61.4	3945	3992	47	1.2
62.7	3860	3945	85	2.2
63.9	3687	3860	173	4.7
65.1	3566	3687	121	3.4
66.3	3546	3566	20	0.6
67.5	3340	3546	206	6.2
68.7	3199	3340	141	4.4
69.9	3191	3199	8	0.3
71.1	3079	3191	112	3.6
72.3	2906	3094	188	6.5
73.5	2862	2906	44	1.5
74.7	2843	2862	19	0.7
75.9	2819	2842	23	0.8
77.1	2818	2819	1	0.0
78.3	2800	2818	18	0.6
79.5	2800	2800	0	0.0
80.7	2800	2800	0	0.0
81.9	2800	2800	0	0.0
83.1	2800	2800	0	0.0
84.3	2800	2800	0	0.0
85.5	2800	2800	0	0.0
86.7	2800	2800	0	0.0
88.0	2800	2800	0	0.0
89.2	2800	2800	0	0.0
90.4	2646	2646	0	0.0
91.6	2534	2534	0	0.0
92.8	2494	2492	-2	-0.1
94.0	2318	2318	0	0.0
95.2	2182	2182	0	0.0
96.4	1795	1796	1	0.1
97.6	1000	1000	0	0.0
98.8	750	750	0	0.0
Min	750	750	-37	-0.3
Max	34939	34939	316	6.5
Mean	7596	7627	31	0.8
Median	4524	4596	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	78.0
1.1<=X<10.0		22.0
X>=5.0		3.7
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	24590	24590	0	0.0
2.4	22416	22416	0	0.0
3.6	19242	19242	0	0.0
4.8	18968	18968	0	0.0
6.0	18548	18548	0	0.0
7.2	18120	18120	0	0.0
8.4	17570	17570	0	0.0
9.6	12448	12448	0	0.0
10.8	12417	12417	0	0.0
12.0	11973	11973	0	0.0
13.3	10775	10775	0	0.0
14.5	10309	10310	1	0.0
15.7	9121	9121	0	0.0
16.9	9040	9040	0	0.0
18.1	8614	8707	93	1.1
19.3	8529	8529	0	0.0
20.5	8189	8189	0	0.0
21.7	8056	8056	0	0.0
22.9	6984	6985	1	0.0
24.1	6866	6901	35	0.5
25.3	6690	6690	0	0.0
26.5	6386	6386	0	0.0
27.7	5970	5970	0	0.0
28.9	5941	5923	-18	-0.3
30.1	5828	5787	-41	-0.7
31.3	5623	5696	73	1.3
32.5	5614	5624	10	0.2
33.7	5519	5614	95	1.7
34.9	5355	5514	159	3.0
36.1	5281	5355	74	1.4
37.3	5008	5280	272	5.4
38.6	4918	5007	89	1.8
39.8	4763	4918	155	3.3
41.0	4726	4760	34	0.7
42.2	4679	4679	0	0.0
43.4	4663	4648	-15	-0.3
44.6	4599	4628	29	0.6
45.8	4431	4605	174	3.9
47.0	4353	4431	78	1.8
48.2	4342	4353	11	0.3
49.4	4259	4259	0	0.0
50.6	4228	4232	4	0.1
51.8	4170	4224	54	1.3
53.0	4156	4156	0	0.0
54.2	4131	4102	-29	-0.7
55.4	4126	4092	-34	-0.8
56.6	4071	4089	18	0.4
57.8	4029	4030	1	0.0
59.0	4021	4028	7	0.2
60.2	4008	3920	-88	-2.2
61.4	3957	3919	-38	-1.0
62.7	3897	3895	-2	-0.1
63.9	3737	3738	1	0.0
65.1	3735	3735	0	0.0
66.3	3650	3650	0	0.0
67.5	3613	3620	7	0.2
68.7	3476	3483	7	0.2
69.9	3466	3476	10	0.3
71.1	3380	3380	0	0.0
72.3	3319	3319	0	0.0
73.5	3286	3148	-138	-4.2
74.7	3148	3115	-33	-1.0
75.9	3115	3102	-13	-0.4
77.1	3079	3081	2	0.1
78.3	2991	3080	89	3.0
79.5	2989	2990	1	0.0
80.7	2988	2989	1	0.0
81.9	2969	2968	-1	0.0
83.1	2821	2822	1	0.0
84.3	2758	2758	0	0.0
85.5	2650	2650	0	0.0
86.7	2511	2374	-137	-5.5
88.0	2375	2348	-27	-1.1
89.2	2349	2337	-12	-0.5
90.4	2339	2314	-25	-1.1
91.6	2314	2283	-31	-1.3
92.8	2309	2186	-123	-5.3
94.0	2309	2023	-286	-12.4
95.2	1799	1799	0	0.0
96.4	1000	1000	0	0.0
97.6	1000	1000	0	0.0
98.8	750	750	0	0.0
Min	750	750	-286	-12.4
Max	24590	24590	272	5.4
Mean	6082	6088	6	-0.1
Median	4244	4246	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	75.6
1.1<=X<10.0		14.6
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		3.7
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	65.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		15.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-5.0**

Feather River Flow at Mouth - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	12042	12050	8	0.1
2.4	10957	10959	2	0.0
3.6	10878	10878	0	0.0
4.8	10791	10791	0	0.0
6.0	10649	10649	0	0.0
7.2	10497	10497	0	0.0
8.4	10334	10334	0	0.0
9.6	10316	10324	8	0.1
10.8	10306	10306	0	0.0
12.0	10150	10154	4	0.0
13.3	10115	10115	0	0.0
14.5	10108	10108	0	0.0
15.7	10087	10088	1	0.0
16.9	9951	9944	-7	-0.1
18.1	9895	9894	-1	0.0
19.3	9859	9867	8	0.1
20.5	9842	9848	6	0.1
21.7	9815	9814	-1	0.0
22.9	9778	9800	22	0.2
24.1	9744	9744	0	0.0
25.3	9716	9712	-4	0.0
26.5	9700	9705	5	0.1
27.7	9699	9700	1	0.0
28.9	9697	9698	1	0.0
30.1	9650	9650	0	0.0
31.3	9636	9637	1	0.0
32.5	9625	9625	0	0.0
33.7	9424	9425	1	0.0
34.9	9359	9363	4	0.0
36.1	9334	9358	24	0.3
37.3	9315	9315	0	0.0
38.6	9202	9180	-22	-0.2
39.8	9185	9147	-38	-0.4
41.0	9028	9071	43	0.5
42.2	9012	9038	26	0.3
43.4	8972	8975	3	0.0
44.6	8964	8963	-1	0.0
45.8	8892	8823	-69	-0.8
47.0	8769	8744	-25	-0.3
48.2	8742	8744	2	0.0
49.4	8648	8653	5	0.1
50.6	8593	8653	60	0.7
51.8	8574	8628	54	0.6
53.0	8551	8548	-3	0.0
54.2	8482	8539	57	0.7
55.4	8447	8449	2	0.0
56.6	8444	8403	-41	-0.5
57.8	8305	8305	0	0.0
59.0	8288	8287	-1	0.0
60.2	8152	8152	0	0.0
61.4	7931	7985	54	0.7
62.7	7884	7884	0	0.0
63.9	7836	7823	-13	-0.2
65.1	7834	7653	-181	-2.3
66.3	7654	7645	-9	-0.1
67.5	7645	7575	-70	-0.9
68.7	7567	7117	-450	-5.9
69.9	7172	6972	-200	-2.8
71.1	6972	6842	-130	-1.9
72.3	6846	6712	-134	-2.0
73.5	6372	6377	5	0.1
74.7	6279	6279	0	0.0
75.9	5865	5865	0	0.0
77.1	5736	5736	0	0.0
78.3	5680	5680	0	0.0
79.5	5240	5240	0	0.0
80.7	5222	5222	0	0.0
81.9	5048	5048	0	0.0
83.1	4699	4699	0	0.0
84.3	4474	4679	205	4.6
85.5	4297	4474	177	4.1
86.7	3371	3558	187	5.5
88.0	2777	2782	5	0.2
89.2	2493	2496	3	0.1
90.4	2220	2219	-1	0.0
91.6	1967	1968	1	0.1
92.8	1960	1960	0	0.0
94.0	1799	1799	0	0.0
95.2	1579	1579	0	0.0
96.4	1506	1400	-106	-7.0
97.6	1398	1392	-6	-0.4
98.8	750	750	0	0.0
Min	750	750	-450	-7.0
Max	12042	12050	205	5.5
Mean	7715	7708	-6	-0.1
Median	8621	8653	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		3.7
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		15.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	9373	9377	4	0.0
2.4	9259	9263	4	0.0
3.6	9087	9086	-1	0.0
4.8	9083	9085	2	0.0
6.0	9001	9001	0	0.0
7.2	8881	8875	-6	-0.1
8.4	8773	8783	10	0.1
9.6	8726	8726	0	0.0
10.8	8657	8660	3	0.0
12.0	8635	8637	2	0.0
13.3	8600	8600	0	0.0
14.5	8587	8587	0	0.0
15.7	8580	8581	1	0.0
16.9	8506	8522	16	0.2
18.1	8503	8509	6	0.1
19.3	8423	8430	7	0.1
20.5	8402	8414	12	0.1
21.7	8400	8408	8	0.1
22.9	8399	8402	3	0.0
24.1	8385	8400	15	0.2
25.3	8382	8388	6	0.1
26.5	8362	8363	1	0.0
27.7	8341	8341	0	0.0
28.9	8280	8291	11	0.1
30.1	7957	7958	1	0.0
31.3	7945	7945	0	0.0
32.5	7755	7755	0	0.0
33.7	7662	7662	0	0.0
34.9	7647	7647	0	0.0
36.1	7216	7216	0	0.0
37.3	7121	7126	5	0.1
38.6	6169	6169	0	0.0
39.8	6167	6166	-1	0.0
41.0	6072	5860	-212	-3.5
42.2	5860	5713	-147	-2.5
43.4	5713	5708	-5	-0.1
44.6	5638	5634	-4	-0.1
45.8	5271	5395	124	2.4
47.0	5061	5263	202	4.0
48.2	4965	5060	95	1.9
49.4	4887	4887	0	0.0
50.6	4807	4808	1	0.0
51.8	4774	4805	31	0.6
53.0	4720	4720	0	0.0
54.2	4594	4594	0	0.0
55.4	4577	4351	-226	-4.9
56.6	4555	4210	-345	-7.6
57.8	4354	4160	-194	-4.5
59.0	4325	4028	-297	-6.9
60.2	3801	3801	0	0.0
61.4	3788	3787	-1	0.0
62.7	3764	3751	-13	-0.3
63.9	3649	3655	6	0.2
65.1	3595	3531	-64	-1.8
66.3	3532	3491	-41	-1.2
67.5	3491	3405	-86	-2.5
68.7	3389	3388	-1	0.0
69.9	3342	3300	-42	-1.3
71.1	3300	3300	0	0.0
72.3	3300	3300	0	0.0
73.5	3300	3284	-16	-0.5
74.7	3270	3227	-43	-1.3
75.9	3227	3214	-13	-0.4
77.1	2959	3015	56	1.9
78.3	2861	2959	98	3.4
79.5	2593	2885	292	11.3
80.7	2492	2589	97	3.9
81.9	2478	2478	0	0.0
83.1	2076	2083	7	0.3
84.3	2014	2014	0	0.0
85.5	1977	1981	4	0.2
86.7	1936	1936	0	0.0
88.0	1854	1859	5	0.3
89.2	1685	1636	-49	-2.9
90.4	1634	1629	-5	-0.3
91.6	1560	1559	-1	-0.1
92.8	1519	1510	-9	-0.6
94.0	1344	1377	33	2.5
95.2	1337	1344	7	0.5
96.4	1297	1297	0	0.0
97.6	1127	1127	0	0.0
98.8	750	750	0	0.0
Min	750	750	-345	-7.6
Max	9373	9377	292	11.3
Mean	5338	5330	-8	-0.1
Median	4847	4848	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	75.6
1.1<=X<10.0		8.5
X>=5.0		1.2
X>=10.0		1.2
-10.0<X<=-1.1		14.6
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		20.0
X>=5.0		5.0
X>=10.0		5.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**5.0**

Feather River Flow at Mouth - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	12814	12817	3	0.0
2.4	12652	12652	0	0.0
3.6	12417	12417	0	0.0
4.8	12181	12183	2	0.0
6.0	12087	12087	0	0.0
7.2	12067	12067	0	0.0
8.4	11956	11922	-34	-0.3
9.6	11902	11902	0	0.0
10.8	11874	11874	0	0.0
12.0	11848	11848	0	0.0
13.3	11810	11810	0	0.0
14.5	11730	11732	2	0.0
15.7	11564	11563	-1	0.0
16.9	11550	11550	0	0.0
18.1	11527	11527	0	0.0
19.3	11500	11500	0	0.0
20.5	11400	11400	0	0.0
21.7	11334	11350	16	0.1
22.9	11321	11321	0	0.0
24.1	11302	11302	0	0.0
25.3	11264	11264	0	0.0
26.5	10982	10982	0	0.0
27.7	10542	10599	57	0.5
28.9	10482	10482	0	0.0
30.1	10020	10021	1	0.0
31.3	9942	9953	11	0.1
32.5	9942	9938	-4	0.0
33.7	9856	9856	0	0.0
34.9	9779	9777	-2	0.0
36.1	9722	9722	0	0.0
37.3	9546	9547	1	0.0
38.6	9454	9454	0	0.0
39.8	9431	9443	12	0.1
41.0	9425	9426	1	0.0
42.2	9255	9265	10	0.1
43.4	8201	8200	-1	0.0
44.6	7594	7594	0	0.0
45.8	7437	7442	5	0.1
47.0	7367	7367	0	0.0
48.2	7291	7291	0	0.0
49.4	7282	7282	0	0.0
50.6	7269	7269	0	0.0
51.8	7154	7164	10	0.1
53.0	6915	7004	89	1.3
54.2	6896	6917	21	0.3
55.4	6828	6908	80	1.2
56.6	6424	6828	404	6.3
57.8	6423	6424	1	0.0
59.0	6293	6295	2	0.0
60.2	6221	6219	-2	0.0
61.4	6168	6148	-20	-0.3
62.7	5961	5849	-112	-1.9
63.9	5842	5542	-300	-5.1
65.1	5547	5520	-27	-0.5
66.3	5545	5433	-112	-2.0
67.5	5417	5200	-217	-4.0
68.7	5399	5179	-220	-4.1
69.9	5298	5118	-180	-3.4
71.1	4870	4767	-103	-2.1
72.3	4007	4271	264	6.6
73.5	3393	3360	-33	-1.0
74.7	3387	3249	-138	-4.1
75.9	3159	3159	0	0.0
77.1	3129	3128	-1	0.0
78.3	2839	2841	2	0.1
79.5	2731	2738	7	0.3
80.7	2722	2722	0	0.0
81.9	2681	2681	0	0.0
83.1	2667	2665	-2	-0.1
84.3	2621	2610	-11	-0.4
85.5	2598	2597	-1	0.0
86.7	2583	2583	0	0.0
88.0	2581	2581	0	0.0
89.2	2568	2568	0	0.0
90.4	2559	2559	0	0.0
91.6	2113	2113	0	0.0
92.8	1493	1493	0	0.0
94.0	1193	1193	0	0.0
95.2	1183	1183	0	0.0
96.4	1117	1117	0	0.0
97.6	1060	1060	0	0.0
98.8	1024	1024	0	0.0
Min	1024	1024	-300	-5.1
Max	12814	12817	404	6.6
Mean	7287	7281	-6	-0.1
Median	7276	7276	0	0.0

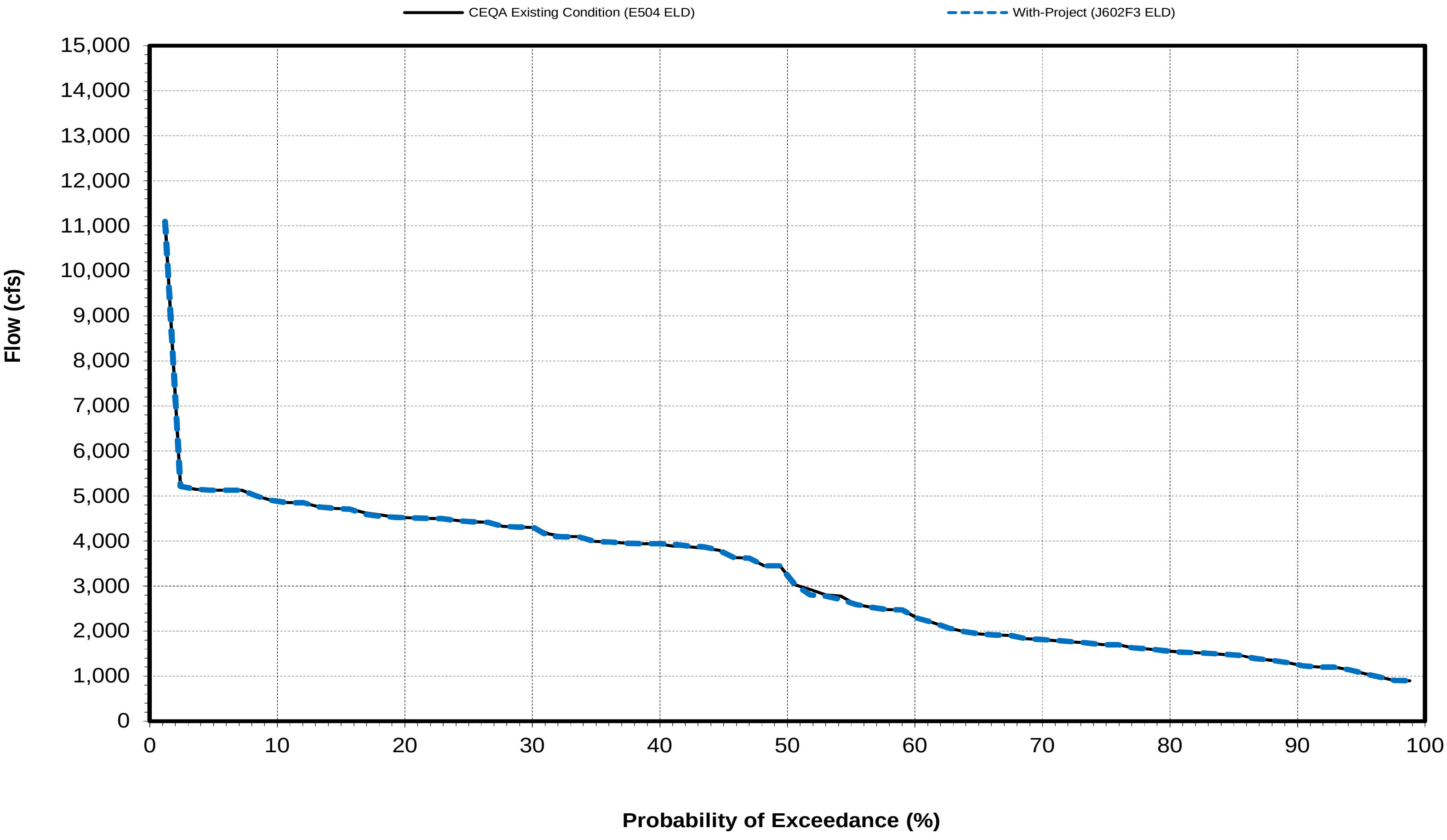
Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		4.9
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		9.8
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

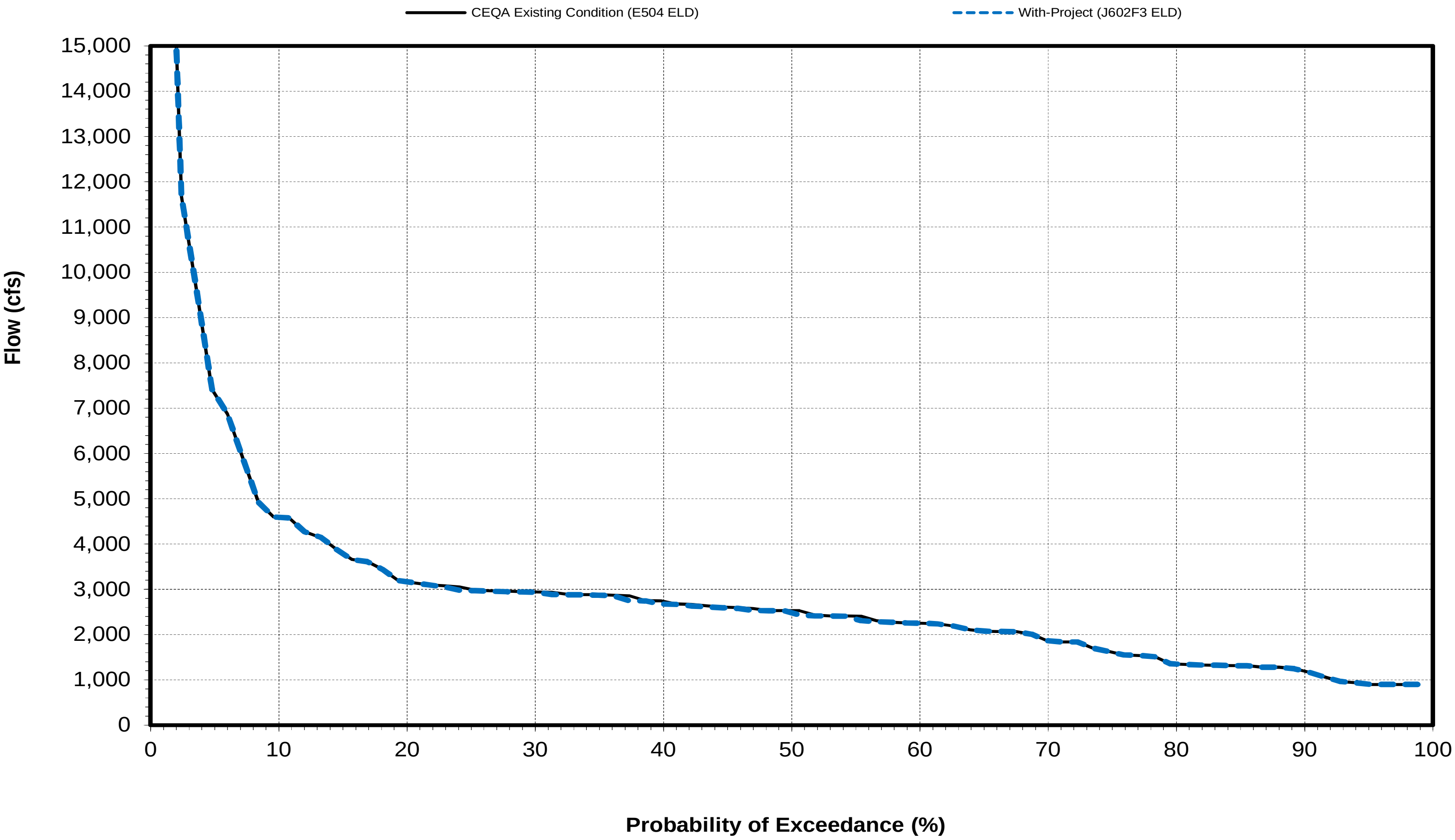
(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Feather River Flow at Mouth **October**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

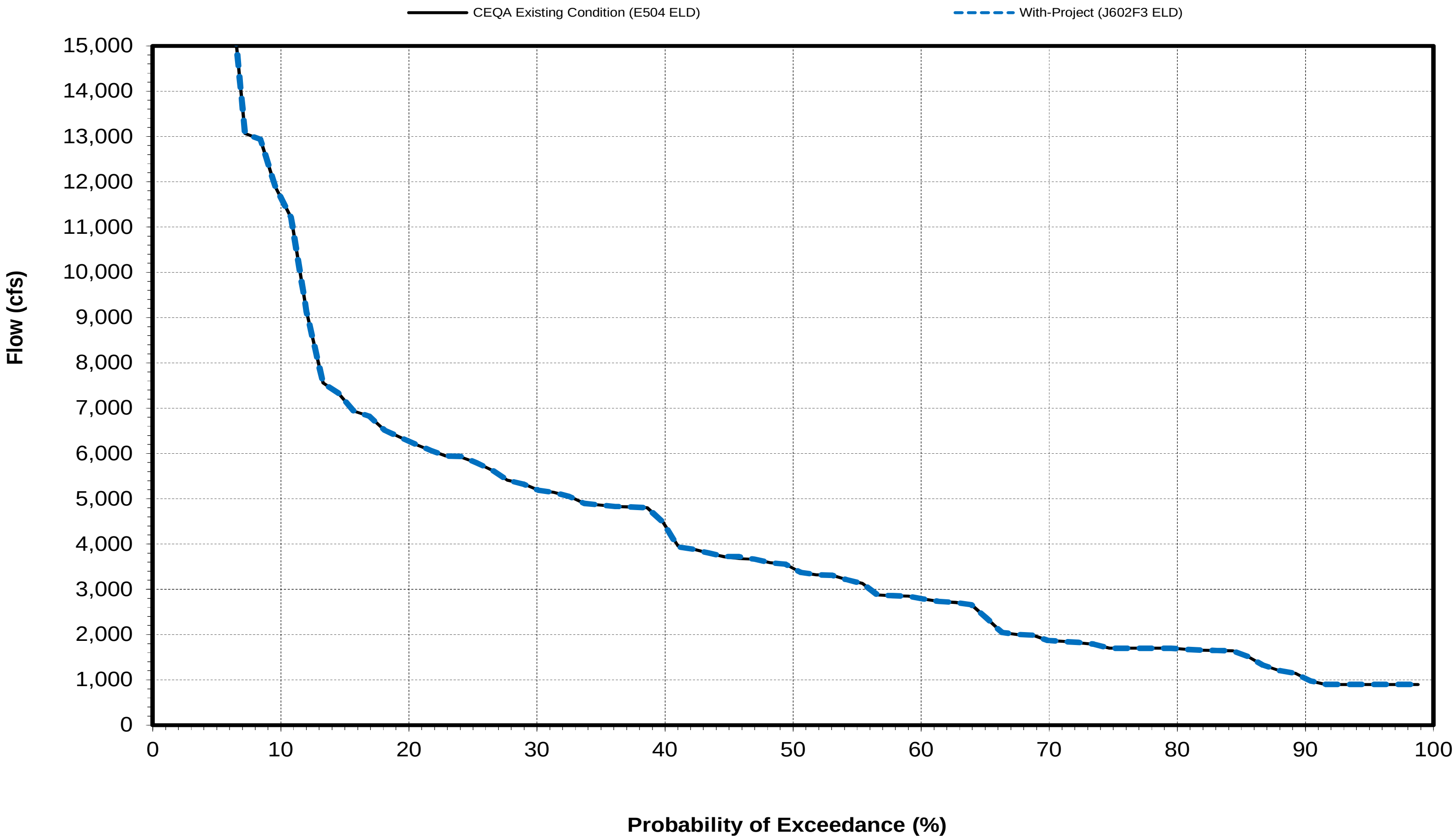
Feather River Flow at Mouth **November**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Feather River Flow at Mouth **December**

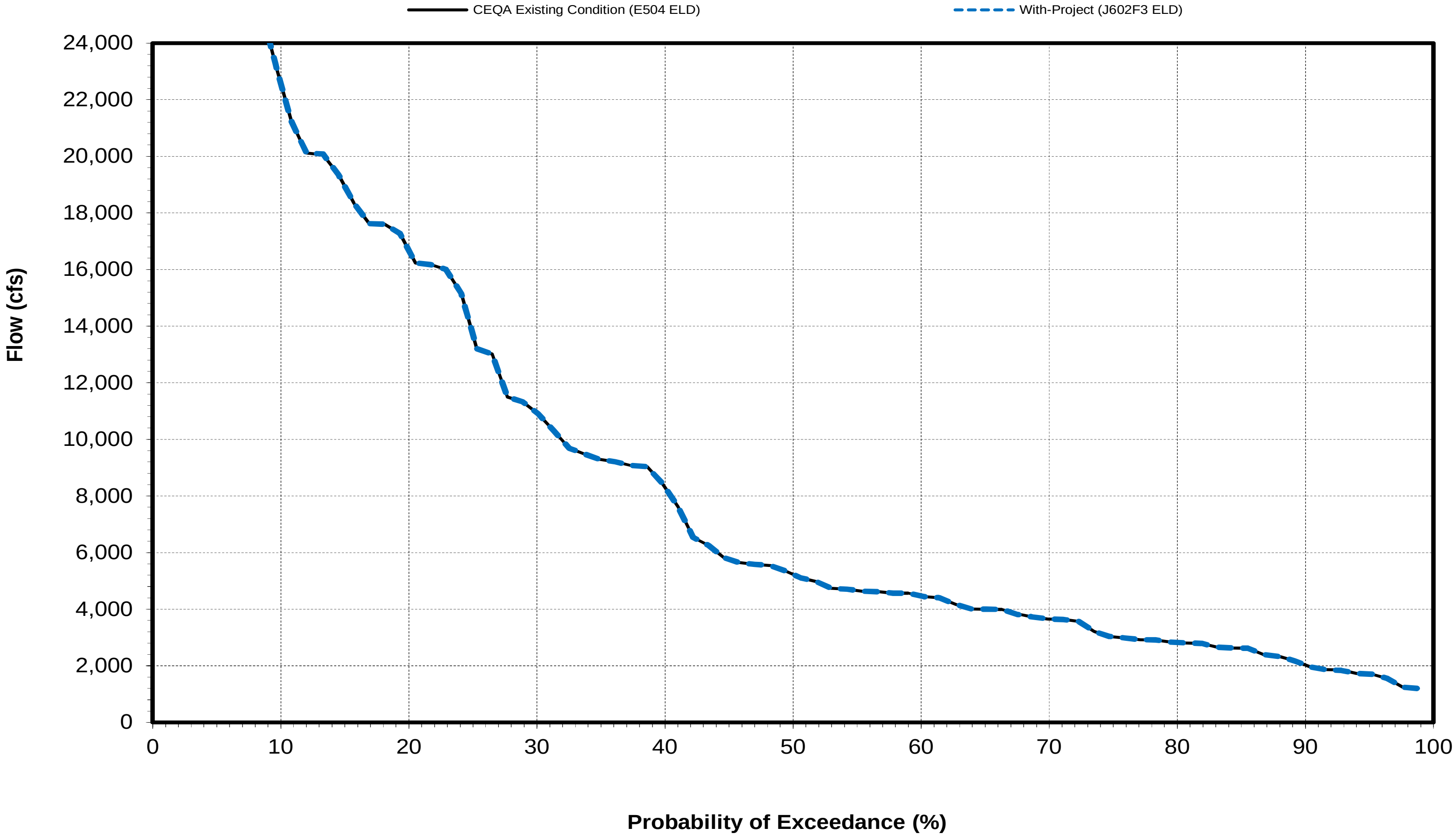


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Feather River Flow at Mouth

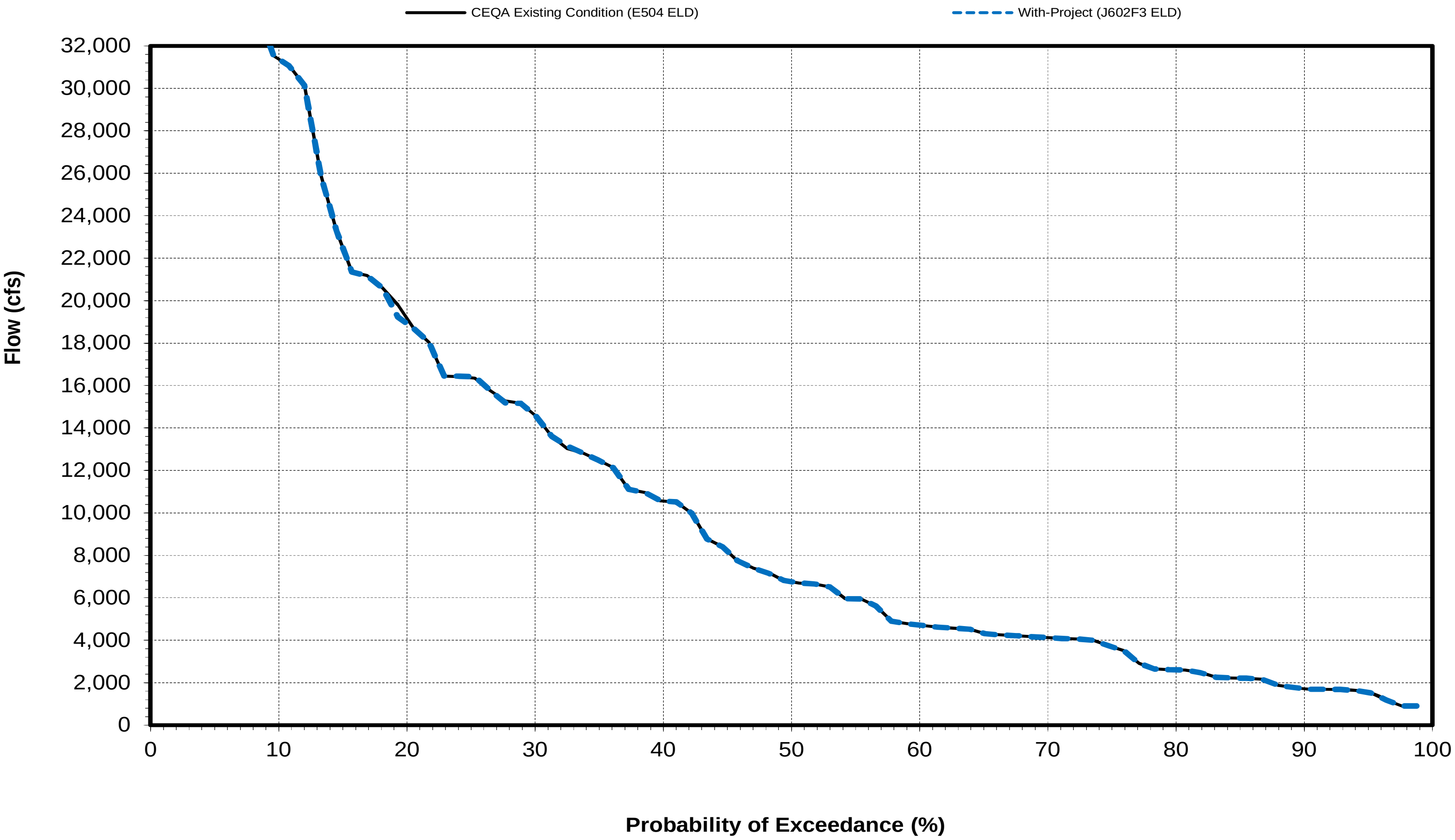
January



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

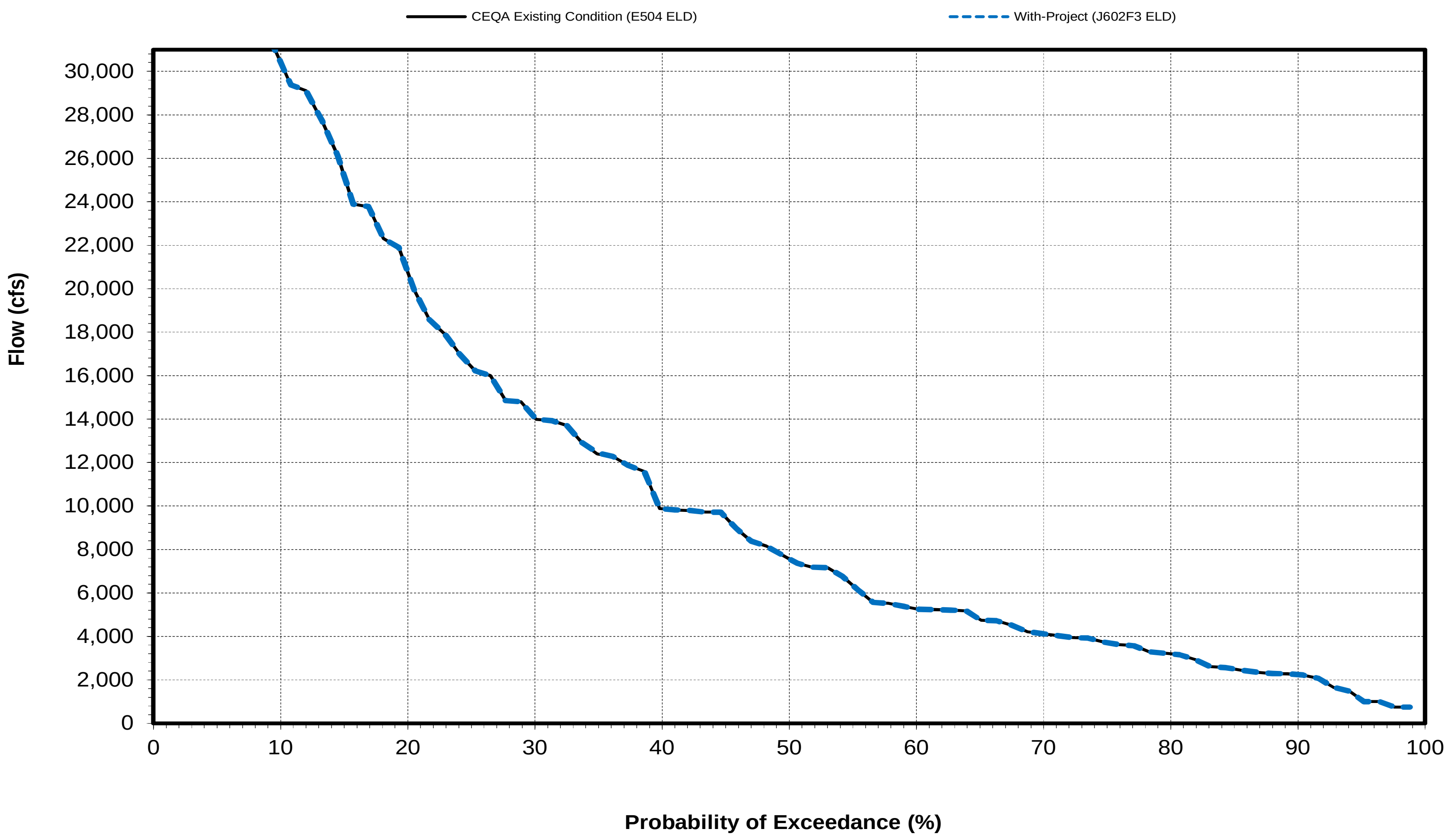
Created: 7/26/2016

Feather River Flow at Mouth **February**

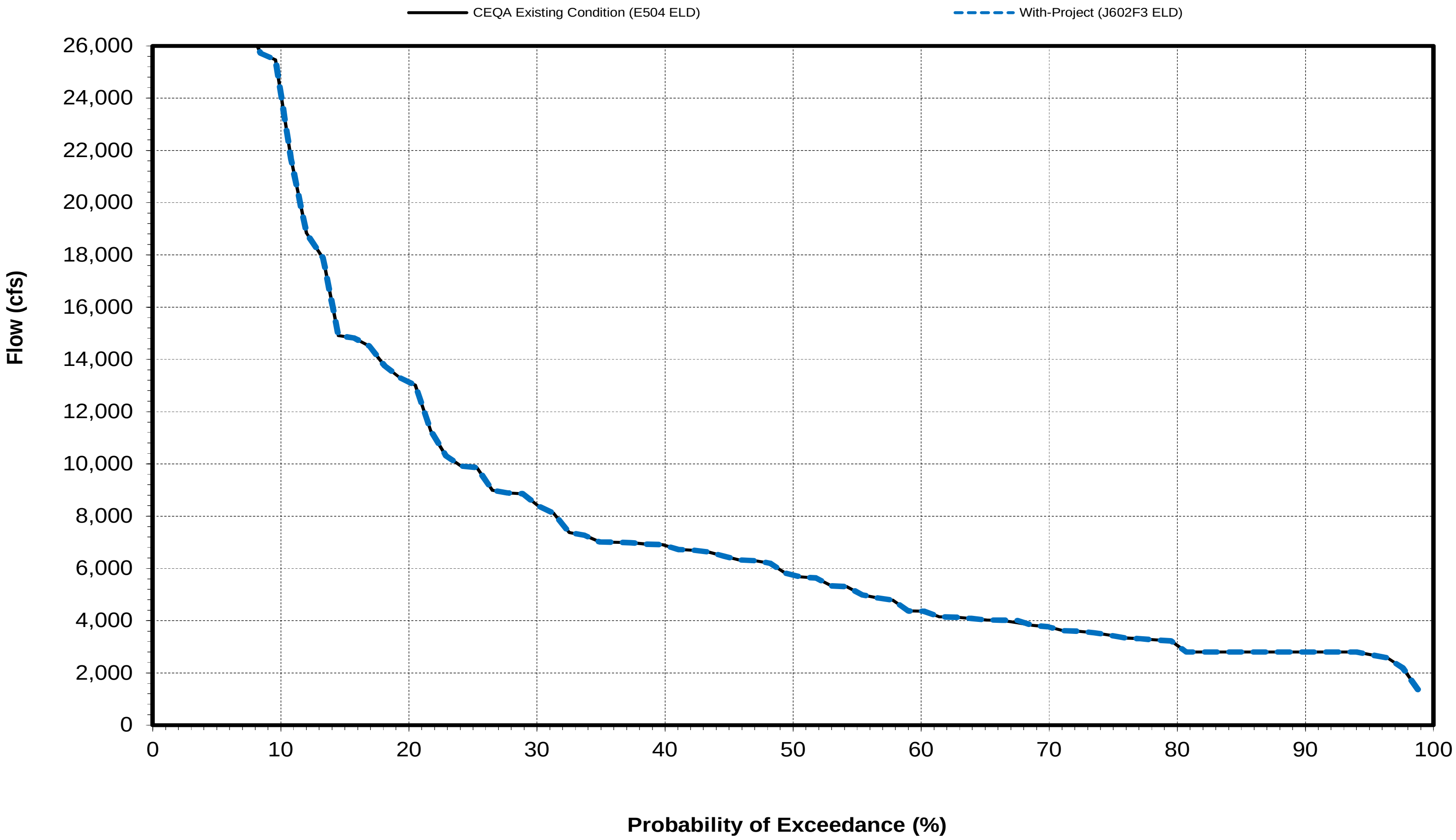


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Feather River Flow at Mouth **March**



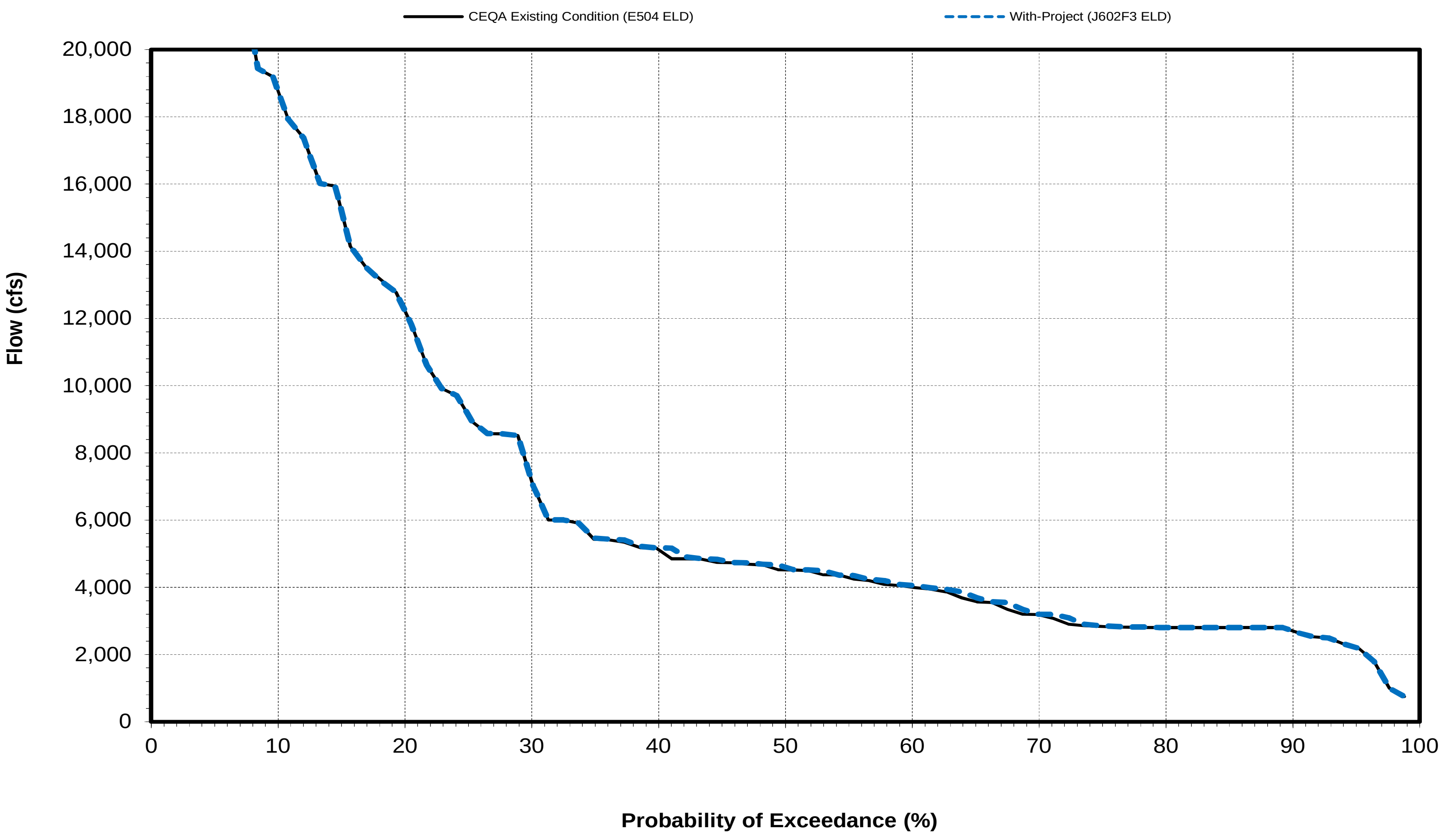
Feather River Flow at Mouth **April**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Feather River Flow at Mouth

May

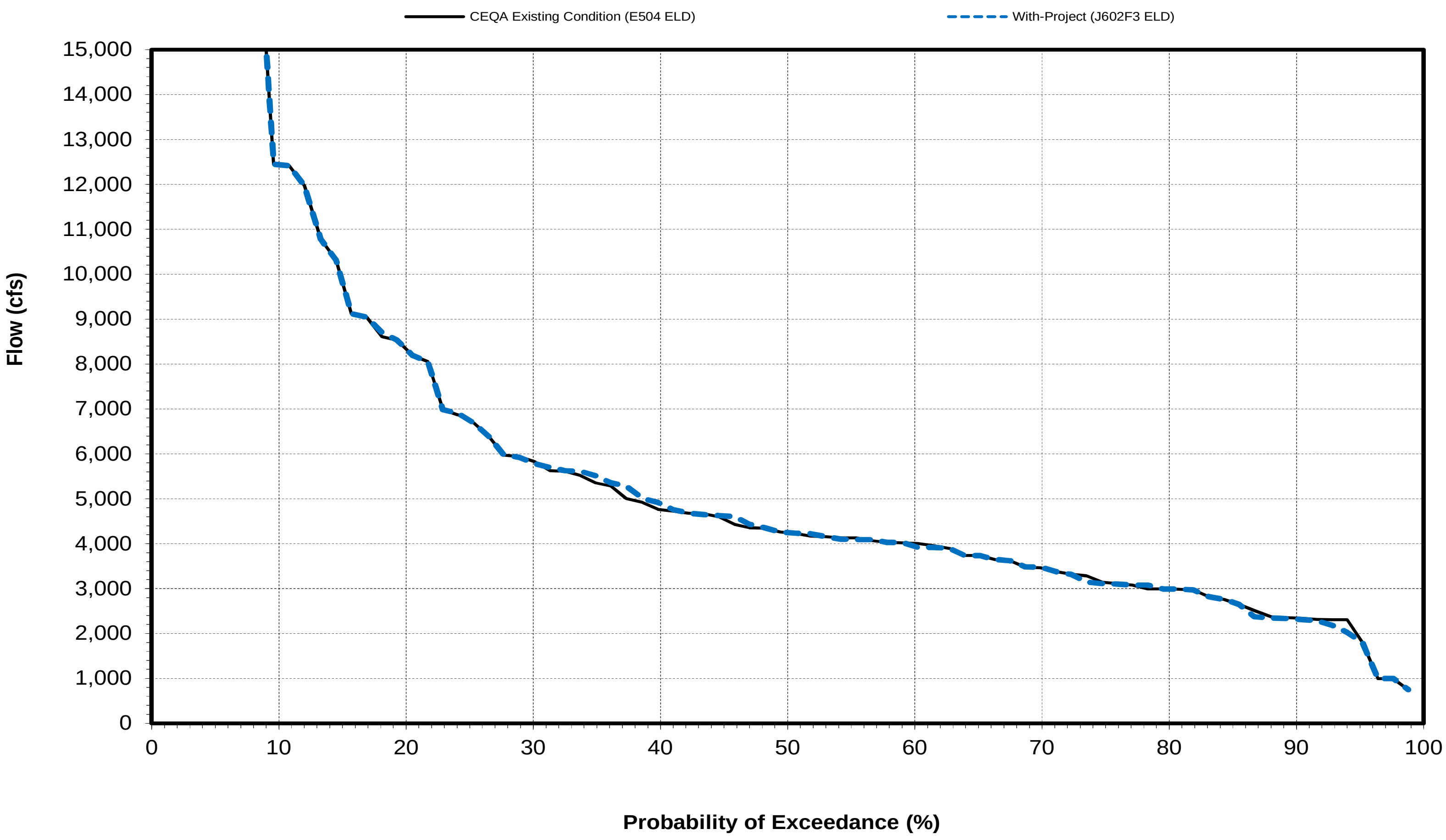


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Feather River Flow at Mouth

June

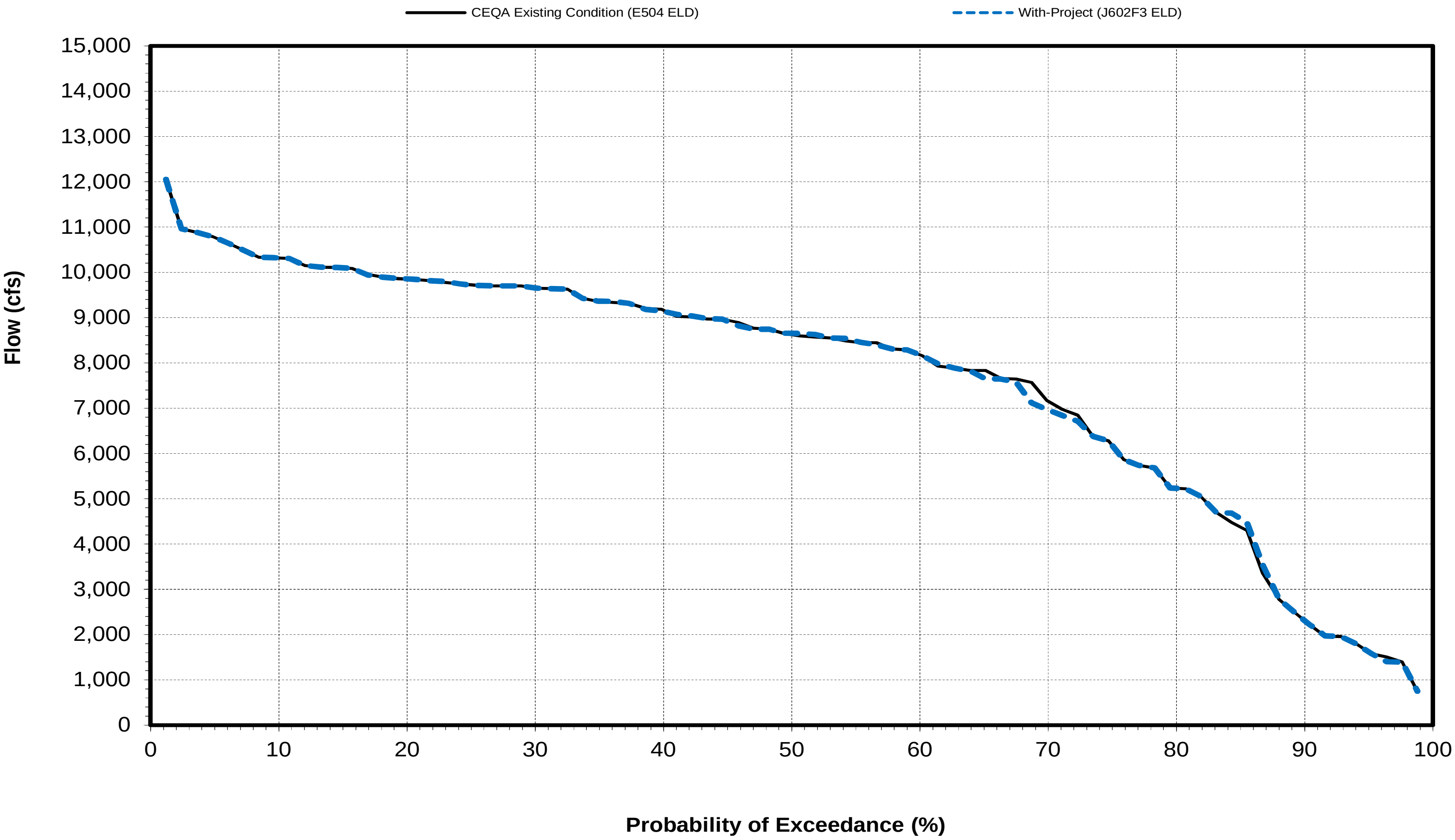


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Feather River Flow at Mouth

July

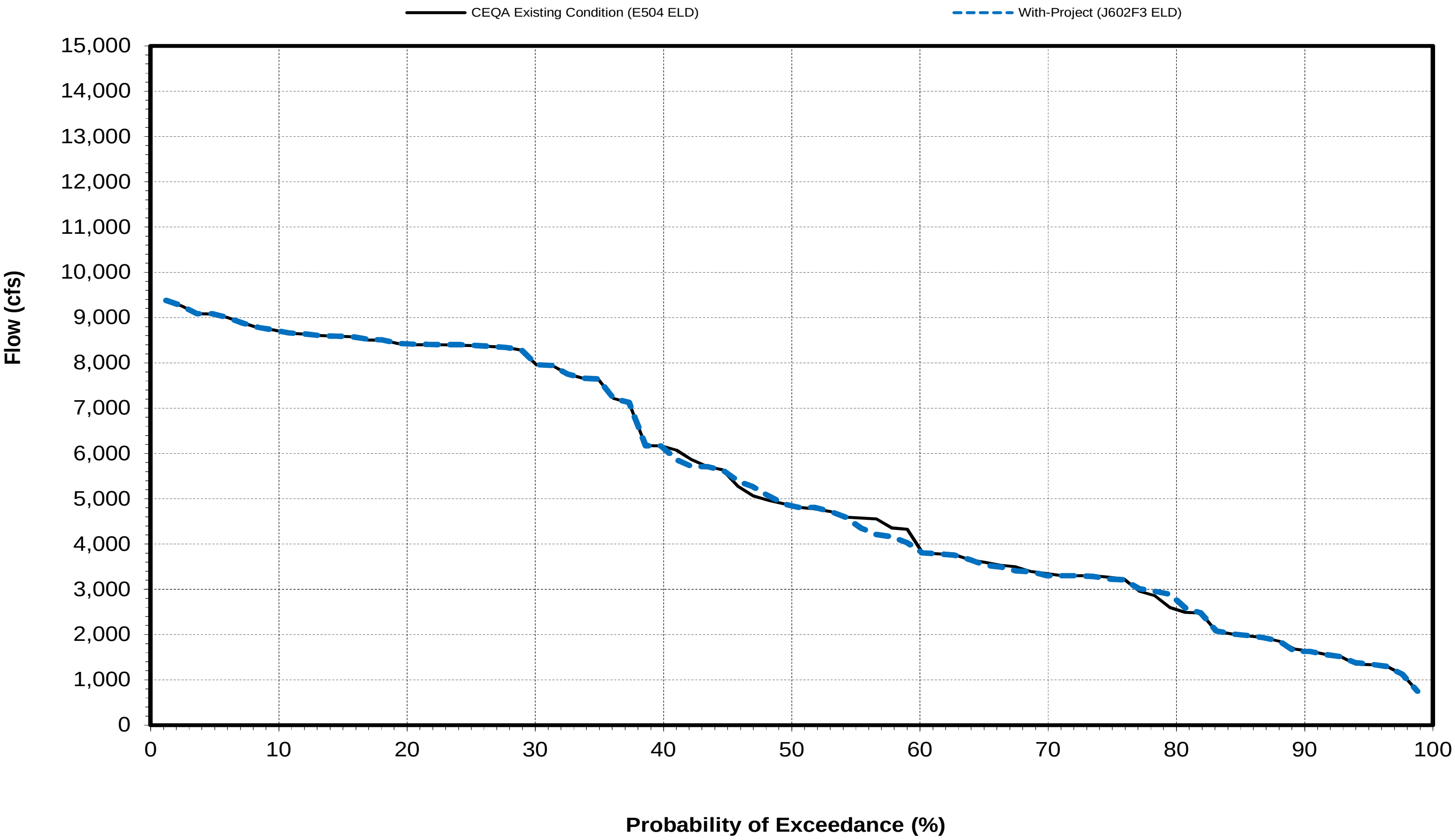


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

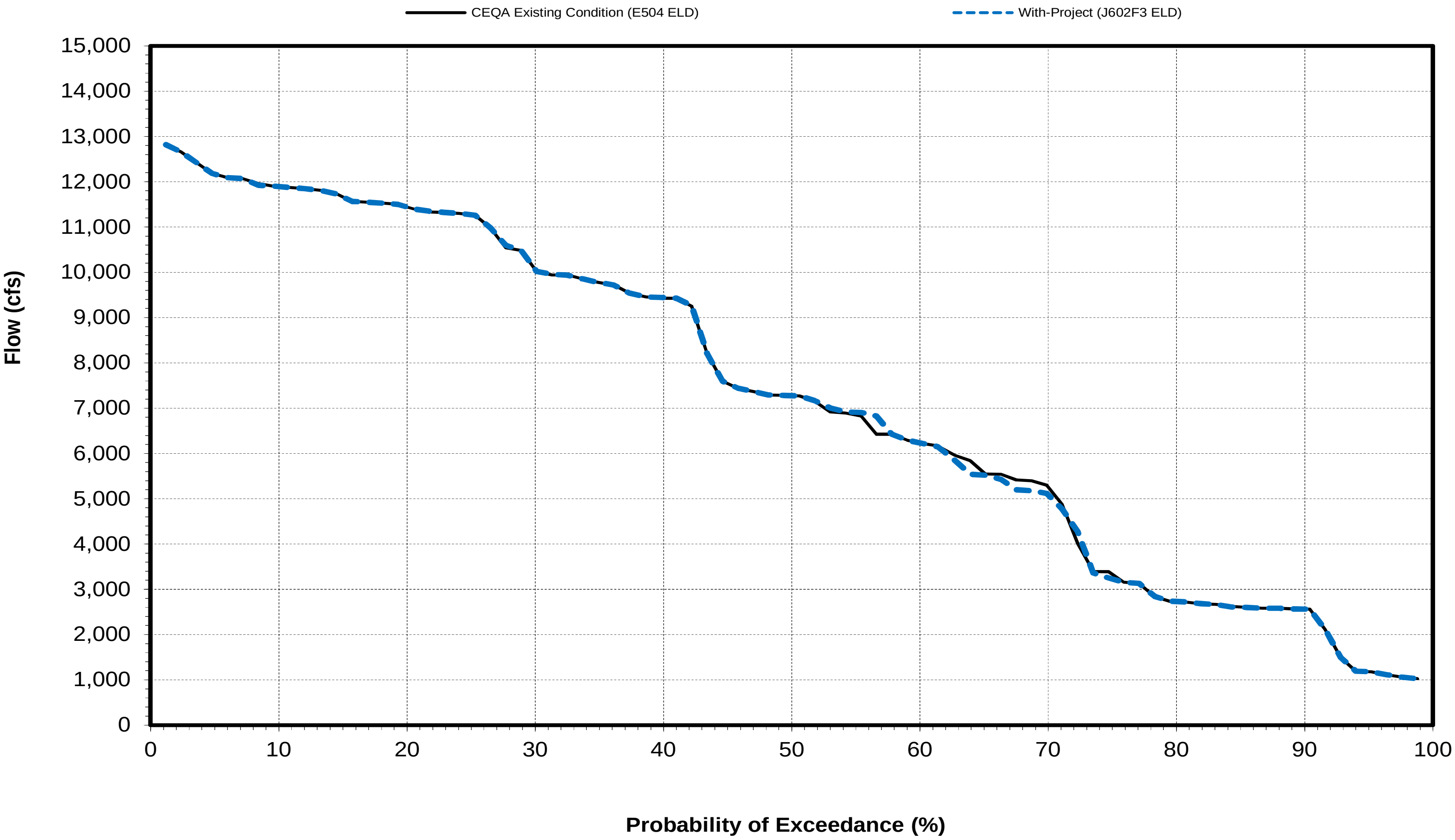
Feather River Flow at Mouth

August



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Feather River Flow at Mouth **September**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Delta Outflow - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	28230	26955	-1275	-4.5
2.4	13461	13510	49	0.4
3.6	11875	11875	0	0.0
4.8	11361	11410	49	0.4
6.0	9063	9063	0	0.0
7.2	8906	8906	0	0.0
8.4	8750	8750	0	0.0
9.6	8438	8438	0	0.0
10.8	8281	8281	0	0.0
12.0	8281	8281	0	0.0
13.3	8125	8125	0	0.0
14.5	8125	8125	0	0.0
15.7	8125	8125	0	0.0
16.9	8125	8125	0	0.0
18.1	7813	7813	0	0.0
19.3	7813	7813	0	0.0
20.5	7813	7813	0	0.0
21.7	7813	7813	0	0.0
22.9	7813	7813	0	0.0
24.1	7813	7813	0	0.0
25.3	7656	7656	0	0.0
26.5	7500	7500	0	0.0
27.7	7500	7500	0	0.0
28.9	7500	7500	0	0.0
30.1	7500	7500	0	0.0
31.3	7188	7188	0	0.0
32.5	7188	7188	0	0.0
33.7	6563	6563	0	0.0
34.9	6309	6406	97	1.5
36.1	6250	6310	60	1.0
37.3	6250	6250	0	0.0
38.6	6250	6250	0	0.0
39.8	6217	6238	21	0.3
41.0	6094	6094	0	0.0
42.2	6094	6094	0	0.0
43.4	5938	5938	0	0.0
44.6	5938	5938	0	0.0
45.8	5938	5938	0	0.0
47.0	5781	5781	0	0.0
48.2	5154	5160	6	0.1
49.4	5052	5082	30	0.6
50.6	4876	4916	40	0.8
51.8	4780	4781	1	0.0
53.0	4743	4751	8	0.2
54.2	4616	4684	68	1.5
55.4	4462	4450	-12	-0.3
56.6	4434	4437	3	0.1
57.8	4418	4434	16	0.4
59.0	4387	4386	-1	0.0
60.2	4385	4385	0	0.0
61.4	4145	4138	-7	-0.2
62.7	4137	4085	-52	-1.3
63.9	4086	4067	-19	-0.5
65.1	4022	4048	26	0.6
66.3	4010	4022	12	0.3
67.5	4006	4006	0	0.0
68.7	4000	4000	0	0.0
69.9	4000	4000	0	0.0
71.1	4000	4000	0	0.0
72.3	4000	4000	0	0.0
73.5	4000	4000	0	0.0
74.7	4000	4000	0	0.0
75.9	4000	4000	0	0.0
77.1	4000	4000	0	0.0
78.3	4000	4000	0	0.0
79.5	4000	4000	0	0.0
80.7	4000	4000	0	0.0
81.9	4000	4000	0	0.0
83.1	4000	4000	0	0.0
84.3	4000	4000	0	0.0
85.5	4000	4000	0	0.0
86.7	4000	4000	0	0.0
88.0	4000	4000	0	0.0
89.2	3745	3742	-3	-0.1
90.4	3454	3279	-175	-5.1
91.6	3000	3000	0	0.0
92.8	3000	3000	0	0.0
94.0	3000	3000	0	0.0
95.2	3000	3000	0	0.0
96.4	3000	3000	0	0.0
97.6	3000	3000	0	0.0
98.8	3000	3000	0	0.0
Min	3000	3000	-1275	-5.1
Max	28230	26955	97	1.5
Mean	6019	6006	-13	0.0
Median	4964	4999	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	80224	76919	-3305	-4.1
2.4	51564	51470	-94	-0.2
3.6	46482	43314	-3168	-6.8
4.8	39392	39313	-79	-0.2
6.0	27210	26157	-1053	-3.9
7.2	19684	19442	-242	-1.2
8.4	19318	19294	-24	-0.1
9.6	16514	16509	-5	0.0
10.8	16250	16250	0	0.0
12.0	15938	15938	0	0.0
13.3	15938	15938	0	0.0
14.5	15625	15625	0	0.0
15.7	15625	15625	0	0.0
16.9	15469	15469	0	0.0
18.1	15469	15469	0	0.0
19.3	15398	15398	0	0.0
20.5	15313	15313	0	0.0
21.7	15313	15313	0	0.0
22.9	14641	14641	0	0.0
24.1	14591	14591	0	0.0
25.3	14573	14573	0	0.0
26.5	14198	14198	0	0.0
27.7	14034	13902	-132	-0.9
28.9	13849	13849	0	0.0
30.1	13789	13789	0	0.0
31.3	13733	13733	0	0.0
32.5	13616	13616	0	0.0
33.7	13371	13371	0	0.0
34.9	12707	12707	0	0.0
36.1	12570	12570	0	0.0
37.3	12549	12549	0	0.0
38.6	11893	12498	605	5.1
39.8	11250	11250	0	0.0
41.0	10838	10839	1	0.0
42.2	10625	10625	0	0.0
43.4	10625	10625	0	0.0
44.6	10625	10625	0	0.0
45.8	10625	10469	-156	-1.5
47.0	10469	10469	0	0.0
48.2	10469	10313	-156	-1.5
49.4	10313	10313	0	0.0
50.6	10313	10313	0	0.0
51.8	10192	10208	16	0.2
53.0	10156	10156	0	0.0
54.2	8004	8004	0	0.0
55.4	6463	6544	81	1.3
56.6	6458	6431	-27	-0.4
57.8	6205	6197	-8	-0.1
59.0	5952	5801	-151	-2.5
60.2	5798	5798	0	0.0
61.4	5709	5730	21	0.4
62.7	5687	5652	-35	-0.6
63.9	5284	5281	-3	-0.1
65.1	4795	4790	-5	-0.1
66.3	4616	4617	1	0.0
67.5	4500	4500	0	0.0
68.7	4500	4500	0	0.0
69.9	4500	4500	0	0.0
71.1	4500	4500	0	0.0
72.3	4500	4500	0	0.0
73.5	4500	4500	0	0.0
74.7	4500	4500	0	0.0
75.9	4500	4500	0	0.0
77.1	4500	4500	0	0.0
78.3	4500	4500	0	0.0
79.5	4500	4500	0	0.0
80.7	4500	4500	0	0.0
81.9	4500	4500	0	0.0
83.1	4500	4500	0	0.0
84.3	4500	4500	0	0.0
85.5	4500	4500	0	0.0
86.7	4500	4500	0	0.0
88.0	4500	4500	0	0.0
89.2	4059	4059	0	0.0
90.4	3500	3724	224	6.4
91.6	3500	3500	0	0.0
92.8	3500	3500	0	0.0
94.0	3500	3500	0	0.0
95.2	3500	3500	0	0.0
96.4	3500	3500	0	0.0
97.6	3500	3500	0	0.0
98.8	3500	3500	0	0.0
Min	3500	3500	-3305	-6.8
Max	80224	76919	605	6.4
Mean	11602	11508	-94	-0.1
Median	10313	10313	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	87.8
1.1<=X<10.0		3.7
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	154723	153590	-1133	-0.7
2.4	93274	89976	-3298	-3.5
3.6	90604	89305	-1299	-1.4
4.8	80615	80647	32	0.0
6.0	80123	77466	-2657	-3.3
7.2	78321	74781	-3540	-4.5
8.4	74167	73055	-1112	-1.5
9.6	69234	69241	7	0.0
10.8	65029	65319	290	0.4
12.0	58057	58149	92	0.2
13.3	49923	50736	813	1.6
14.5	42012	42012	0	0.0
15.7	41673	41673	0	0.0
16.9	36723	37216	493	1.3
18.1	36493	36486	-7	0.0
19.3	34781	35094	313	0.9
20.5	34303	34040	-263	-0.8
21.7	28805	28974	169	0.6
22.9	28319	28319	0	0.0
24.1	27943	27925	-18	-0.1
25.3	23486	23487	1	0.0
26.5	23394	23400	6	0.0
27.7	22170	22309	139	0.6
28.9	16848	16848	0	0.0
30.1	15759	15760	1	0.0
31.3	14740	14752	12	0.1
32.5	14669	14670	1	0.0
33.7	14645	14387	-258	-1.8
34.9	14296	14290	-6	0.0
36.1	13718	13716	-2	0.0
37.3	13566	13558	-8	-0.1
38.6	13153	13146	-7	-0.1
39.8	12116	12117	1	0.0
41.0	12104	12094	-10	-0.1
42.2	11507	11515	8	0.1
43.4	11386	11386	0	0.0
44.6	11282	11287	5	0.0
45.8	10882	10945	63	0.6
47.0	10868	10876	8	0.1
48.2	10518	10307	-211	-2.0
49.4	9784	10005	221	2.3
50.6	9147	9147	0	0.0
51.8	9046	9039	-7	-0.1
53.0	8622	8622	0	0.0
54.2	8391	8390	-1	0.0
55.4	8256	8256	0	0.0
56.6	6974	6970	-4	-0.1
57.8	6672	6668	-4	-0.1
59.0	6406	6406	0	0.0
60.2	5722	5723	1	0.0
61.4	5353	5353	0	0.0
62.7	5152	5152	0	0.0
63.9	5145	5145	0	0.0
65.1	5088	5097	9	0.2
66.3	5078	5088	10	0.2
67.5	5057	5057	0	0.0
68.7	5032	5032	0	0.0
69.9	5004	5010	6	0.1
71.1	4973	4973	0	0.0
72.3	4853	4861	8	0.2
73.5	4827	4853	26	0.5
74.7	4824	4827	3	0.1
75.9	4778	4779	1	0.0
77.1	4675	4675	0	0.0
78.3	4649	4649	0	0.0
79.5	4621	4606	-15	-0.3
80.7	4500	4500	0	0.0
81.9	4500	4500	0	0.0
83.1	4500	4500	0	0.0
84.3	4500	4500	0	0.0
85.5	4500	4500	0	0.0
86.7	4500	4500	0	0.0
88.0	4500	4500	0	0.0
89.2	4500	4500	0	0.0
90.4	4500	4500	0	0.0
91.6	4500	4500	0	0.0
92.8	4500	4500	0	0.0
94.0	4409	4423	14	0.3
95.2	4319	4000	-319	-7.4
96.4	3952	3952	0	0.0
97.6	3778	3744	-34	-0.9
98.8	3500	3500	0	0.0
Min	3500	3500	-3540	-7.4
Max	154723	153590	813	2.3
Mean	21022	20882	-140	-0.2
Median	9466	9576	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		9.8
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	276154	273051	-3103	-1.1
2.4	208154	205052	-3102	-1.5
3.6	157301	157476	175	0.1
4.8	131346	130060	-1286	-1.0
6.0	116786	117474	688	0.6
7.2	110656	110523	-133	-0.1
8.4	108295	108229	-66	-0.1
9.6	102788	102877	89	0.1
10.8	100800	98257	-2543	-2.5
12.0	98053	98054	1	0.0
13.3	97354	97354	0	0.0
14.5	82772	82775	3	0.0
15.7	80246	80251	5	0.0
16.9	77759	77759	0	0.0
18.1	75545	76026	481	0.6
19.3	72723	72689	-34	0.0
20.5	67850	67677	-173	-0.3
21.7	66423	64957	-1466	-2.2
22.9	63239	63616	377	0.6
24.1	63115	63430	315	0.5
25.3	61192	61187	-5	0.0
26.5	50357	50164	-193	-0.4
27.7	48747	48521	-226	-0.5
28.9	48101	48077	-24	0.0
30.1	48065	47729	-336	-0.7
31.3	46120	46120	0	0.0
32.5	44620	44622	2	0.0
33.7	41607	41607	0	0.0
34.9	39791	39679	-112	-0.3
36.1	39678	39478	-200	-0.5
37.3	35185	34775	-410	-1.2
38.6	32361	32142	-219	-0.7
39.8	29271	29260	-11	0.0
41.0	28706	28706	0	0.0
42.2	28526	28526	0	0.0
43.4	26664	26657	-7	0.0
44.6	24879	24879	0	0.0
45.8	22462	22394	-68	-0.3
47.0	21827	21828	1	0.0
48.2	21633	21631	-2	0.0
49.4	21610	21610	0	0.0
50.6	21482	21482	0	0.0
51.8	20957	20956	-1	0.0
53.0	20956	20953	-3	0.0
54.2	20221	20202	-19	-0.1
55.4	19341	19335	-6	0.0
56.6	19012	19021	9	0.0
57.8	18882	18879	-3	0.0
59.0	17214	17211	-3	0.0
60.2	17165	17162	-3	0.0
61.4	16282	16143	-139	-0.9
62.7	14658	14578	-80	-0.5
63.9	14587	14504	-83	-0.6
65.1	14192	14191	-1	0.0
66.3	13158	13159	1	0.0
67.5	12955	12998	43	0.3
68.7	12741	12741	0	0.0
69.9	11946	11921	-25	-0.2
71.1	11763	11764	1	0.0
72.3	11148	11148	0	0.0
73.5	11142	11148	6	0.1
74.7	10952	10947	-5	0.0
75.9	10497	10617	120	1.1
77.1	10008	10009	1	0.0
78.3	9634	9691	57	0.6
79.5	9633	9650	17	0.2
80.7	9526	9526	0	0.0
81.9	9499	9499	0	0.0
83.1	9395	9390	-5	-0.1
84.3	9388	9386	-2	0.0
85.5	8980	8978	-2	0.0
86.7	8792	8787	-5	-0.1
88.0	8403	8370	-33	-0.4
89.2	8189	8220	31	0.4
90.4	8071	8189	118	1.5
91.6	7890	8065	175	2.2
92.8	7697	7890	193	2.5
94.0	7545	7696	151	2.0
95.2	7337	7545	208	2.8
96.4	7028	7027	-1	0.0
97.6	7008	7009	1	0.0
98.8	6000	6000	0	0.0
Min	6000	6000	-3103	-2.5
Max	276154	273051	688	2.8
Mean	41708	41575	-133	0.0
Median	21546	21546	-1	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		30.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	220495	220397	-98	0.0
2.4	215813	211701	-4112	-1.9
3.6	181963	181787	-176	-0.1
4.8	146184	145980	-204	-0.1
6.0	138666	138126	-540	-0.4
7.2	136468	136981	513	0.4
8.4	134681	134140	-541	-0.4
9.6	130847	130168	-679	-0.5
10.8	123781	124084	303	0.2
12.0	123623	120832	-2791	-2.3
13.3	115371	114954	-417	-0.4
14.5	104551	104083	-468	-0.4
15.7	101840	99884	-1956	-1.9
16.9	95830	94926	-904	-0.9
18.1	86066	85110	-956	-1.1
19.3	83794	83460	-334	-0.4
20.5	78423	78074	-349	-0.4
21.7	77779	77229	-550	-0.7
22.9	74879	74858	-21	0.0
24.1	74095	72922	-1173	-1.6
25.3	73129	72146	-983	-1.3
26.5	71340	70842	-498	-0.7
27.7	68825	67185	-1640	-2.4
28.9	67044	65355	-1689	-2.5
30.1	61162	59475	-1687	-2.8
31.3	56816	56041	-775	-1.4
32.5	55577	54741	-836	-1.5
33.7	55433	54724	-709	-1.3
34.9	54741	54515	-226	-0.4
36.1	53943	53256	-687	-1.3
37.3	53244	53241	-3	0.0
38.6	52573	51539	-1034	-2.0
39.8	51401	50539	-862	-1.7
41.0	48912	48827	-85	-0.2
42.2	48828	47994	-834	-1.7
43.4	44612	44594	-18	0.0
44.6	44594	43856	-738	-1.7
45.8	41115	39973	-1142	-2.8
47.0	40394	39818	-576	-1.4
48.2	40121	39529	-592	-1.5
49.4	37426	36591	-835	-2.2
50.6	35975	35449	-526	-1.5
51.8	35656	35228	-428	-1.2
53.0	35070	35073	3	0.0
54.2	33756	34832	1076	3.2
55.4	31165	31165	0	0.0
56.6	26755	26755	0	0.0
57.8	25530	25530	0	0.0
59.0	25431	25434	3	0.0
60.2	23971	23390	-581	-2.4
61.4	23645	23180	-465	-2.0
62.7	23155	23156	1	0.0
63.9	22878	22898	20	0.1
65.1	21939	21939	0	0.0
66.3	21276	20373	-903	-4.2
67.5	18697	18698	1	0.0
68.7	18313	18320	7	0.0
69.9	18112	18113	1	0.0
71.1	17587	17223	-364	-2.1
72.3	17222	16366	-856	-5.0
73.5	17200	16095	-1105	-6.4
74.7	15770	15753	-17	-0.1
75.9	15680	15652	-28	-0.2
77.1	15652	15044	-608	-3.9
78.3	14746	14750	4	0.0
79.5	14467	14571	104	0.7
80.7	14397	14397	0	0.0
81.9	13895	13896	1	0.0
83.1	13526	13526	0	0.0
84.3	11867	11873	6	0.1
85.5	11413	11414	1	0.0
86.7	11388	11145	-243	-2.1
88.0	11145	10943	-202	-1.8
89.2	10939	10865	-74	-0.7
90.4	10760	10786	26	0.2
91.6	10199	10446	247	2.4
92.8	10100	10100	0	0.0
94.0	9739	9739	0	0.0
95.2	9542	9542	0	0.0
96.4	8636	8636	0	0.0
97.6	7819	7819	0	0.0
98.8	7388	7388	0	0.0
Min	7388	7388	-4112	-6.4
Max	220495	220397	1076	3.2
Mean	52546	52097	-449	-0.9
Median	36701	36020	-235	-0.4

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	58.5
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		39.0
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	260721	260794	73	0.0
2.4	210501	210812	311	0.1
3.6	168859	170079	1220	0.7
4.8	139450	142243	2793	2.0
6.0	117185	117988	803	0.7
7.2	108133	109398	1265	1.2
8.4	103926	103934	8	0.0
9.6	89160	89115	-45	-0.1
10.8	87209	87593	384	0.4
12.0	83597	85410	1813	2.2
13.3	82293	84874	2581	3.1
14.5	81694	82857	1163	1.4
15.7	78231	76247	-1984	-2.5
16.9	68155	69766	1611	2.4
18.1	67896	68346	450	0.7
19.3	67345	67197	-148	-0.2
20.5	63653	64195	542	0.9
21.7	62576	63963	1387	2.2
22.9	61522	61273	-249	-0.4
24.1	58959	59899	940	1.6
25.3	56637	56620	-17	0.0
26.5	54100	55337	1237	2.3
27.7	49487	50046	559	1.1
28.9	48002	46657	-1345	-2.8
30.1	47036	45301	-1735	-3.7
31.3	38637	39636	999	2.6
32.5	38567	39073	506	1.3
33.7	38096	38278	182	0.5
34.9	37045	37564	519	1.4
36.1	36300	37091	791	2.2
37.3	35246	37050	1804	5.1
38.6	34645	35608	963	2.8
39.8	34471	34960	489	1.4
41.0	33956	34645	689	2.0
42.2	31293	32239	946	3.0
43.4	30019	30437	418	1.4
44.6	29667	29426	-241	-0.8
45.8	27773	27789	16	0.1
47.0	27470	27746	276	1.0
48.2	27362	27219	-143	-0.5
49.4	25742	25437	-305	-1.2
50.6	25040	25135	95	0.4
51.8	24206	24434	228	0.9
53.0	23611	24236	625	2.6
54.2	23224	23982	758	3.3
55.4	22839	23228	389	1.7
56.6	22507	22840	333	1.5
57.8	21674	22523	849	3.9
59.0	20569	20164	-405	-2.0
60.2	19852	19539	-313	-1.6
61.4	19501	19505	4	0.0
62.7	18819	18822	3	0.0
63.9	18285	18676	391	2.1
65.1	18232	18383	151	0.8
66.3	18052	18288	236	1.3
67.5	17562	18047	485	2.8
68.7	17318	17236	-82	-0.5
69.9	17234	17233	-1	0.0
71.1	17141	17027	-114	-0.7
72.3	16820	15736	-1084	-6.4
73.5	16586	15619	-967	-5.8
74.7	13952	13934	-18	-0.1
75.9	13698	13811	113	0.8
77.1	13638	13698	60	0.4
78.3	13372	13639	267	2.0
79.5	12516	12516	0	0.0
80.7	12240	12241	1	0.0
81.9	12131	12132	1	0.0
83.1	11062	11062	0	0.0
84.3	10717	10949	232	2.2
85.5	10663	10717	54	0.5
86.7	10542	10664	122	1.2
88.0	10078	10000	-78	-0.8
89.2	9066	9067	1	0.0
90.4	8856	8859	3	0.0
91.6	8766	8766	0	0.0
92.8	8370	8370	0	0.0
94.0	8325	8321	-4	0.0
95.2	8081	8081	0	0.0
96.4	7871	7858	-13	-0.2
97.6	7239	7239	0	0.0
98.8	6088	6088	0	0.0
Min	6088	6088	-1984	-6.4
Max	260721	260794	2793	5.1
Mean	42182	42473	291	0.6
Median	25391	25286	118	0.5

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	52.4
1.1<=X<10.0		37.8
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		9.8
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	139429	140359	930	0.7
2.4	105079	104380	-699	-0.7
3.6	96796	98042	1246	1.3
4.8	90278	90319	41	0.0
6.0	78787	78767	-20	0.0
7.2	78387	78077	-310	-0.4
8.4	76364	76730	366	0.5
9.6	73428	73579	151	0.2
10.8	69568	70607	1039	1.5
12.0	67455	68023	568	0.8
13.3	64335	63728	-607	-0.9
14.5	60537	60917	380	0.6
15.7	59064	58910	-154	-0.3
16.9	56280	57273	993	1.8
18.1	55844	56270	426	0.8
19.3	53064	53528	464	0.9
20.5	50489	53172	2683	5.3
21.7	47084	47594	510	1.1
22.9	46415	47402	987	2.1
24.1	44062	43844	-218	-0.5
25.3	39740	40093	353	0.9
26.5	33949	34229	280	0.8
27.7	30770	30935	165	0.5
28.9	29259	29848	589	2.0
30.1	28946	29014	68	0.2
31.3	28667	28895	228	0.8
32.5	28336	28785	449	1.6
33.7	28142	28319	177	0.6
34.9	28135	28246	111	0.4
36.1	27789	27700	-89	-0.3
37.3	27379	27587	208	0.8
38.6	27150	27470	320	1.2
39.8	26906	26498	-408	-1.5
41.0	26450	25509	-941	-3.6
42.2	23598	24483	885	3.8
43.4	22749	23958	1209	5.3
44.6	22709	23353	644	2.8
45.8	21658	22953	1295	6.0
47.0	21248	21270	22	0.1
48.2	20429	20823	394	1.9
49.4	20108	20489	381	1.9
50.6	19634	20316	682	3.5
51.8	19280	20171	891	4.6
53.0	18883	19989	1106	5.9
54.2	18591	19701	1110	6.0
55.4	18533	19311	778	4.2
56.6	18092	19297	1205	6.7
57.8	17127	17196	69	0.4
59.0	16541	16297	-244	-1.5
60.2	15657	15438	-219	-1.4
61.4	14442	15221	779	5.4
62.7	14395	14396	1	0.0
63.9	14204	14155	-49	-0.3
65.1	14061	13702	-359	-2.6
66.3	13799	13578	-221	-1.6
67.5	13530	13511	-19	-0.1
68.7	13114	13114	0	0.0
69.9	12965	12975	10	0.1
71.1	12959	12974	15	0.1
72.3	12282	12782	500	4.1
73.5	12167	12583	416	3.4
74.7	11923	12179	256	2.1
75.9	11673	12034	361	3.1
77.1	11657	11923	266	2.3
78.3	11318	11326	8	0.1
79.5	11188	11187	-1	0.0
80.7	11055	11055	0	0.0
81.9	10577	10577	0	0.0
83.1	9966	9968	2	0.0
84.3	9808	9815	7	0.1
85.5	9713	9712	-1	0.0
86.7	9673	9673	0	0.0
88.0	9673	9673	0	0.0
89.2	9427	9427	0	0.0
90.4	9276	9276	0	0.0
91.6	9227	9227	0	0.0
92.8	9193	9193	0	0.0
94.0	8652	8652	0	0.0
95.2	8305	8305	0	0.0
96.4	7817	7817	0	0.0
97.6	7100	7100	0	0.0
98.8	6632	6633	1	0.0
Min	6632	6633	-941	-3.6
Max	139429	140359	2683	6.7
Mean	30378	30652	274	1.0
Median	19871	20403	90	0.3

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	59.8
1.1<=X<10.0		32.9
X>=5.0		8.5
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	87602	87647	45	0.1
2.4	76100	76149	49	0.1
3.6	73005	73050	45	0.1
4.8	70566	70622	56	0.1
6.0	60167	59511	-656	-1.1
7.2	59457	59496	39	0.1
8.4	56206	56251	45	0.1
9.6	55809	55860	51	0.1
10.8	54746	54801	55	0.1
12.0	48671	48716	45	0.1
13.3	48364	48405	41	0.1
14.5	46364	46404	40	0.1
15.7	45751	45784	33	0.1
16.9	39602	39648	46	0.1
18.1	38804	38850	46	0.1
19.3	30682	30437	-245	-0.8
20.5	29318	29761	443	1.5
21.7	29288	29375	87	0.3
22.9	29147	29199	52	0.2
24.1	29048	29086	38	0.1
25.3	26415	26463	48	0.2
26.5	25367	25413	46	0.2
27.7	24773	24818	45	0.2
28.9	23554	23593	39	0.2
30.1	21143	21310	167	0.8
31.3	20576	20624	48	0.2
32.5	20200	20248	48	0.2
33.7	20179	20219	40	0.2
34.9	19838	19863	25	0.1
36.1	19793	19829	36	0.2
37.3	19722	19745	23	0.1
38.6	19587	19635	48	0.2
39.8	19385	19431	46	0.2
41.0	18837	18876	39	0.2
42.2	18444	18491	47	0.3
43.4	18265	18306	41	0.2
44.6	18262	18298	36	0.2
45.8	17768	17817	49	0.3
47.0	17311	17355	44	0.3
48.2	17057	17101	44	0.3
49.4	14933	14978	45	0.3
50.6	14870	14858	-12	-0.1
51.8	14802	14850	48	0.3
53.0	14762	14811	49	0.3
54.2	13318	14613	1295	9.7
55.4	13265	13975	710	5.4
56.6	12737	13820	1083	8.5
57.8	12539	13387	848	6.8
59.0	12532	13263	731	5.8
60.2	11680	12532	852	7.3
61.4	11320	11926	606	5.4
62.7	11116	11725	609	5.5
63.9	10854	11355	501	4.6
65.1	10702	11015	313	2.9
66.3	10269	10702	433	4.2
67.5	10053	10448	395	3.9
68.7	9984	10322	338	3.4
69.9	9923	10286	363	3.7
71.1	9891	9896	5	0.1
72.3	9876	9882	6	0.1
73.5	9301	9301	0	0.0
74.7	9142	9301	159	1.7
75.9	9032	9142	110	1.2
77.1	9014	9032	18	0.2
78.3	8847	9009	162	1.8
79.5	8801	8581	-220	-2.5
80.7	8581	8347	-234	-2.7
81.9	8276	8276	0	0.0
83.1	8245	8235	-10	-0.1
84.3	8035	8051	16	0.2
85.5	7575	7575	0	0.0
86.7	7459	7459	0	0.0
88.0	7100	7100	0	0.0
89.2	7031	7031	0	0.0
90.4	6875	6875	0	0.0
91.6	6701	6701	0	0.0
92.8	6291	6291	0	0.0
94.0	5998	5998	0	0.0
95.2	4954	4954	0	0.0
96.4	4087	4087	0	0.0
97.6	4070	4070	0	0.0
98.8	4000	4000	0	0.0
Min	4000	4000	-656	-2.7
Max	87602	87647	1295	9.7
Mean	22122	22251	128	1.0
Median	14902	14918	45	0.2

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	74.4
1.1<=X<10.0		22.0
X>=5.0		9.8
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	71969	71969	0	0.0
2.4	69560	69560	0	0.0
3.6	41202	41202	0	0.0
4.8	40846	40846	0	0.0
6.0	38527	38527	0	0.0
7.2	37561	37561	0	0.0
8.4	37104	37104	0	0.0
9.6	33057	33057	0	0.0
10.8	30295	30295	0	0.0
12.0	23517	23517	0	0.0
13.3	21481	21483	2	0.0
14.5	21054	21008	-46	-0.2
15.7	20982	20982	0	0.0
16.9	20436	20436	0	0.0
18.1	19673	19673	0	0.0
19.3	15235	15235	0	0.0
20.5	15125	15124	-1	0.0
21.7	14468	14469	1	0.0
22.9	14417	14417	0	0.0
24.1	13190	13190	0	0.0
25.3	13088	13089	1	0.0
26.5	12363	12365	2	0.0
27.7	11278	11277	-1	0.0
28.9	10901	10900	-1	0.0
30.1	10835	10633	-202	-1.9
31.3	10540	10025	-515	-4.9
32.5	10025	9920	-105	-1.0
33.7	9917	9915	-2	0.0
34.9	9383	9383	0	0.0
36.1	9168	9168	0	0.0
37.3	9098	9098	0	0.0
38.6	8740	8740	0	0.0
39.8	8262	8171	-91	-1.1
41.0	8171	8150	-21	-0.3
42.2	8150	7968	-182	-2.2
43.4	7968	7846	-122	-1.5
44.6	7845	7700	-145	-1.8
45.8	7700	7673	-27	-0.4
47.0	7624	7644	20	0.3
48.2	7577	7489	-88	-1.2
49.4	7251	7251	0	0.0
50.6	7243	7243	0	0.0
51.8	7243	7243	0	0.0
53.0	7206	7206	0	0.0
54.2	7133	7133	0	0.0
55.4	7100	7100	0	0.0
56.6	7100	7100	0	0.0
57.8	7100	7100	0	0.0
59.0	7100	7100	0	0.0
60.2	7100	7100	0	0.0
61.4	7100	7100	0	0.0
62.7	7100	7100	0	0.0
63.9	7100	7100	0	0.0
65.1	7100	7100	0	0.0
66.3	7100	7031	-69	-1.0
67.5	7021	6860	-161	-2.3
68.7	6842	6853	11	0.2
69.9	6753	6753	0	0.0
71.1	6724	6688	-36	-0.5
72.3	6690	6573	-117	-1.7
73.5	6592	6562	-30	-0.5
74.7	6564	6422	-142	-2.2
75.9	6448	6406	-42	-0.7
77.1	6422	6363	-59	-0.9
78.3	6406	6302	-104	-1.6
79.5	6250	6250	0	0.0
80.7	6219	6219	0	0.0
81.9	6096	6076	-20	-0.3
83.1	6014	5781	-233	-3.9
84.3	5938	5770	-168	-2.8
85.5	5770	5690	-80	-1.4
86.7	5620	5620	0	0.0
88.0	5469	5379	-90	-1.6
89.2	5379	5156	-223	-4.1
90.4	4849	4577	-272	-5.6
91.6	4576	4514	-62	-1.4
92.8	4131	4131	0	0.0
94.0	4067	4067	0	0.0
95.2	4057	4062	5	0.1
96.4	4000	4000	0	0.0
97.6	4000	4000	0	0.0
98.8	4000	4000	0	0.0
Min	4000	4000	-515	-5.6
Max	71969	71969	20	0.3
Mean	12784	12743	-42	-0.6
Median	7247	7247	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	78.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		22.0
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		40.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	34113	34113	0	0.0
2.4	28161	28161	0	0.0
3.6	22625	22625	0	0.0
4.8	14454	14454	0	0.0
6.0	11632	11638	6	0.1
7.2	11578	11632	54	0.5
8.4	11521	11449	-72	-0.6
9.6	11082	11054	-28	-0.3
10.8	10904	10948	44	0.4
12.0	10878	10895	17	0.2
13.3	10855	10868	13	0.1
14.5	10729	10645	-84	-0.8
15.7	10565	10553	-12	-0.1
16.9	10482	10482	0	0.0
18.1	10437	10436	-1	0.0
19.3	10296	10298	2	0.0
20.5	9959	9959	0	0.0
21.7	8896	9023	127	1.4
22.9	8808	8808	0	0.0
24.1	8787	8786	-1	0.0
25.3	8589	8572	-17	-0.2
26.5	8519	8469	-50	-0.6
27.7	8464	8464	0	0.0
28.9	8454	8234	-220	-2.6
30.1	8151	8146	-5	-0.1
31.3	8000	8000	0	0.0
32.5	8000	8000	0	0.0
33.7	8000	8000	0	0.0
34.9	8000	8000	0	0.0
36.1	8000	8000	0	0.0
37.3	8000	8000	0	0.0
38.6	8000	8000	0	0.0
39.8	8000	8000	0	0.0
41.0	8000	8000	0	0.0
42.2	8000	8000	0	0.0
43.4	8000	8000	0	0.0
44.6	8000	8000	0	0.0
45.8	8000	8000	0	0.0
47.0	8000	8000	0	0.0
48.2	8000	8000	0	0.0
49.4	8000	8000	0	0.0
50.6	8000	8000	0	0.0
51.8	8000	8000	0	0.0
53.0	6612	6608	-4	-0.1
54.2	6541	6556	15	0.2
55.4	6500	6500	0	0.0
56.6	6500	6500	0	0.0
57.8	6500	6500	0	0.0
59.0	6500	6500	0	0.0
60.2	6500	6500	0	0.0
61.4	6500	6500	0	0.0
62.7	6500	6500	0	0.0
63.9	5558	5682	124	2.2
65.1	5451	5588	137	2.5
66.3	5393	5472	79	1.5
67.5	5330	5445	115	2.2
68.7	5316	5330	14	0.3
69.9	5060	5154	94	1.9
71.1	5000	5000	0	0.0
72.3	5000	5000	0	0.0
73.5	5000	5000	0	0.0
74.7	5000	5000	0	0.0
75.9	5000	5000	0	0.0
77.1	5000	5000	0	0.0
78.3	5000	5000	0	0.0
79.5	5000	5000	0	0.0
80.7	5000	5000	0	0.0
81.9	5000	5000	0	0.0
83.1	5000	5000	0	0.0
84.3	5000	5000	0	0.0
85.5	4754	4751	-3	-0.1
86.7	4028	4028	0	0.0
88.0	4000	4000	0	0.0
89.2	4000	4000	0	0.0
90.4	4000	4000	0	0.0
91.6	4000	4000	0	0.0
92.8	4000	4000	0	0.0
94.0	4000	4000	0	0.0
95.2	4000	4000	0	0.0
96.4	4000	4000	0	0.0
97.6	4000	4000	0	0.0
98.8	4000	4000	0	0.0
Min	4000	4000	-220	-2.6
Max	34113	34113	137	2.5
Mean	7957	7961	4	0.1
Median	8000	8000	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	91.5
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	16716	16717	1	0.0
2.4	11827	11827	0	0.0
3.6	8995	8995	0	0.0
4.8	5618	5618	0	0.0
6.0	5605	5605	0	0.0
7.2	5325	5287	-38	-0.7
8.4	5228	5228	0	0.0
9.6	4393	4394	1	0.0
10.8	4326	4377	51	1.2
12.0	4284	4254	-30	-0.7
13.3	4250	4251	1	0.0
14.5	4242	4241	-1	0.0
15.7	4238	4238	0	0.0
16.9	4194	4233	39	0.9
18.1	4150	4195	45	1.1
19.3	4134	4148	14	0.3
20.5	4103	4132	29	0.7
21.7	4086	4129	43	1.1
22.9	4073	4082	9	0.2
24.1	4037	4049	12	0.3
25.3	4031	4035	4	0.1
26.5	4009	4029	20	0.5
27.7	4000	4000	0	0.0
28.9	4000	4000	0	0.0
30.1	4000	4000	0	0.0
31.3	4000	4000	0	0.0
32.5	4000	4000	0	0.0
33.7	4000	4000	0	0.0
34.9	4000	4000	0	0.0
36.1	4000	4000	0	0.0
37.3	4000	4000	0	0.0
38.6	4000	4000	0	0.0
39.8	4000	4000	0	0.0
41.0	4000	4000	0	0.0
42.2	4000	4000	0	0.0
43.4	4000	4000	0	0.0
44.6	4000	4000	0	0.0
45.8	4000	4000	0	0.0
47.0	4000	4000	0	0.0
48.2	4000	4000	0	0.0
49.4	4000	4000	0	0.0
50.6	4000	4000	0	0.0
51.8	4000	4000	0	0.0
53.0	4000	4000	0	0.0
54.2	4000	4000	0	0.0
55.4	4000	4000	0	0.0
56.6	4000	4000	0	0.0
57.8	4000	4000	0	0.0
59.0	4000	4000	0	0.0
60.2	4000	4000	0	0.0
61.4	4000	4000	0	0.0
62.7	4000	4000	0	0.0
63.9	4000	4000	0	0.0
65.1	4000	4000	0	0.0
66.3	4000	4000	0	0.0
67.5	4000	4000	0	0.0
68.7	4000	4000	0	0.0
69.9	4000	4000	0	0.0
71.1	4000	4000	0	0.0
72.3	4000	4000	0	0.0
73.5	4000	4000	0	0.0
74.7	4000	4000	0	0.0
75.9	4000	4000	0	0.0
77.1	3967	3985	18	0.5
78.3	3935	3937	2	0.1
79.5	3905	3919	14	0.4
80.7	3895	3887	-8	-0.2
81.9	3852	3880	28	0.7
83.1	3804	3857	53	1.4
84.3	3801	3845	44	1.2
85.5	3791	3806	15	0.4
86.7	3763	3791	28	0.7
88.0	3762	3769	7	0.2
89.2	3724	3723	-1	0.0
90.4	3715	3716	1	0.0
91.6	3712	3715	3	0.1
92.8	3671	3679	8	0.2
94.0	3626	3669	43	1.2
95.2	3500	3500	0	0.0
96.4	3361	3361	0	0.0
97.6	3250	3135	-115	-3.5
98.8	3135	3077	-58	-1.9
Min	3135	3077	-115	-3.5
Max	16716	16717	53	1.4
Mean	4342	4345	3	0.1
Median	4000	4000	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	90.2
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Delta Outflow - Probability of Exceedance

September

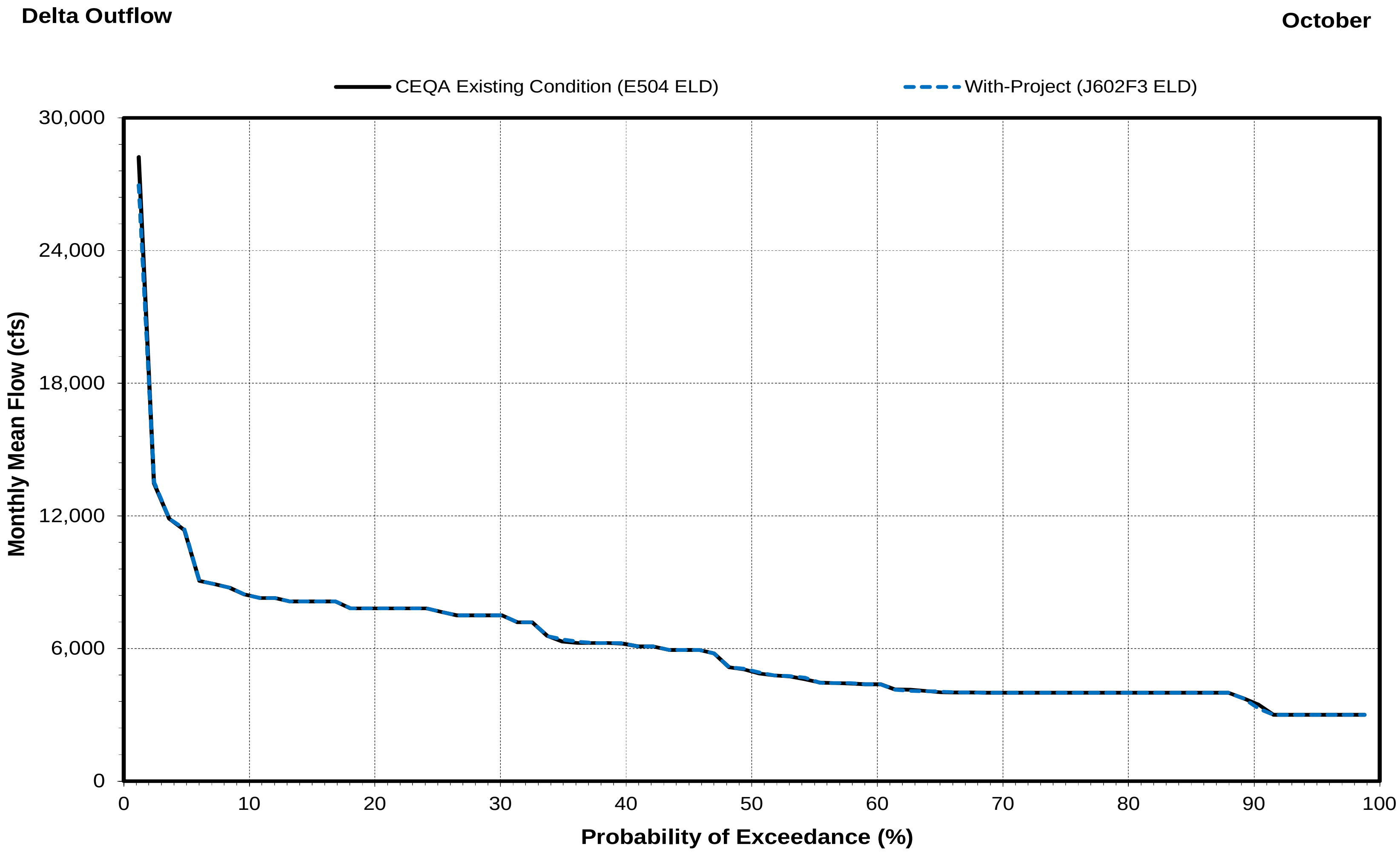
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	21875	21875	0	0.0
2.4	21250	21250	0	0.0
3.6	21094	21094	0	0.0
4.8	20938	21094	156	0.7
6.0	20938	20938	0	0.0
7.2	20625	20625	0	0.0
8.4	20243	20244	1	0.0
9.6	20156	20156	0	0.0
10.8	20156	20156	0	0.0
12.0	20156	20156	0	0.0
13.3	20000	20078	78	0.4
14.5	20000	20000	0	0.0
15.7	20000	19844	-156	-0.8
16.9	19688	19688	0	0.0
18.1	19375	19375	0	0.0
19.3	19375	19375	0	0.0
20.5	19375	19375	0	0.0
21.7	19063	19063	0	0.0
22.9	19063	19063	0	0.0
24.1	18906	18906	0	0.0
25.3	18438	18594	156	0.8
26.5	18438	18594	156	0.8
27.7	18438	18438	0	0.0
28.9	18438	18438	0	0.0
30.1	17524	17524	0	0.0
31.3	14063	14063	0	0.0
32.5	13594	13594	0	0.0
33.7	12344	12344	0	0.0
34.9	11719	11719	0	0.0
36.1	11719	11719	0	0.0
37.3	11563	11563	0	0.0
38.6	11563	11563	0	0.0
39.8	11563	11563	0	0.0
41.0	11563	11563	0	0.0
42.2	11563	11563	0	0.0
43.4	11406	11406	0	0.0
44.6	11406	11406	0	0.0
45.8	10781	10781	0	0.0
47.0	4761	4762	1	0.0
48.2	4612	4615	3	0.1
49.4	4369	4369	0	0.0
50.6	4269	4269	0	0.0
51.8	4259	4261	2	0.0
53.0	4191	4192	1	0.0
54.2	4084	4080	-4	-0.1
55.4	4080	4034	-46	-1.1
56.6	4014	4014	0	0.0
57.8	4008	4008	0	0.0
59.0	3877	3882	5	0.1
60.2	3749	3752	3	0.1
61.4	3716	3694	-22	-0.6
62.7	3653	3646	-7	-0.2
63.9	3646	3620	-26	-0.7
65.1	3616	3377	-239	-6.6
66.3	3077	3364	287	9.3
67.5	3061	3077	16	0.5
68.7	3030	3062	32	1.1
69.9	3000	3029	29	1.0
71.1	3000	3026	26	0.9
72.3	3000	3000	0	0.0
73.5	3000	3000	0	0.0
74.7	3000	3000	0	0.0
75.9	3000	3000	0	0.0
77.1	3000	3000	0	0.0
78.3	3000	3000	0	0.0
79.5	3000	3000	0	0.0
80.7	3000	3000	0	0.0
81.9	3000	3000	0	0.0
83.1	3000	3000	0	0.0
84.3	3000	3000	0	0.0
85.5	3000	3000	0	0.0
86.7	3000	3000	0	0.0
88.0	3000	3000	0	0.0
89.2	3000	3000	0	0.0
90.4	3000	3000	0	0.0
91.6	3000	3000	0	0.0
92.8	3000	3000	0	0.0
94.0	3000	3000	0	0.0
95.2	3000	3000	0	0.0
96.4	3000	3000	0	0.0
97.6	3000	3000	0	0.0
98.8	3000	3000	0	0.0
Min	3000	3000	-239	-6.6
Max	21875	21875	287	9.3
Mean	9725	9731	6	0.1
Median	4319	4319	0	0.0

Entire 82-Year Simulation Period

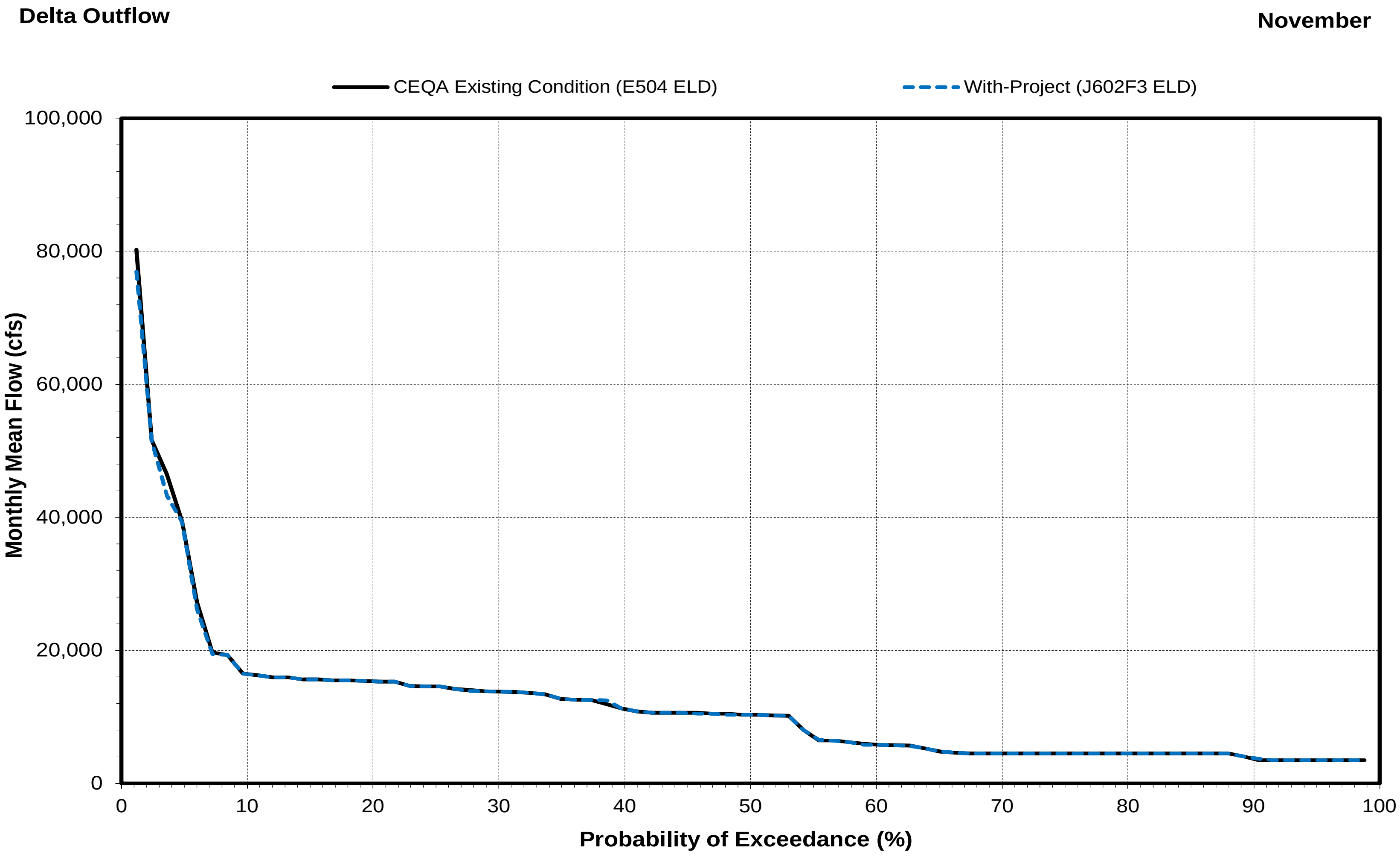
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	95.1
1.1<=X<10.0		2.4
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**



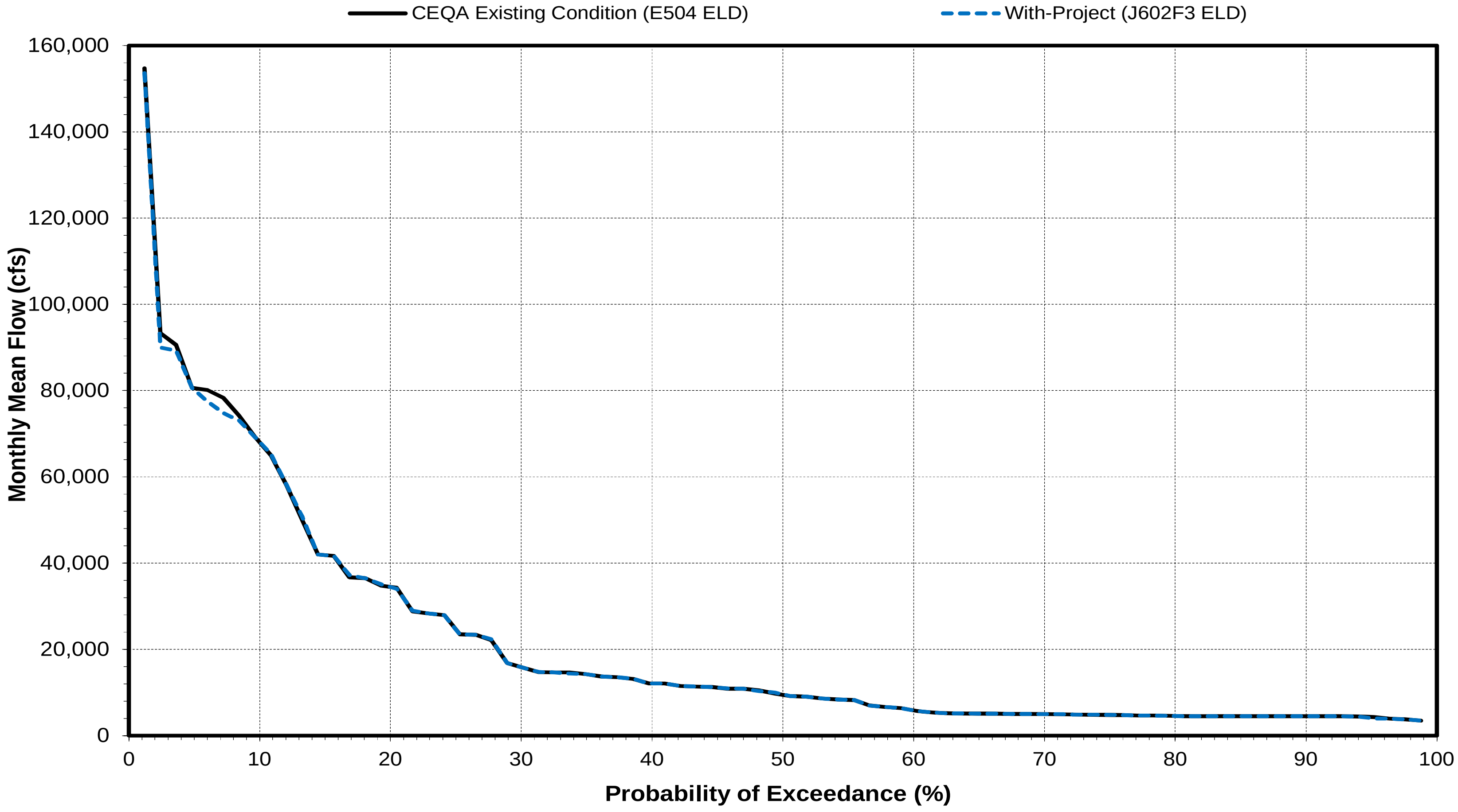
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

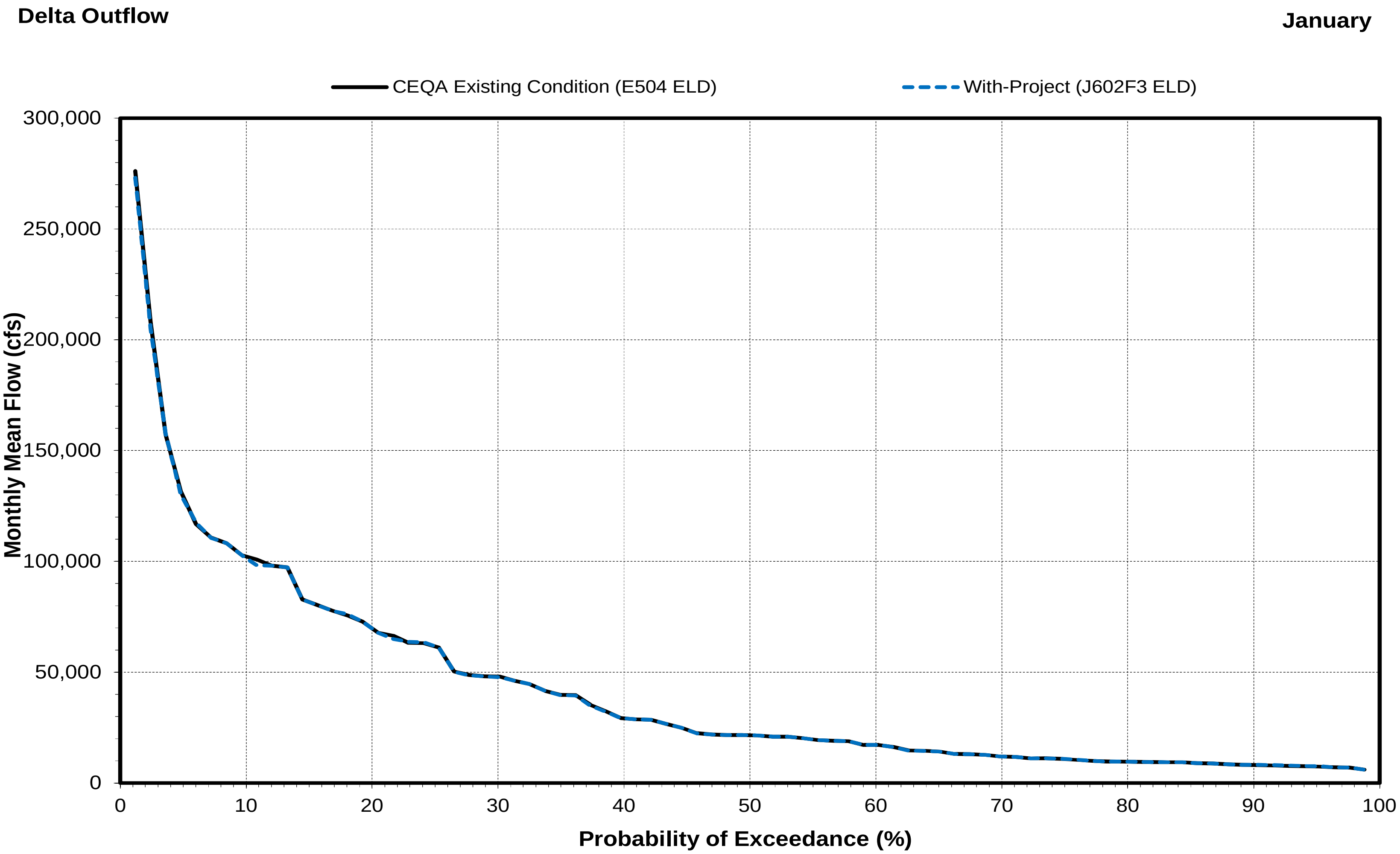
Delta Outflow

December

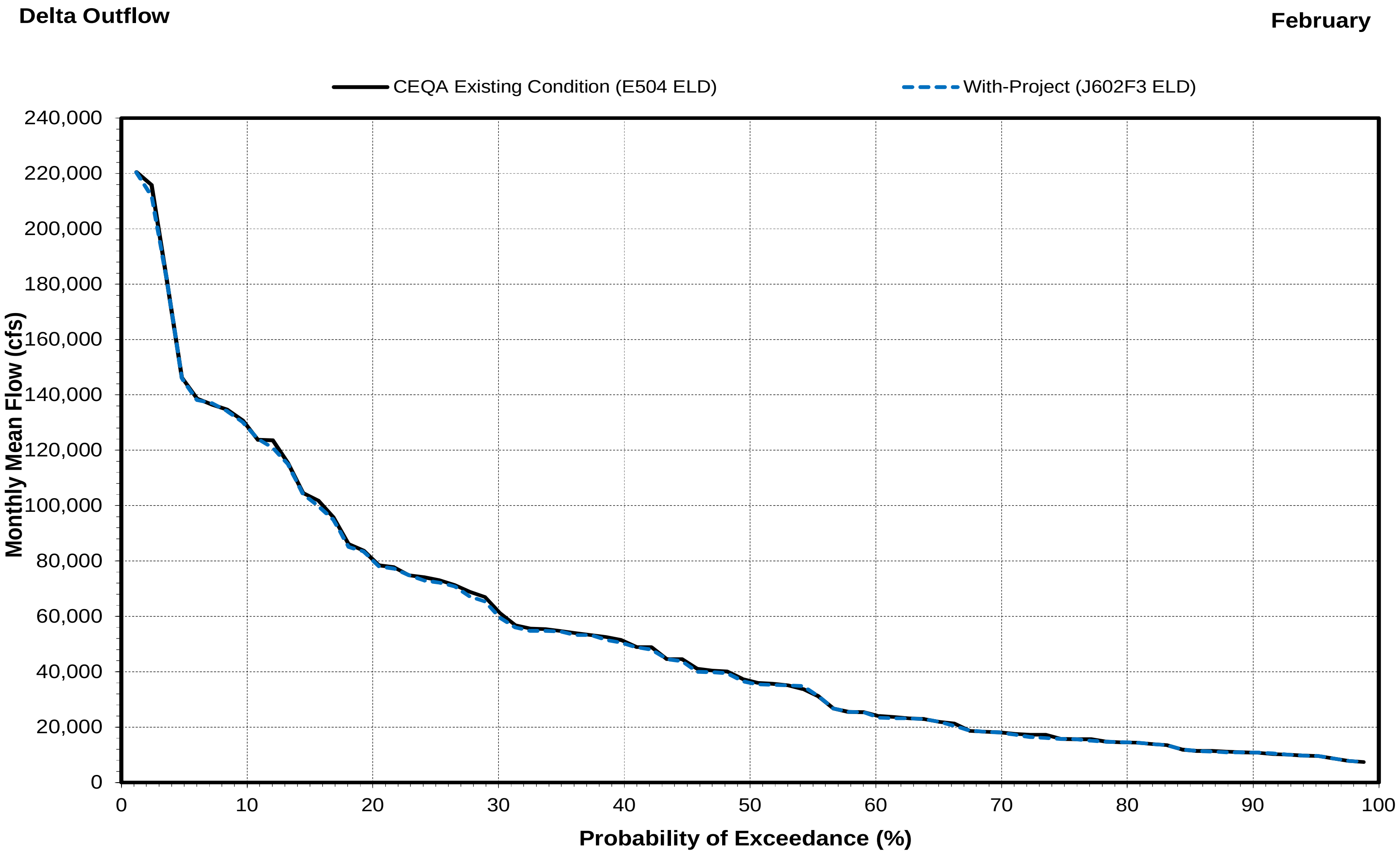


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

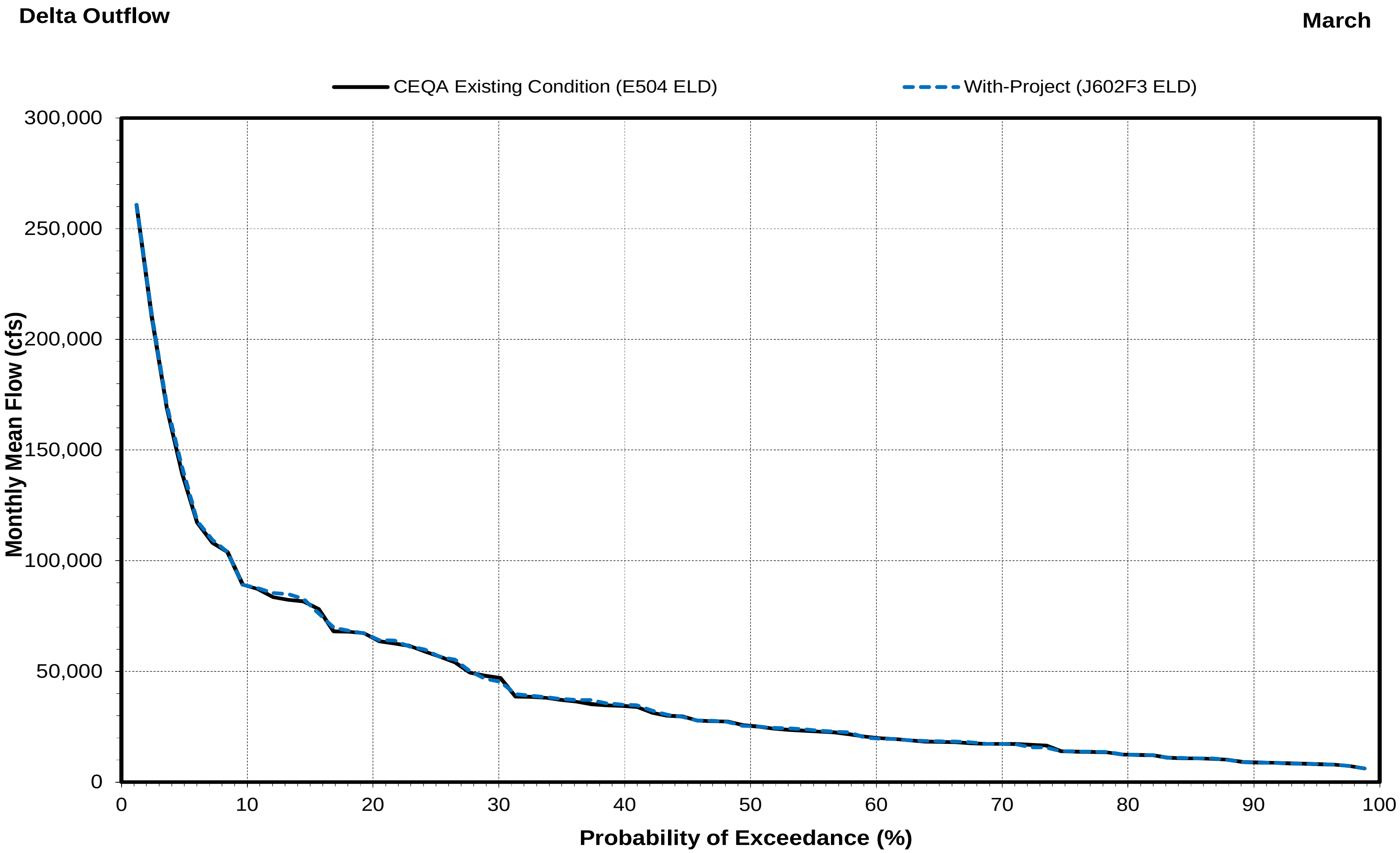


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



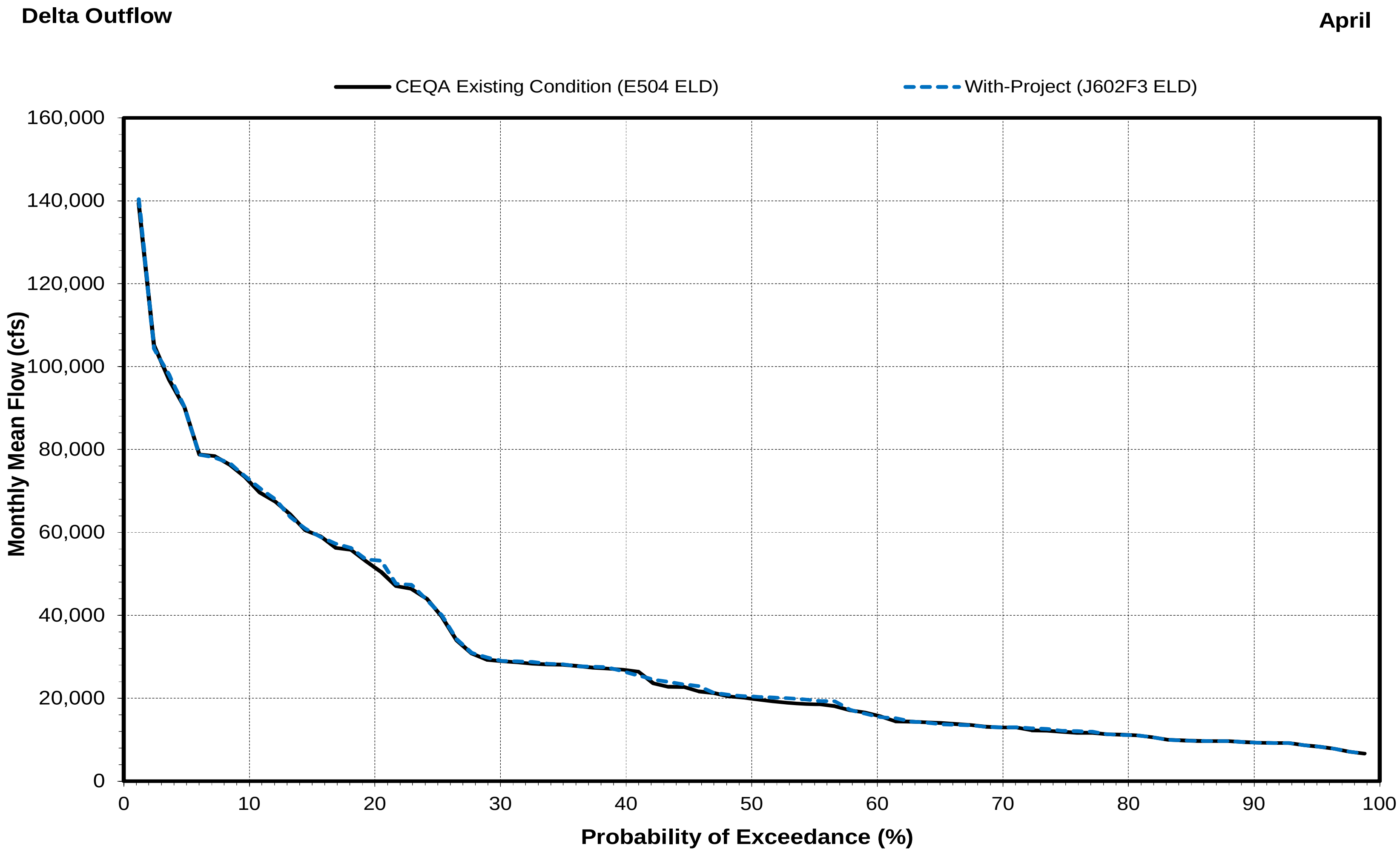
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



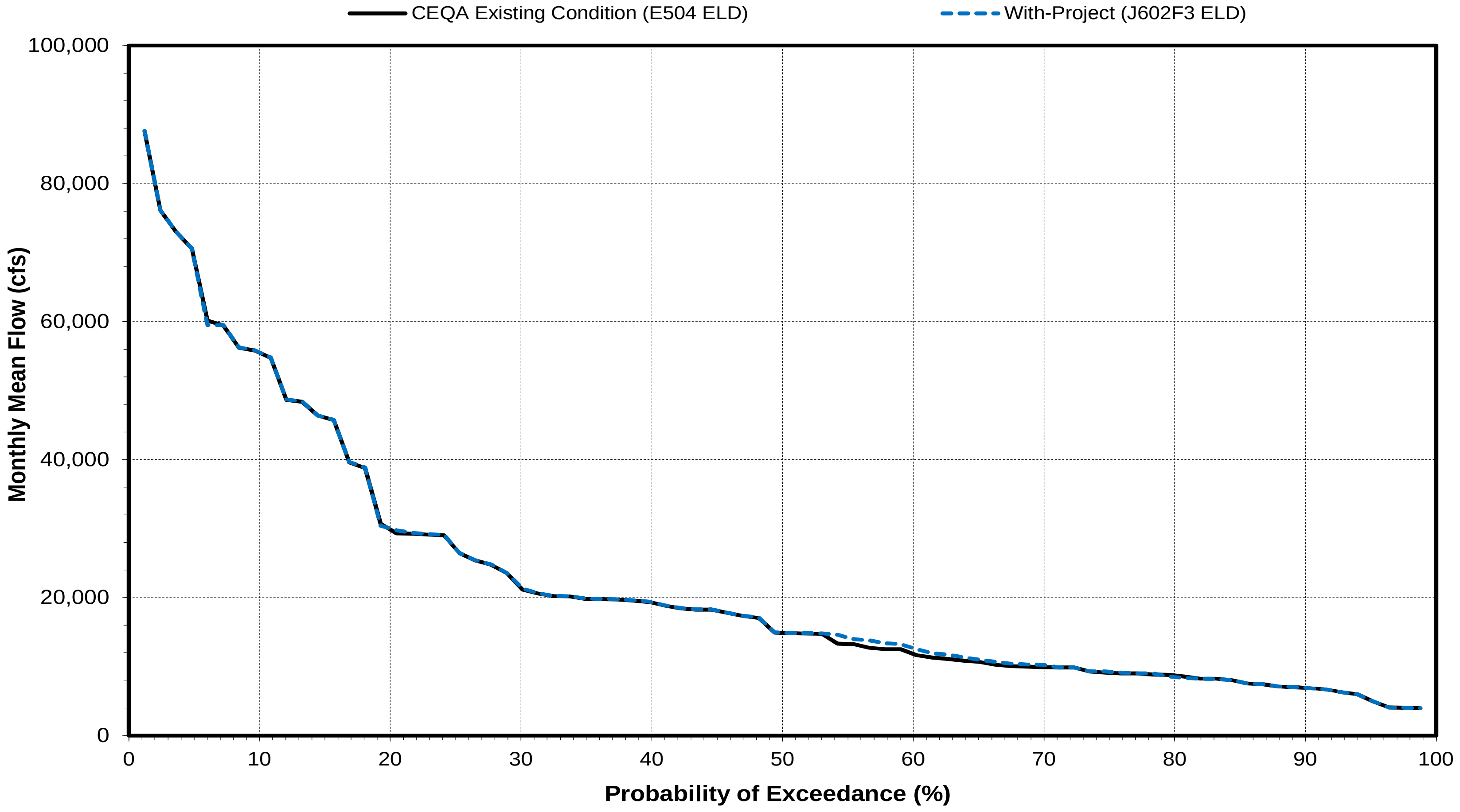
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

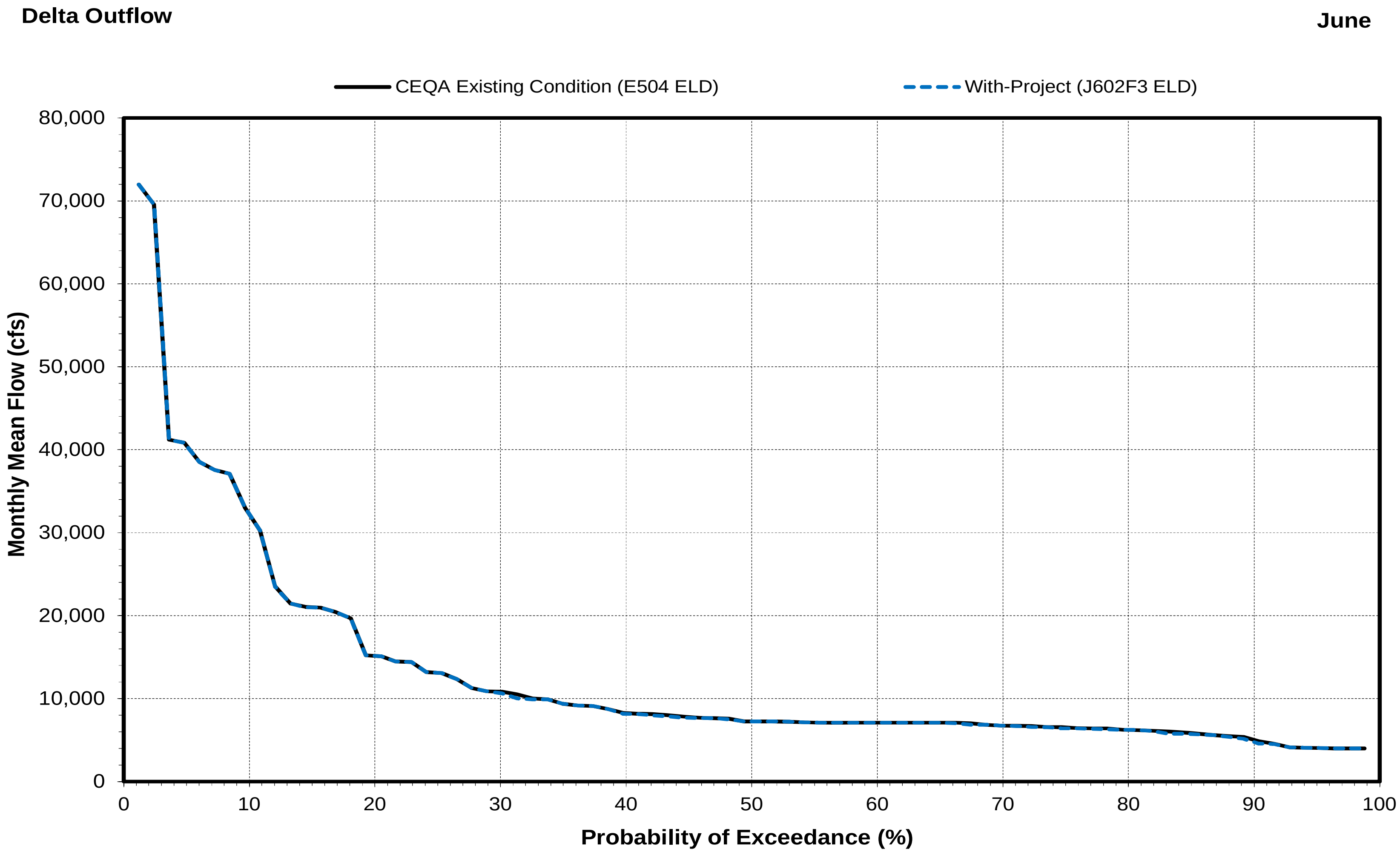


Delta Outflow

May

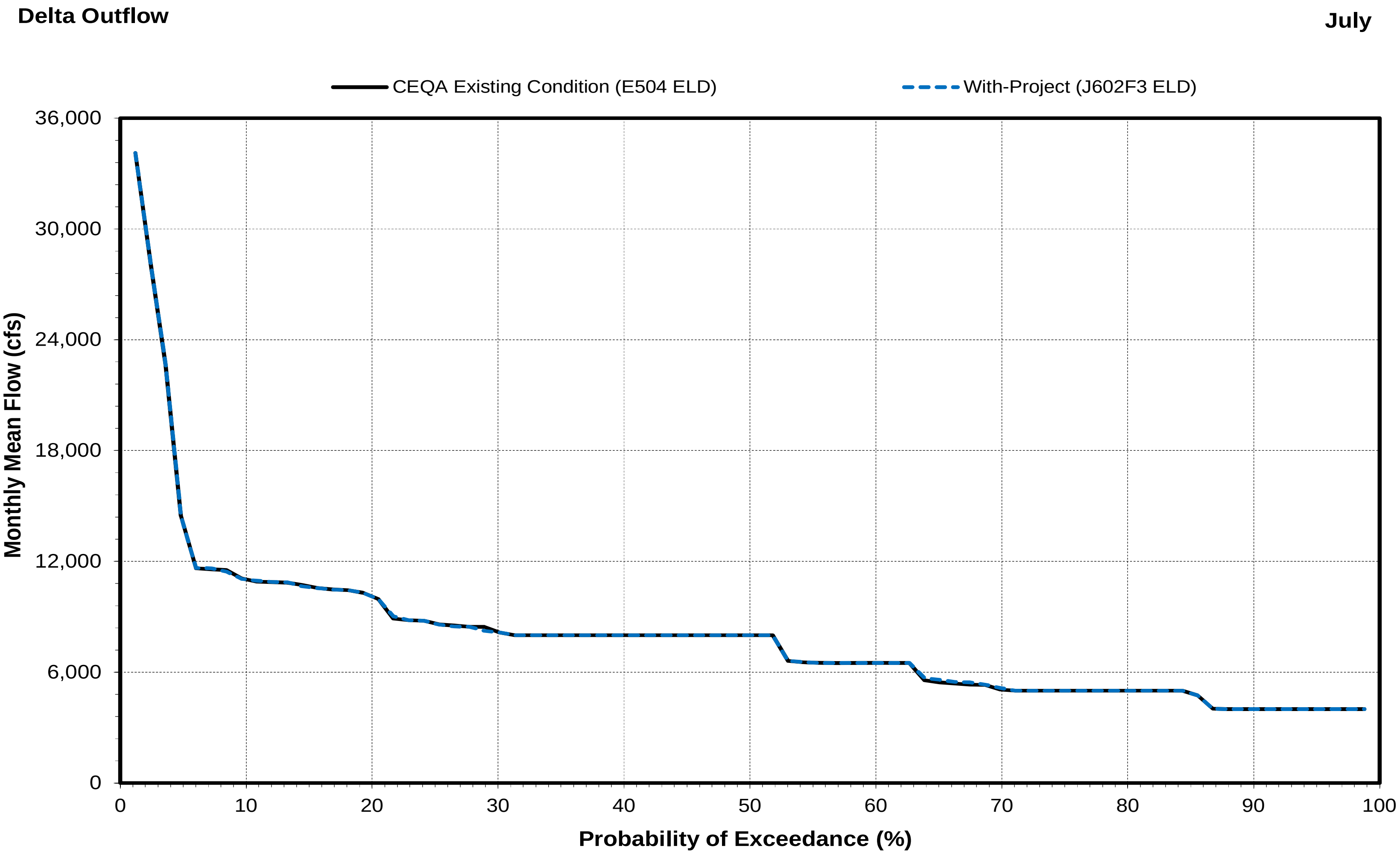
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



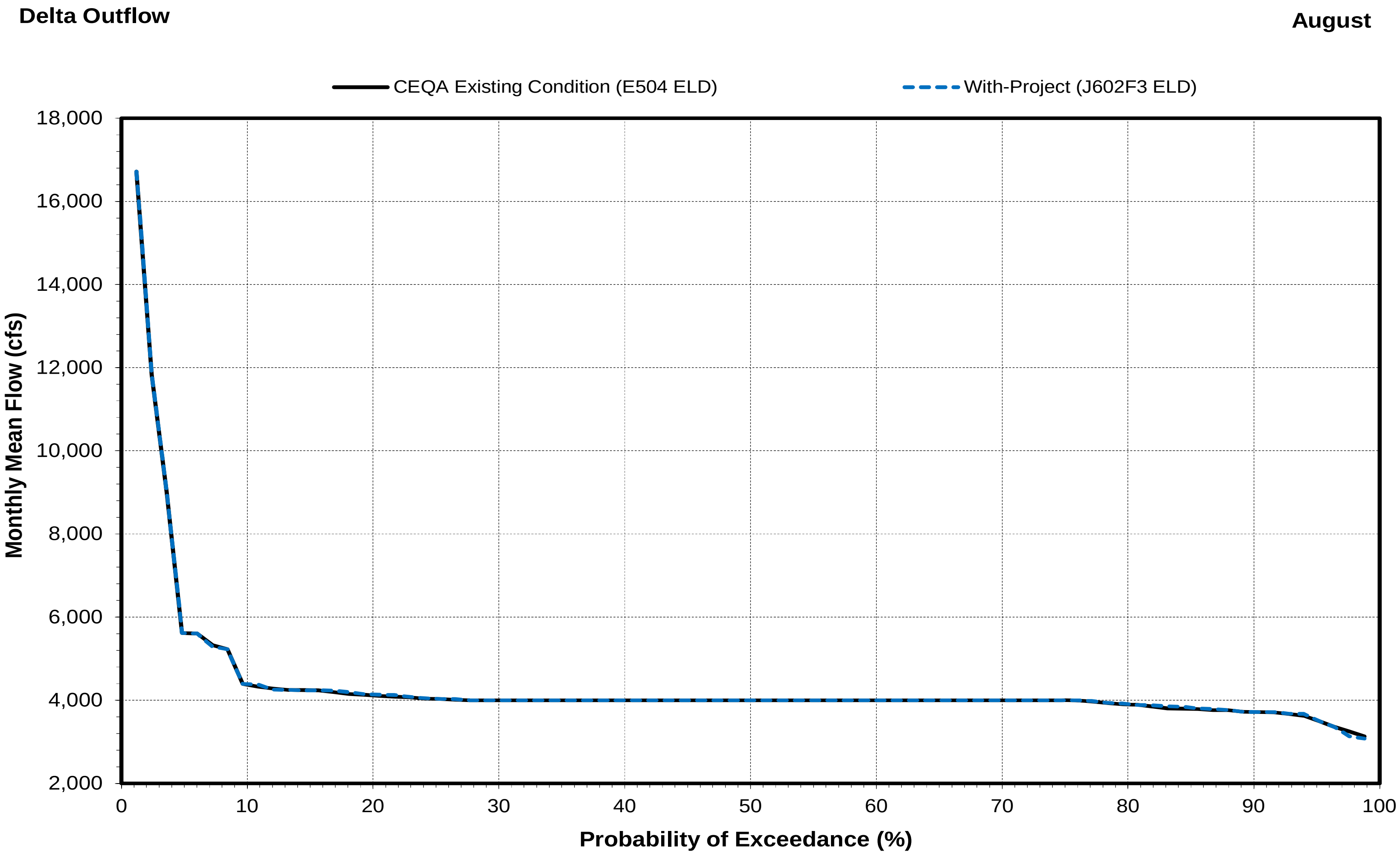
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



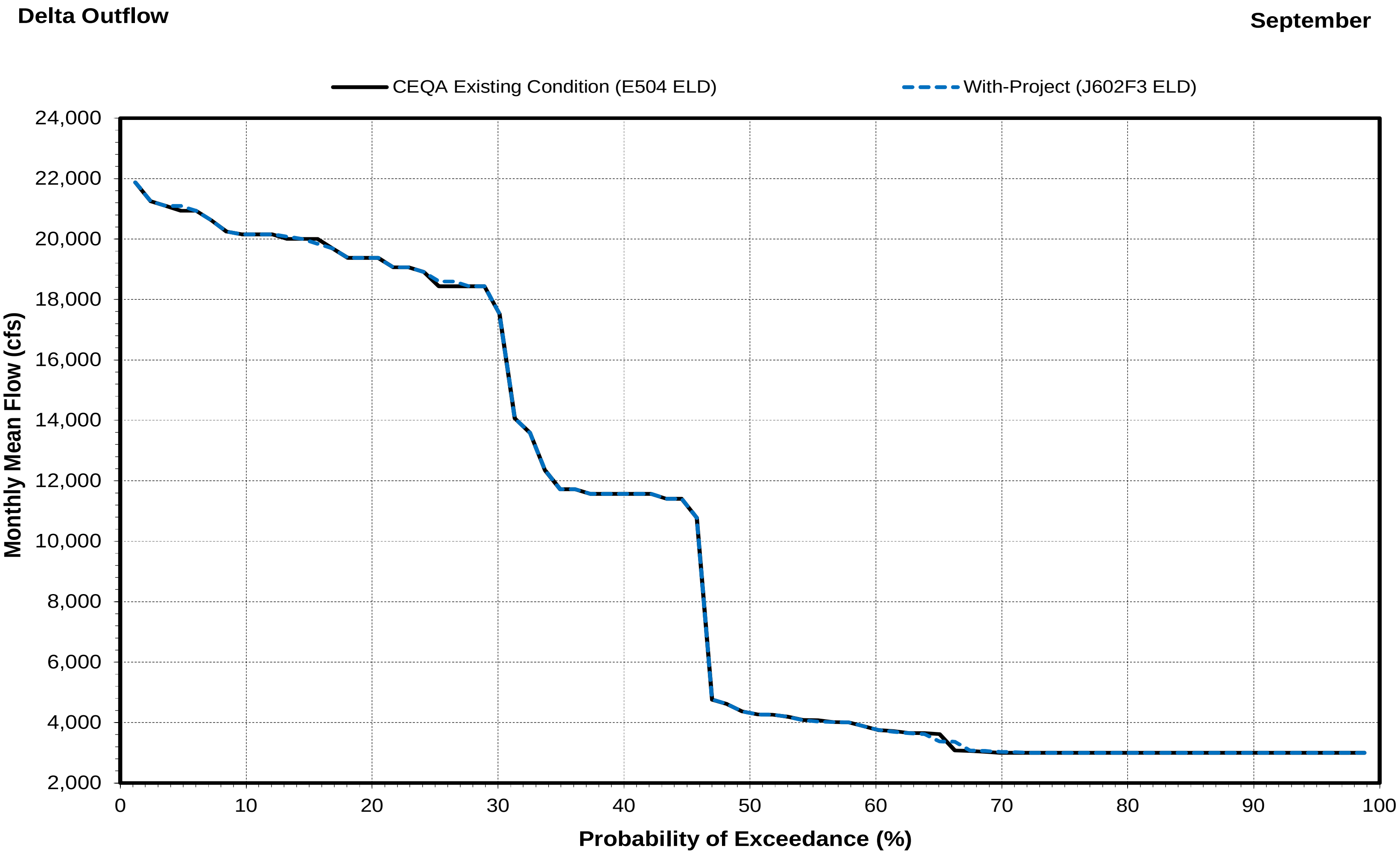
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Delta X2 Location - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (km)
	Monthly Mean Location (km)	Monthly Mean Location (km)	
1.2	93.2	93.2	0.0
2.0	93.1	93.0	-0.1
3.0	92.8	92.8	0.0
4.0	92.6	92.7	0.1
5.0	92.5	92.5	0.0
6.0	92.2	92.2	0.0
7.0	92.1	92.1	0.0
8.0	92.1	92.1	0.0
9.0	91.9	91.9	0.0
10.0	91.8	91.8	0.0
11.0	91.7	91.7	0.0
12.0	91.6	91.6	0.0
13.0	91.4	91.3	-0.1
14.0	91.3	91.2	0.0
15.0	91.2	91.2	0.0
16.0	91.2	91.2	0.0
17.0	91.1	91.1	0.0
18.0	91.0	91.0	0.0
19.0	91.0	91.0	0.0
20.0	90.9	90.9	0.0
21.0	90.9	90.8	-0.1
22.0	90.9	90.8	-0.1
23.0	90.8	90.7	-0.1
24.0	90.7	90.6	-0.1
25.0	90.6	90.5	-0.1
26.0	90.6	90.5	-0.1
27.0	90.5	90.5	-0.1
28.0	90.5	90.4	0.0
29.0	90.5	90.4	0.0
30.0	90.4	90.3	-0.1
31.0	90.4	90.1	-0.3
32.0	90.1	89.9	-0.2
33.0	89.8	89.9	0.0
34.0	89.8	89.8	0.1
35.0	89.7	89.7	0.0
36.0	89.7	89.7	0.0
37.0	89.4	89.5	0.0
38.0	89.3	89.3	0.0
39.0	89.2	89.2	0.1
40.0	89.0	89.2	0.1
41.0	88.9	88.9	0.0
42.0	88.9	88.9	0.0
43.0	88.8	88.8	0.0
44.0	88.7	88.7	0.0
45.0	88.7	88.7	0.0
46.0	88.6	88.6	0.0
47.0	88.4	88.4	0.0
48.0	88.4	88.4	0.0
49.0	88.3	88.3	0.0
50.0	88.1	88.1	0.0
51.0	87.9	87.9	0.0
52.0	87.8	87.8	0.0
53.0	87.8	87.8	0.0
54.0	82.2	82.2	0.0
55.0	81.0	81.0	0.0
56.0	81.0	81.0	0.0
57.0	81.0	81.0	0.0
58.0	81.0	81.0	0.0
59.0	81.0	81.0	0.0
60.0	81.0	81.0	0.0
61.0	81.0	81.0	0.0
62.0	81.0	81.0	0.0
63.0	81.0	81.0	0.0
64.0	81.0	81.0	0.0
65.0	80.9	81.0	0.0
66.0	80.9	80.9	0.0
67.0	76.8	76.8	0.0
68.0	74.1	74.1	0.0
69.0	74.1	74.1	0.0
70.0	74.1	74.1	0.0
71.0	74.1	74.1	0.0
72.0	74.1	74.0	0.0
73.0	74.1	74.0	0.0
74.0	74.1	74.0	0.0
75.0	74.1	74.0	0.0
76.0	74.0	74.0	0.0
77.0	74.0	74.0	0.0
78.0	74.0	74.0	0.0
79.0	74.0	74.0	0.0
80.0	74.0	74.0	0.0
81.0	74.0	74.0	0.0
82.0	74.0	74.0	0.0
83.0	74.0	74.0	0.0
84.0	74.0	74.0	0.0
85.0	74.0	74.0	0.0
86.0	74.0	74.0	0.0
87.0	74.0	74.0	0.0
88.0	73.9	73.9	0.0
89.0	73.9	73.9	0.0
90.0	73.9	73.9	0.0
91.0	73.9	73.9	0.0
92.0	73.9	73.9	0.0
93.0	73.9	73.9	0.0
94.0	73.9	73.9	0.0
95.0	73.9	73.9	0.0
96.0	71.5	71.5	0.0
97.0	69.3	69.3	0.0
98.0	67.7	67.7	0.0
98.8	66.8	66.8	0.0
Min	66.8	66.8	-0.3
Max	93.2	93.2	0.1
Mean	83.5	83.5	0.0
Median	88.1	88.1	0.0

Delta X2 Location - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (km)
	Monthly Mean Location (km)	Monthly Mean Location (km)	
1.2	94.8	94.8	0.0
2.0	94.5	94.5	0.0
3.0	94.3	94.3	0.0
4.0	94.2	94.2	0.0
5.0	94.1	94.1	0.0
6.0	93.8	93.8	0.0
7.0	93.8	93.8	0.0
8.0	93.7	93.7	0.0
9.0	93.4	93.5	0.1
10.0	93.2	93.4	0.1
11.0	93.1	93.2	0.0
12.0	92.6	92.6	0.0
13.0	92.4	92.4	0.0
14.0	92.2	92.2	0.0
15.0	92.1	92.1	0.0
16.0	92.1	92.1	0.0
17.0	92.0	92.0	-0.1
18.0	92.0	92.0	0.0
19.0	91.9	91.9	0.0
20.0	91.9	91.9	0.0
21.0	91.9	91.8	-0.1
22.0	91.8	91.8	-0.1
23.0	91.8	91.7	-0.1
24.0	91.8	91.7	-0.1
25.0	91.7	91.6	0.0
26.0	91.6	91.5	-0.1
27.0	91.4	91.4	0.0
28.0	91.2	91.3	0.1
29.0	91.1	91.1	0.0
30.0	91.1	91.1	0.0
31.0	91.1	91.1	0.0
32.0	91.0	91.0	0.0
33.0	90.9	90.9	-0.1
34.0	90.9	90.8	-0.1
35.0	90.9	90.8	-0.1
36.0	90.8	90.8	-0.1
37.0	90.6	90.6	0.0
38.0	90.5	90.5	0.0
39.0	90.4	90.5	0.0
40.0	90.4	90.4	0.0
41.0	90.3	90.3	0.0
42.0	90.2	90.2	0.0
43.0	90.2	90.2	0.0
44.0	90.1	90.1	0.0
45.0	90.0	90.0	0.0
46.0	90.0	90.0	0.0
47.0	89.9	89.9	0.0
48.0	89.8	89.8	0.0
49.0	89.7	89.7	0.0
50.0	89.7	89.7	0.0
51.0	89.5	89.5	0.0
52.0	87.9	87.9	0.0
53.0	81.1	81.1	0.0
54.0	81.1	81.1	0.0
55.0	81.1	81.1	0.0
56.0	81.1	81.1	0.0
57.0	81.1	81.1	0.0
58.0	81.1	81.0	0.0
59.0	81.0	81.0	0.0
60.0	81.0	81.0	0.0
61.0	81.0	81.0	0.0
62.0	81.0	81.0	0.0
63.0	80.9	80.9	0.0
64.0	80.9	80.9	0.0
65.0	80.8	80.8	0.0
66.0	75.6	75.6	0.0
67.0	74.1	74.1	0.0
68.0	74.1	74.1	0.0
69.0	74.1	74.1	0.0
70.0	74.1	74.1	0.0
71.0	74.1	74.0	-0.1
72.0	74.1	74.0	-0.1
73.0	74.1	74.0	0.0
74.0	74.0	74.0	0.0
75.0	74.0	74.0	0.0
76.0	74.0	74.0	0.0
77.0	74.0	74.0	0.0
78.0	74.0	74.0	0.0
79.0	74.0	74.0	0.0
80.0	74.0	74.0	0.0
81.0	74.0	74.0	0.0
82.0	74.0	74.0	0.0
83.0	74.0	74.0	0.0
84.0	74.0	74.0	0.0
85.0	73.9	74.0	0.0
86.0	73.9	73.9	0.0
87.0	73.9	73.9	0.0
88.0	73.9	73.9	0.0
89.0	73.9	73.9	0.0
90.0	73.9	73.9	0.0
91.0	73.9	73.9	0.0
92.0	73.9	73.9	0.0
93.0	73.9	73.9	0.0
94.0	73.9	73.9	0.0
95.0	72.1	72.1	0.0
96.0	70.1	70.7	0.7
97.0	69.2	69.7	0.5
98.0	68.5	68.6	0.0
98.8	67.3	67.3	0.0
Min	67.3	67.3	-0.1
Max	94.8	94.8	0.7
Mean	83.9	83.9	0.0
Median	89.7	89.7	0.0

Delta X2 Location - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (km)
	Monthly Mean Location (km)	Monthly Mean Location (km)	
1.2	94.9	94.8	0.0
2.0	94.5	94.5	0.0
3.0	94.2	94.2	0.0
4.0	94.0	93.9	0.0
5.0	93.5	93.5	-0.1
6.0	93.5	93.4	0.0
7.0	93.4	93.4	0.0
8.0	92.9	92.9	0.0
9.0	92.6	92.6	0.0
10.0	92.4	92.4	0.0
11.0	92.2	92.2	0.0
12.0	92.1	92.1	0.0
13.0	91.9	91.8	0.0
14.0	91.7	91.7	0.0
15.0	91.6	91.6	0.0
16.0	91.5	91.5	0.0
17.0	91.5	91.5	-0.1
18.0	91.5	91.4	-0.1
19.0	91.3	91.3	0.0
20.0	91.3	91.3	0.0
21.0	91.2	91.3	0.0
22.0	91.2	91.2	0.1
23.0	91.1	91.1	0.0
24.0	91.0	91.0	0.0
25.0	90.9	90.8	0.0
26.0	90.8	90.8	0.0
27.0	90.7	90.7	0.0
28.0	90.6	90.6	0.0
29.0	90.6	90.6	0.0
30.0	90.6	90.6	0.0
31.0	90.6	90.6	0.0
32.0	90.5	90.5	0.0
33.0	90.4	90.4	0.0
34.0	90.4	90.4	0.0
35.0	90.3	90.3	0.0
36.0	90.3	90.2	-0.1
37.0	90.1	90.1	0.0
38.0	89.9	89.9	0.0
39.0	89.8	89.8	0.0
40.0	89.6	89.6	0.0
41.0	88.9	89.1	0.2
42.0	88.3	88.2	0.0
43.0	87.5	87.4	0.0
44.0	86.0	86.0	0.0
45.0	84.6	84.6	0.0
46.0	83.8	83.7	-0.1
47.0	83.1	82.5	-0.6
48.0	81.6	81.6	0.0
49.0	81.1	81.2	0.1
50.0	81.0	81.1	0.0
51.0	81.0	81.0	0.0
52.0	81.0	81.0	0.0
53.0	81.0	81.0	0.0
54.0	81.0	81.0	0.0
55.0	81.0	81.0	0.0
56.0	80.9	81.0	0.0
57.0	80.9	81.0	0.0
58.0	80.9	80.9	0.0
59.0	80.9	80.9	0.0
60.0	80.9	80.9	0.0
61.0	79.7	79.7	0.0
62.0	77.9	77.9	0.0
63.0	76.6	76.6	0.0
64.0	76.5	76.5	0.0
65.0	76.4	76.4	0.0
66.0	76.2	76.2	0.0
67.0	76.1	76.1	0.0
68.0	76.0	76.0	0.0
69.0	75.8	75.8	0.0
70.0	75.6	75.6	0.0
71.0	75.6	75.6	0.0
72.0	75.4	75.4	0.0
73.0	75.3	75.3	0.0
74.0	75.1	75.1	0.0
75.0	74.9	74.9	0.0
76.0	74.8	74.8	0.0
77.0	74.4	74.4	0.0
78.0	74.1	74.1	0.0
79.0	74.1	74.1	0.0
80.0	74.1	74.0	0.0
81.0	74.0	74.0	0.0
82.0	74.0	74.0	0.0
83.0	74.0	74.0	0.0
84.0	74.0	74.0	0.0
85.0	74.0	74.0	0.0
86.0	74.0	74.0	0.0
87.0	74.0	74.0	0.0
88.0	73.9	73.9	0.0
89.0	73.1	73.1	0.0
90.0	72.0	72.4	0.4
91.0	71.4	72.0	0.6
92.0	71.2	71.7	0.5
93.0	71.1	71.3	0.2
94.0	70.5	70.6	0.1
95.0	62.7	63.7	1.0
96.0	60.3	60.7	0.4
97.0	58.9	58.9	0.0
98.0	55.8	55.9	0.1
98.8	51.5	51.9	0.4
Min	51.5	51.9	-0.6
Max	94.9	94.8	1.0
Mean	82.3	82.3	0.0
Median	81.0	81.1	0.0

Delta X2 Location - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Location (km)	With-Project (J602F3 ELD) Monthly Mean Location (km)	Absolute Difference (km)
1.2	93.0	93.0	0.0
2.0	92.6	92.7	0.1
3.0	92.3	92.4	0.1
4.0	91.9	91.9	0.0
5.0	91.0	91.0	0.0
6.0	90.9	90.9	0.0
7.0	90.8	90.8	0.0
8.0	90.8	90.8	0.0
9.0	90.7	90.8	0.0
10.0	90.7	90.7	0.0
11.0	90.7	90.6	-0.1
12.0	90.6	90.6	0.0
13.0	90.6	90.6	0.0
14.0	90.6	90.6	0.0
15.0	90.5	90.5	0.0
16.0	90.5	90.5	0.0
17.0	90.5	90.5	0.0
18.0	90.3	90.3	0.0
19.0	90.2	90.3	0.1
20.0	88.8	88.8	0.0
21.0	87.8	87.8	0.0
22.0	87.7	87.7	0.0
23.0	87.3	87.3	0.0
24.0	86.7	86.7	0.0
25.0	86.0	86.0	0.1
26.0	85.7	85.8	0.1
27.0	85.2	85.3	0.1
28.0	84.4	84.4	0.0
29.0	84.0	84.0	0.0
30.0	83.5	83.5	0.0
31.0	83.4	83.4	0.0
32.0	83.3	83.4	0.1
33.0	83.2	83.3	0.1
34.0	83.2	83.2	0.0
35.0	83.2	83.2	0.0
36.0	83.1	83.1	0.0
37.0	82.6	82.6	0.0
38.0	82.3	82.2	-0.1
39.0	82.2	82.1	-0.1
40.0	82.1	82.1	0.0
41.0	82.1	82.1	0.0
42.0	81.8	81.8	0.0
43.0	81.7	81.7	0.0
44.0	81.4	81.4	0.0
45.0	81.1	81.1	0.0
46.0	80.9	80.9	0.0
47.0	80.8	80.8	0.0
48.0	80.6	80.6	0.0
49.0	80.4	80.4	0.0
50.0	80.2	80.2	0.0
51.0	80.0	80.0	0.0
52.0	80.0	80.0	0.0
53.0	79.8	79.8	0.0
54.0	79.6	79.6	0.0
55.0	79.3	79.3	0.0
56.0	79.1	79.1	0.0
57.0	78.9	78.9	0.0
58.0	78.8	78.8	0.0
59.0	78.7	78.7	0.0
60.0	78.5	78.5	0.0
61.0	78.2	78.2	0.0
62.0	77.1	77.1	0.0
63.0	75.6	75.6	0.0
64.0	75.0	75.0	0.0
65.0	74.8	74.6	-0.2
66.0	73.5	73.6	0.2
67.0	72.7	72.8	0.1
68.0	72.3	72.3	0.0
69.0	71.7	71.7	0.0
70.0	71.0	71.0	0.0
71.0	70.4	70.4	0.0
72.0	69.6	69.6	0.0
73.0	69.1	69.0	-0.2
74.0	68.8	68.6	-0.1
75.0	67.9	68.0	0.0
76.0	66.1	66.1	0.0
77.0	65.7	65.7	0.0
78.0	65.5	65.3	-0.2
79.0	64.3	64.1	-0.2
80.0	63.1	63.1	0.0
81.0	62.7	62.8	0.1
82.0	62.6	62.6	0.0
83.0	62.4	62.4	0.0
84.0	59.7	59.7	0.0
85.0	58.2	58.2	0.0
86.0	56.9	56.8	-0.1
87.0	55.3	55.1	-0.2
88.0	54.7	54.7	0.0
89.0	53.4	53.3	0.0
90.0	52.4	52.7	0.4
91.0	51.9	52.3	0.4
92.0	51.6	51.8	0.2
93.0	51.4	51.5	0.0
94.0	51.1	51.2	0.1
95.0	49.9	50.3	0.3
96.0	49.4	49.6	0.1
97.0	48.7	48.7	0.1
98.0	47.8	47.9	0.1
98.8	47.3	47.3	0.0
Min	47.3	47.3	-0.2
Max	93.0	93.0	0.4
Mean	76.2	76.3	0.0
Median	80.2	80.2	0.0

Delta X2 Location - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Location (km)	With-Project (J602F3 ELD) Monthly Mean Location (km)	Absolute Difference (km)
1.2	88.5	88.3	-0.3
2.0	88.4	88.0	-0.4
3.0	87.6	87.3	-0.2
4.0	86.8	86.8	0.0
5.0	86.5	86.5	0.0
6.0	85.6	85.6	0.0
7.0	85.2	85.2	0.0
8.0	85.0	85.0	0.0
9.0	84.7	84.7	0.0
10.0	84.3	84.3	0.0
11.0	84.3	84.2	0.0
12.0	84.2	84.0	-0.2
13.0	83.9	83.9	0.0
14.0	83.7	83.7	0.0
15.0	83.5	83.5	0.0
16.0	83.3	83.3	0.0
17.0	83.2	83.2	0.0
18.0	83.1	83.1	0.0
19.0	83.0	83.0	0.0
20.0	82.7	82.7	0.0
21.0	82.3	82.3	0.0
22.0	82.0	82.0	0.0
23.0	81.9	81.8	0.0
24.0	81.8	81.8	0.0
25.0	81.2	81.2	0.0
26.0	80.7	80.7	0.0
27.0	80.3	80.3	0.0
28.0	80.1	80.1	0.0
29.0	80.0	80.0	0.0
30.0	79.1	79.1	0.0
31.0	78.9	78.9	-0.1
32.0	78.7	78.7	0.0
33.0	78.2	78.2	0.0
34.0	77.3	77.4	0.1
35.0	75.6	75.8	0.2
36.0	75.6	75.7	0.1
37.0	75.2	75.2	0.0
38.0	74.2	74.2	0.0
39.0	73.2	73.2	0.0
40.0	72.9	72.9	0.0
41.0	72.8	72.8	0.0
42.0	72.3	72.3	0.0
43.0	71.8	71.8	0.0
44.0	71.4	71.4	0.0
45.0	71.1	71.1	0.0
46.0	70.8	70.8	0.0
47.0	70.8	70.8	0.0
48.0	70.4	70.4	0.0
49.0	70.1	70.1	0.0
50.0	70.0	70.0	0.0
51.0	69.8	69.8	0.0
52.0	69.5	69.5	0.0
53.0	69.1	69.1	0.0
54.0	68.9	68.9	0.0
55.0	67.6	67.6	0.0
56.0	66.8	66.9	0.1
57.0	66.5	66.7	0.2
58.0	66.2	66.2	0.1
59.0	65.6	65.6	0.0
60.0	63.5	63.5	0.0
61.0	62.0	62.1	0.1
62.0	60.6	60.7	0.1
63.0	59.7	59.7	0.0
64.0	59.3	59.3	0.0
65.0	57.8	57.8	0.0
66.0	57.1	57.1	0.0
67.0	56.8	56.9	0.1
68.0	56.8	56.8	0.0
69.0	56.1	56.2	0.0
70.0	54.5	54.6	0.1
71.0	54.3	54.6	0.2
72.0	54.3	54.3	0.1
73.0	54.1	54.1	0.0
74.0	53.7	53.7	0.0
75.0	53.2	53.2	0.0
76.0	52.6	52.6	0.0
77.0	51.5	51.5	0.0
78.0	51.1	51.1	0.0
79.0	50.5	50.5	0.1
80.0	50.0	50.1	0.1
81.0	49.9	49.9	0.0
82.0	49.6	49.6	0.0
83.0	49.6	49.5	0.0
84.0	49.3	49.3	0.0
85.0	49.0	49.0	0.0
86.0	48.8	48.8	0.0
87.0	48.6	48.7	0.0
88.0	48.5	48.5	0.0
89.0	48.4	48.4	0.0
90.0	48.3	48.4	0.0
91.0	48.2	48.2	0.0
92.0	48.0	48.0	0.0
93.0	47.7	47.7	0.0
94.0	47.5	47.5	0.0
95.0	47.5	47.5	0.0
96.0	47.3	47.3	0.0
97.0	47.3	47.3	0.0
98.0	47.2	47.2	0.0
98.8	47.2	47.2	0.0
Min	47.2	47.2	-0.4
Max	88.5	88.3	0.2
Mean	67.4	67.4	0.0
Median	70.0	70.0	0.0

Delta X2 Location - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (km)
	Monthly Mean Location (km)	Monthly Mean Location (km)	
1.2	84.2	84.2	0.0
2.0	83.2	83.2	0.0
3.0	81.9	81.9	0.0
4.0	81.0	81.0	0.0
5.0	80.8	80.8	0.0
6.0	80.7	80.7	0.0
7.0	79.9	79.9	0.0
8.0	78.9	78.7	-0.2
9.0	78.2	78.1	-0.1
10.0	77.7	77.7	0.0
11.0	77.0	77.0	0.0
12.0	76.2	76.2	0.0
13.0	75.5	75.5	0.0
14.0	74.6	74.6	0.0
15.0	74.1	74.1	0.0
16.0	73.8	73.8	0.0
17.0	73.3	73.3	0.0
18.0	73.0	72.8	-0.2
19.0	71.8	71.7	-0.1
20.0	71.4	71.4	0.0
21.0	71.0	71.0	0.0
22.0	70.5	70.5	0.0
23.0	70.3	70.4	0.1
24.0	69.6	69.6	0.0
25.0	69.5	69.5	0.0
26.0	68.3	68.9	0.6
27.0	67.4	68.3	0.8
28.0	67.3	67.8	0.5
29.0	67.2	67.7	0.4
30.0	67.2	67.3	0.0
31.0	66.5	66.5	0.0
32.0	66.3	66.3	0.0
33.0	65.8	65.8	0.0
34.0	65.2	65.1	0.0
35.0	65.0	65.0	0.0
36.0	64.6	64.8	0.3
37.0	64.4	64.5	0.0
38.0	64.4	64.2	-0.2
39.0	64.0	63.8	-0.2
40.0	63.3	63.2	-0.1
41.0	62.5	62.1	-0.5
42.0	61.8	62.0	0.2
43.0	61.6	61.8	0.2
44.0	61.6	61.6	0.1
45.0	61.2	61.2	0.1
46.0	60.3	60.5	0.2
47.0	59.9	60.1	0.2
48.0	58.5	58.7	0.1
49.0	58.0	58.2	0.2
50.0	57.6	57.9	0.3
51.0	57.4	57.7	0.3
52.0	57.3	57.5	0.2
53.0	57.0	56.9	0.0
54.0	56.4	56.4	0.0
55.0	56.1	56.2	0.1
56.0	55.7	56.0	0.3
57.0	55.5	55.8	0.3
58.0	55.2	55.4	0.2
59.0	54.3	54.4	0.1
60.0	53.8	54.0	0.2
61.0	53.3	53.6	0.2
62.0	53.1	53.3	0.2
63.0	53.0	53.2	0.2
64.0	52.8	52.8	0.0
65.0	52.5	52.7	0.2
66.0	52.4	52.6	0.2
67.0	52.4	52.5	0.1
68.0	51.9	52.1	0.1
69.0	51.4	51.6	0.2
70.0	51.4	51.6	0.2
71.0	51.2	51.6	0.4
72.0	51.0	51.2	0.2
73.0	50.9	50.9	0.1
74.0	50.1	50.1	0.0
75.0	49.1	49.1	0.0
76.0	49.0	49.0	0.0
77.0	48.7	48.7	0.0
78.0	48.5	48.5	0.0
79.0	48.3	48.3	0.0
80.0	48.2	48.2	0.0
81.0	48.1	48.1	0.0
82.0	48.1	48.1	0.0
83.0	48.0	48.0	0.0
84.0	48.0	48.0	0.0
85.0	47.9	47.9	0.0
86.0	47.8	47.8	0.0
87.0	47.8	47.8	0.0
88.0	47.7	47.8	0.0
89.0	47.7	47.7	0.0
90.0	47.7	47.7	0.0
91.0	47.6	47.6	0.0
92.0	47.5	47.5	0.0
93.0	47.4	47.4	0.0
94.0	47.4	47.4	0.0
95.0	47.3	47.3	0.0
96.0	47.3	47.3	0.0
97.0	47.3	47.3	0.0
98.0	47.3	47.3	0.0
98.8	47.2	47.2	0.0
Min	47.2	47.2	-0.5
Max	84.2	84.2	0.8
Mean	60.3	60.4	0.1
Median	57.6	57.9	0.0

Delta X2 Location - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (km)
	Monthly Mean Location (km)	Monthly Mean Location (km)	
1.2	81.9	82.0	0.0
2.0	80.5	80.4	-0.1
3.0	79.4	79.4	0.0
4.0	78.7	78.7	0.0
5.0	78.0	78.0	0.0
6.0	78.0	77.9	-0.1
7.0	77.6	77.6	0.0
8.0	77.3	77.3	0.0
9.0	77.2	77.2	0.0
10.0	76.7	76.7	0.0
11.0	75.6	75.6	0.0
12.0	75.5	75.5	0.0
13.0	74.3	74.3	0.0
14.0	74.0	74.0	0.0
15.0	73.6	73.6	0.0
16.0	73.1	73.2	0.0
17.0	72.8	73.0	0.1
18.0	72.4	72.5	0.0
19.0	72.3	72.3	0.0
20.0	72.3	72.3	0.0
21.0	69.8	70.0	0.2
22.0	66.6	67.0	0.4
23.0	66.4	66.6	0.2
24.0	66.1	66.5	0.4
25.0	65.8	66.2	0.4
26.0	65.7	65.9	0.2
27.0	65.6	65.6	0.1
28.0	65.5	65.5	0.0
29.0	65.3	65.3	0.0
30.0	64.8	64.6	-0.1
31.0	64.6	64.5	-0.1
32.0	64.4	64.5	0.1
33.0	64.2	64.3	0.1
34.0	64.0	64.1	0.1
35.0	63.5	64.0	0.5
36.0	63.5	63.6	0.2
37.0	63.5	63.5	0.0
38.0	63.3	63.3	0.0
39.0	63.2	63.1	-0.1
40.0	63.1	63.0	-0.1
41.0	63.0	62.9	-0.2
42.0	62.9	62.8	-0.1
43.0	62.5	62.6	0.1
44.0	62.1	62.5	0.4
45.0	61.9	62.3	0.4
46.0	61.9	61.8	-0.1
47.0	61.8	61.8	-0.1
48.0	61.4	61.0	-0.4
49.0	61.2	60.7	-0.5
50.0	60.9	60.6	-0.3
51.0	60.4	60.5	0.1
52.0	60.0	60.3	0.2
53.0	59.7	59.6	-0.1
54.0	59.0	59.1	0.0
55.0	58.5	58.6	0.1
56.0	58.0	58.4	0.4
57.0	57.7	58.3	0.5
58.0	57.7	57.9	0.2
59.0	57.7	57.1	-0.6
60.0	57.6	57.0	-0.6
61.0	57.2	56.8	-0.4
62.0	56.9	56.8	-0.1
63.0	56.8	56.7	-0.1
64.0	56.7	56.5	-0.2
65.0	56.6	56.1	-0.4
66.0	56.5	56.1	-0.4
67.0	55.9	56.0	0.1
68.0	55.0	55.0	0.0
69.0	54.3	53.8	-0.4
70.0	54.0	53.7	-0.3
71.0	53.8	53.7	-0.1
72.0	53.1	53.0	-0.1
73.0	52.1	51.9	-0.1
74.0	51.3	51.1	-0.2
75.0	50.8	50.7	-0.1
76.0	50.6	50.6	0.0
77.0	50.1	50.1	0.0
78.0	50.0	50.0	0.0
79.0	49.8	49.9	0.1
80.0	49.7	49.8	0.1
81.0	49.6	49.6	0.0
82.0	49.4	49.3	-0.1
83.0	49.2	49.1	-0.1
84.0	48.9	48.8	0.0
85.0	48.7	48.7	0.0
86.0	48.6	48.6	0.0
87.0	48.5	48.5	-0.1
88.0	48.3	48.2	0.0
89.0	48.2	48.1	-0.1
90.0	48.2	48.1	-0.1
91.0	48.1	48.0	0.0
92.0	47.9	47.9	0.0
93.0	47.7	47.7	0.0
94.0	47.4	47.4	0.0
95.0	47.4	47.4	0.0
96.0	47.3	47.3	0.0
97.0	47.2	47.2	0.0
98.0	47.2	47.2	0.0
98.8	47.2	47.2	0.0
Min	47.2	47.2	-0.6
Max	81.9	82.0	0.5
Mean	60.7	60.7	0.0
Median	60.9	60.6	0.0

Delta X2 Location - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (km)
	Monthly Mean Location (km)	Monthly Mean Location (km)	
1.2	82.2	82.2	0.0
2.0	81.7	81.7	0.0
3.0	80.8	80.8	0.0
4.0	79.9	79.9	0.0
5.0	79.3	79.3	0.0
6.0	79.0	79.0	0.0
7.0	78.6	78.6	0.0
8.0	78.1	78.1	0.0
9.0	77.8	77.8	0.0
10.0	77.6	77.6	0.0
11.0	77.0	77.0	0.0
12.0	77.0	77.0	0.0
13.0	76.4	76.4	0.0
14.0	76.1	76.1	0.0
15.0	75.9	75.7	-0.2
16.0	75.5	75.2	-0.4
17.0	74.5	74.4	-0.1
18.0	74.4	73.9	-0.4
19.0	73.3	73.2	-0.1
20.0	72.5	72.6	0.2
21.0	72.1	72.3	0.2
22.0	72.1	72.1	0.0
23.0	71.9	72.0	0.1
24.0	70.9	70.9	0.0
25.0	70.4	70.6	0.2
26.0	69.7	70.1	0.4
27.0	69.2	69.7	0.5
28.0	69.1	69.4	0.4
29.0	68.9	69.0	0.1
30.0	68.7	68.9	0.3
31.0	68.6	68.9	0.3
32.0	68.5	68.6	0.0
33.0	68.3	68.3	0.0
34.0	68.0	68.1	0.1
35.0	67.8	67.6	-0.2
36.0	67.5	67.6	0.0
37.0	67.4	67.2	-0.2
38.0	67.1	67.0	-0.2
39.0	66.8	66.6	-0.2
40.0	66.6	66.1	-0.5
41.0	66.1	66.1	0.0
42.0	66.0	66.1	0.0
43.0	65.5	65.4	-0.1
44.0	65.0	64.9	-0.1
45.0	64.6	64.5	-0.1
46.0	64.3	64.1	-0.2
47.0	63.9	63.5	-0.4
48.0	63.8	63.3	-0.5
49.0	63.6	63.2	-0.4
50.0	63.3	63.0	-0.3
51.0	63.0	62.8	-0.2
52.0	62.7	62.7	0.0
53.0	62.3	62.4	0.1
54.0	61.9	62.0	0.2
55.0	61.7	61.7	0.0
56.0	61.6	61.5	-0.1
57.0	61.5	61.3	-0.3
58.0	61.5	60.8	-0.6
59.0	61.4	60.7	-0.7
60.0	60.7	60.5	-0.2
61.0	60.4	60.2	-0.2
62.0	60.3	60.0	-0.3
63.0	60.2	59.9	-0.2
64.0	60.1	59.8	-0.3
65.0	59.7	59.8	0.1
66.0	59.6	59.6	0.0
67.0	59.6	59.4	-0.2
68.0	59.3	59.1	-0.1
69.0	58.9	58.9	-0.1
70.0	58.8	58.7	-0.1
71.0	57.8	57.7	-0.1
72.0	57.3	57.0	-0.3
73.0	56.2	55.9	-0.2
74.0	55.5	55.4	-0.1
75.0	55.4	55.2	-0.1
76.0	55.2	54.8	-0.4
77.0	54.8	54.6	-0.3
78.0	53.9	53.7	-0.2
79.0	53.5	53.3	-0.2
80.0	53.2	53.0	-0.2
81.0	52.8	52.7	-0.1
82.0	52.7	52.6	-0.1
83.0	52.7	52.6	-0.2
84.0	52.0	52.0	0.0
85.0	51.1	51.1	0.0
86.0	50.3	50.3	0.0
87.0	49.7	49.8	0.0
88.0	49.6	49.5	-0.1
89.0	49.3	49.2	-0.1
90.0	49.2	49.2	0.0
91.0	49.2	49.2	0.0
92.0	49.0	49.0	0.0
93.0	48.7	48.7	0.0
94.0	48.7	48.7	0.0
95.0	48.3	48.3	0.0
96.0	47.9	47.9	0.0
97.0	47.6	47.6	0.0
98.0	47.5	47.5	0.0
98.8	47.3	47.3	0.0
Min	47.3	47.3	-0.7
Max	82.2	82.2	0.5
Mean	63.5	63.4	-0.1
Median	63.3	63.0	0.0

Delta X2 Location - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Location (km)	With-Project (J602F3 ELD) Monthly Mean Location (km)	Absolute Difference (km)
1.2	86.9	86.9	0.0
2.0	86.3	86.3	0.0
3.0	86.0	86.0	0.0
4.0	85.5	85.5	0.0
5.0	84.3	84.3	0.0
6.0	82.2	82.2	0.0
7.0	82.0	82.0	0.0
8.0	81.3	81.4	0.0
9.0	81.0	81.0	0.0
10.0	81.0	81.0	0.0
11.0	80.8	80.8	0.0
12.0	80.8	80.8	0.0
13.0	80.0	80.0	0.0
14.0	79.7	79.7	0.0
15.0	79.3	79.3	0.0
16.0	78.8	78.8	0.0
17.0	78.6	78.7	0.0
18.0	78.2	78.1	0.0
19.0	78.1	78.1	0.0
20.0	77.6	77.6	0.0
21.0	77.1	77.1	0.0
22.0	76.7	76.6	-0.1
23.0	76.3	75.7	-0.6
24.0	75.8	75.7	-0.2
25.0	75.6	75.6	0.0
26.0	75.6	75.6	0.0
27.0	75.4	75.4	0.0
28.0	75.3	75.3	0.0
29.0	75.1	75.1	0.1
30.0	75.0	75.0	0.0
31.0	75.0	75.0	0.0
32.0	74.8	74.8	0.0
33.0	74.3	74.5	0.1
34.0	73.8	73.9	0.1
35.0	73.3	73.1	-0.3
36.0	72.7	72.6	-0.2
37.0	72.6	71.7	-0.9
38.0	72.0	71.3	-0.7
39.0	71.6	71.1	-0.5
40.0	71.4	70.6	-0.8
41.0	71.2	69.9	-1.2
42.0	70.1	69.5	-0.5
43.0	69.7	69.3	-0.4
44.0	69.5	69.0	-0.5
45.0	69.2	68.8	-0.4
46.0	68.8	68.7	-0.1
47.0	68.3	68.2	-0.1
48.0	68.1	67.0	-1.1
49.0	67.6	66.7	-0.9
50.0	66.8	66.4	-0.4
51.0	66.1	66.0	-0.1
52.0	65.7	65.6	-0.1
53.0	65.5	65.4	-0.1
54.0	65.5	65.4	-0.1
55.0	65.4	65.3	-0.2
56.0	65.4	65.1	-0.3
57.0	65.3	65.0	-0.3
58.0	65.1	65.0	-0.1
59.0	64.9	64.8	-0.1
60.0	64.9	64.7	-0.2
61.0	64.8	64.7	-0.1
62.0	64.5	64.5	0.0
63.0	64.3	64.3	0.0
64.0	63.9	63.9	-0.1
65.0	62.9	62.9	0.0
66.0	62.9	62.8	-0.1
67.0	62.6	62.6	-0.1
68.0	62.4	62.4	0.0
69.0	62.3	62.3	0.0
70.0	62.1	62.1	0.0
71.0	61.7	61.7	0.0
72.0	61.6	61.5	0.0
73.0	61.0	60.9	0.0
74.0	60.4	60.3	0.0
75.0	60.1	60.1	0.0
76.0	60.0	60.0	0.0
77.0	59.6	59.6	0.0
78.0	59.5	59.3	-0.1
79.0	59.3	59.1	-0.2
80.0	59.0	58.9	-0.1
81.0	58.4	58.5	0.1
82.0	57.4	57.4	0.0
83.0	57.1	57.0	0.0
84.0	56.6	56.5	-0.1
85.0	55.7	55.6	-0.1
86.0	54.5	54.5	0.0
87.0	53.7	53.7	0.0
88.0	53.6	53.6	0.0
89.0	52.9	52.9	0.0
90.0	52.8	52.7	0.0
91.0	52.3	52.3	0.0
92.0	51.8	51.9	0.0
93.0	51.7	51.7	0.1
94.0	51.6	51.6	0.0
95.0	50.3	50.3	0.0
96.0	49.8	49.8	0.0
97.0	49.1	49.1	0.0
98.0	48.5	48.5	0.0
98.8	48.3	48.3	0.0
Min	48.3	48.3	-1.2
Max	86.9	86.9	0.1
Mean	67.7	67.6	-0.1
Median	66.8	66.4	0.0

Delta X2 Location - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Location (km)	With-Project (J602F3 ELD) Monthly Mean Location (km)	Absolute Difference (km)
1.2	90.0	90.0	0.0
2.0	89.7	89.7	0.0
3.0	89.3	89.3	0.0
4.0	89.0	89.0	0.0
5.0	88.3	88.3	0.0
6.0	86.5	86.5	0.0
7.0	86.4	86.4	0.0
8.0	85.2	85.2	0.0
9.0	83.9	83.9	0.0
10.0	83.2	83.2	0.0
11.0	83.1	83.1	0.0
12.0	83.0	83.0	0.0
13.0	83.0	83.0	0.0
14.0	82.9	82.9	0.0
15.0	82.7	82.7	0.0
16.0	82.5	82.5	0.0
17.0	82.4	82.4	0.0
18.0	81.9	81.9	0.0
19.0	81.8	81.6	-0.2
20.0	81.6	81.5	-0.1
21.0	81.4	81.4	0.0
22.0	81.3	81.3	0.0
23.0	81.3	81.3	0.0
24.0	81.3	81.1	-0.2
25.0	81.2	81.1	-0.1
26.0	81.1	81.1	-0.1
27.0	81.1	81.0	0.0
28.0	81.0	81.0	0.0
29.0	81.0	81.0	0.0
30.0	81.0	81.0	0.0
31.0	81.0	81.0	0.0
32.0	80.9	81.0	0.1
33.0	80.9	80.9	0.0
34.0	80.9	80.8	-0.1
35.0	80.8	80.7	-0.1
36.0	80.7	80.5	-0.2
37.0	80.6	80.4	-0.2
38.0	80.3	80.3	-0.1
39.0	80.2	80.1	-0.1
40.0	80.2	79.8	-0.3
41.0	80.0	79.4	-0.6
42.0	79.5	79.3	-0.3
43.0	79.3	78.7	-0.6
44.0	78.9	78.5	-0.5
45.0	78.2	78.1	-0.1
46.0	77.4	77.5	0.0
47.0	77.4	77.4	0.0
48.0	77.1	77.1	0.0
49.0	77.1	77.1	0.0
50.0	77.0	77.0	0.0
51.0	77.0	77.0	0.0
52.0	76.8	76.8	0.0
53.0	76.4	76.4	0.0
54.0	75.7	75.7	0.0
55.0	75.3	75.6	0.3
56.0	75.0	75.3	0.3
57.0	74.9	75.0	0.1
58.0	74.8	74.9	0.1
59.0	74.8	74.8	0.0
60.0	74.7	74.6	0.0
61.0	74.5	74.5	0.0
62.0	74.4	74.4	0.0
63.0	74.1	74.1	0.0
64.0	73.5	73.4	-0.1
65.0	73.1	73.0	-0.1
66.0	72.9	72.8	-0.2
67.0	72.5	72.4	-0.1
68.0	72.2	72.2	0.0
69.0	72.1	72.0	-0.1
70.0	71.9	71.9	-0.1
71.0	71.6	71.6	0.0
72.0	70.6	70.6	0.0
73.0	69.8	69.8	0.0
74.0	69.1	69.1	0.0
75.0	68.7	68.7	0.0
76.0	68.5	68.5	0.0
77.0	67.6	67.6	0.0
78.0	67.4	67.4	0.0
79.0	67.0	67.0	0.0
80.0	66.0	66.0	0.0
81.0	65.0	65.1	0.0
82.0	65.0	65.0	0.0
83.0	64.2	64.2	0.0
84.0	64.1	64.1	0.0
85.0	64.0	64.0	0.0
86.0	63.4	63.5	0.1
87.0	62.6	62.6	0.0
88.0	62.4	62.4	0.0
89.0	59.5	59.5	0.0
90.0	58.8	58.8	0.0
91.0	58.0	58.0	0.0
92.0	57.2	57.2	0.0
93.0	56.8	56.8	0.0
94.0	56.3	56.4	0.0
95.0	55.8	55.8	0.0
96.0	55.1	55.1	0.0
97.0	52.4	52.4	0.0
98.0	49.8	49.8	0.0
98.8	49.4	49.4	0.0
Min	49.4	49.4	-0.6
Max	90.0	90.0	0.3
Mean	74.6	74.6	0.0
Median	77.0	77.0	0.0

Delta X2 Location - Probability of Exceedance

August

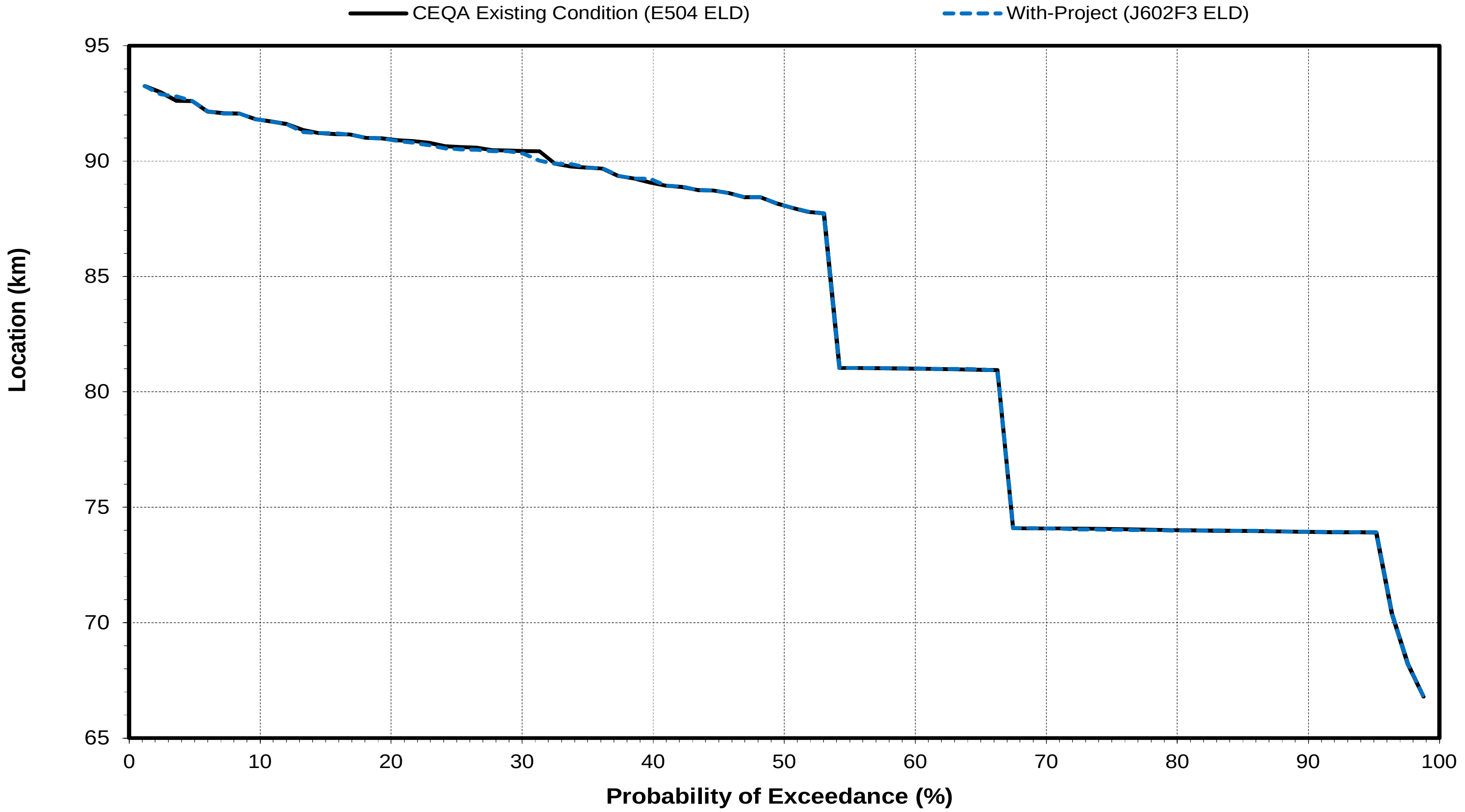
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Location (km)	With-Project (J602F3 ELD) Monthly Mean Location (km)	Absolute Difference (km)
1.2	90.8	90.8	0.0
2.0	90.4	90.4	0.0
3.0	90.1	90.1	0.0
4.0	89.8	89.8	0.0
5.0	88.9	88.9	0.0
6.0	88.7	88.7	0.0
7.0	88.3	88.3	0.0
8.0	88.0	88.0	0.0
9.0	87.2	87.2	0.0
10.0	86.3	86.3	0.0
11.0	86.2	86.2	0.0
12.0	86.1	86.1	0.0
13.0	86.1	86.1	0.0
14.0	86.0	86.0	0.0
15.0	85.8	85.8	0.0
16.0	85.6	85.6	0.0
17.0	85.5	85.5	0.0
18.0	85.4	85.4	0.0
19.0	85.3	85.3	0.0
20.0	85.2	85.3	0.1
21.0	85.1	85.2	0.1
22.0	85.0	85.0	0.0
23.0	85.0	84.9	0.0
24.0	84.9	84.9	0.0
25.0	84.8	84.8	0.0
26.0	84.8	84.8	0.0
27.0	84.7	84.7	0.0
28.0	84.6	84.6	0.0
29.0	84.4	84.4	0.0
30.0	84.4	84.4	0.0
31.0	84.4	84.4	0.0
32.0	84.3	84.3	0.0
33.0	84.2	84.3	0.0
34.0	84.2	84.2	0.0
35.0	84.2	84.2	0.0
36.0	84.1	84.1	0.0
37.0	83.0	83.1	0.0
38.0	82.4	82.5	0.1
39.0	82.3	82.4	0.1
40.0	82.2	82.3	0.1
41.0	82.0	82.3	0.3
42.0	81.9	82.1	0.2
43.0	81.7	81.8	0.0
44.0	81.6	81.5	0.0
45.0	81.5	81.5	0.0
46.0	81.5	81.5	0.0
47.0	81.4	81.4	0.0
48.0	81.4	81.4	0.0
49.0	81.2	81.1	0.0
50.0	80.9	80.9	0.0
51.0	80.8	80.8	0.0
52.0	80.8	80.7	0.0
53.0	80.8	80.7	0.0
54.0	80.5	80.7	0.2
55.0	80.2	80.3	0.1
56.0	80.0	80.0	0.0
57.0	80.0	80.0	0.0
58.0	80.0	80.0	0.0
59.0	79.8	79.8	0.0
60.0	79.8	79.8	0.0
61.0	79.5	79.5	0.0
62.0	79.4	79.4	0.0
63.0	79.3	79.3	0.0
64.0	79.1	79.0	0.0
65.0	79.0	78.9	0.0
66.0	78.8	78.8	0.0
67.0	78.7	78.8	0.0
68.0	78.7	78.7	0.0
69.0	78.6	78.6	0.1
70.0	78.5	78.6	0.1
71.0	78.5	78.5	0.0
72.0	78.3	78.4	0.1
73.0	78.2	78.3	0.1
74.0	78.1	78.2	0.1
75.0	77.9	77.9	0.0
76.0	77.5	77.6	0.0
77.0	77.4	77.4	0.0
78.0	77.1	77.1	0.0
79.0	76.8	76.8	0.0
80.0	76.5	76.5	0.0
81.0	76.4	76.4	0.0
82.0	76.2	76.2	0.0
83.0	75.9	76.0	0.0
84.0	75.9	75.9	0.0
85.0	75.4	75.4	0.0
86.0	74.8	74.8	0.0
87.0	74.5	74.4	-0.1
88.0	74.0	73.9	-0.1
89.0	73.4	73.4	0.0
90.0	72.3	72.3	0.0
91.0	71.8	71.8	0.0
92.0	71.5	71.5	0.0
93.0	70.9	70.9	0.0
94.0	69.8	69.8	0.0
95.0	68.4	68.4	0.0
96.0	63.8	63.7	0.0
97.0	61.1	61.1	0.0
98.0	59.4	59.4	0.0
98.8	57.3	57.3	0.0
Min	57.3	57.3	-0.1
Max	90.8	90.8	0.3
Mean	80.4	80.4	0.0
Median	80.9	80.9	0.0

Delta X2 Location - Probability of Exceedance

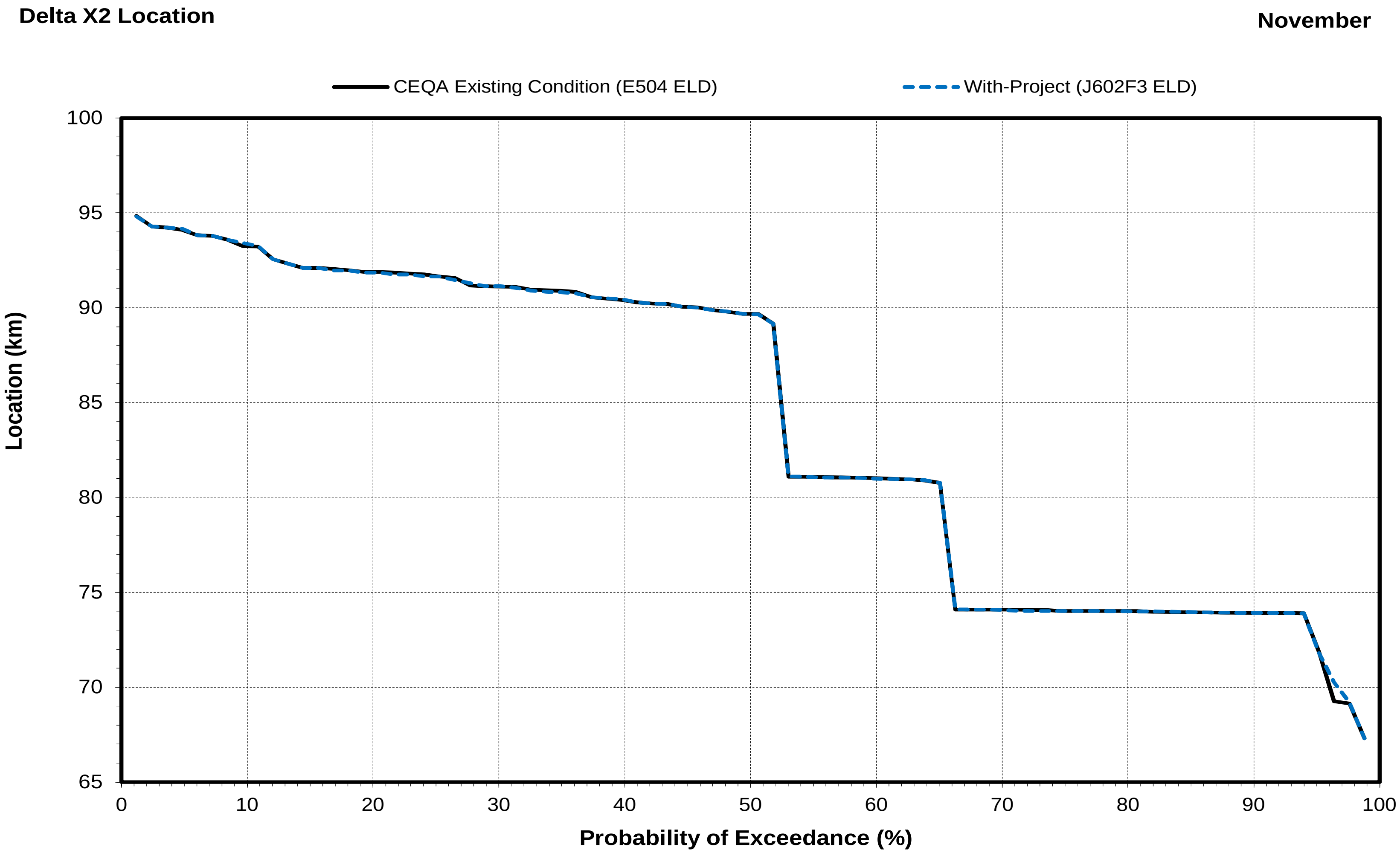
September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (km)
	Monthly Mean Location (km)	Monthly Mean Location (km)	
1.2	92.2	92.2	0.0
2.0	91.5	91.5	-0.1
3.0	90.8	90.7	0.0
4.0	90.3	90.3	0.0
5.0	90.2	90.3	0.1
6.0	90.2	90.2	0.0
7.0	90.2	90.2	0.1
8.0	90.0	90.0	0.0
9.0	89.8	89.8	0.0
10.0	89.6	89.6	0.0
11.0	89.4	89.4	0.0
12.0	89.3	89.4	0.0
13.0	89.3	89.3	0.0
14.0	88.9	88.8	-0.1
15.0	88.6	88.5	0.0
16.0	88.4	88.4	0.0
17.0	88.2	88.2	0.0
18.0	88.2	88.2	0.0
19.0	88.1	88.1	0.0
20.0	88.1	88.1	-0.1
21.0	88.1	88.0	-0.1
22.0	87.9	87.9	0.0
23.0	87.8	87.8	0.0
24.0	87.6	87.6	-0.1
25.0	87.5	87.5	0.0
26.0	87.5	87.5	0.0
27.0	87.5	87.5	0.0
28.0	87.5	87.5	0.0
29.0	87.5	87.4	-0.1
30.0	87.5	87.4	-0.1
31.0	87.4	87.4	-0.1
32.0	87.4	87.3	-0.1
33.0	87.3	87.3	-0.1
34.0	87.3	87.2	0.0
35.0	87.1	87.1	0.0
36.0	86.9	86.9	0.0
37.0	86.6	86.6	0.0
38.0	86.5	86.5	0.0
39.0	86.4	86.4	0.0
40.0	86.3	86.3	0.0
41.0	86.1	86.0	0.0
42.0	86.0	86.0	0.0
43.0	86.0	86.0	0.0
44.0	85.9	85.9	0.0
45.0	85.9	85.9	0.0
46.0	85.9	85.9	0.0
47.0	85.8	85.8	0.0
48.0	85.8	85.8	0.0
49.0	85.8	85.8	0.0
50.0	85.7	85.7	0.0
51.0	85.6	85.6	0.0
52.0	85.6	85.6	0.0
53.0	85.6	85.6	0.0
54.0	85.4	85.4	0.0
55.0	85.3	85.3	0.0
56.0	85.1	85.2	0.0
57.0	85.0	85.0	0.0
58.0	84.9	85.0	0.0
59.0	84.9	84.9	0.0
60.0	84.9	84.9	0.0
61.0	84.9	84.9	0.0
62.0	84.8	84.8	0.0
63.0	84.8	84.8	0.0
64.0	84.8	84.8	0.0
65.0	84.8	84.7	0.0
66.0	84.7	84.7	0.1
67.0	84.6	84.7	0.0
68.0	84.6	84.6	0.0
69.0	84.5	84.5	0.0
70.0	84.4	84.4	0.0
71.0	84.3	84.4	0.0
72.0	84.3	84.3	0.0
73.0	84.3	84.3	0.0
74.0	84.3	84.3	0.0
75.0	84.3	84.3	0.0
76.0	84.3	84.2	-0.1
77.0	84.2	84.2	0.0
78.0	84.1	84.1	0.0
79.0	84.0	84.0	0.0
80.0	83.8	83.8	0.0
81.0	83.6	83.6	0.0
82.0	83.4	83.4	0.0
83.0	83.3	83.3	0.0
84.0	83.2	83.2	0.0
85.0	83.1	83.1	0.0
86.0	82.9	82.9	0.0
87.0	82.7	82.8	0.1
88.0	82.7	82.7	0.0
89.0	82.7	82.7	0.0
90.0	82.5	82.4	0.0
91.0	82.3	82.3	-0.1
92.0	82.2	82.2	0.0
93.0	82.0	82.0	0.0
94.0	81.7	81.7	0.0
95.0	81.5	81.4	0.0
96.0	76.1	76.1	0.0
97.0	71.9	71.9	0.0
98.0	68.8	68.8	0.0
98.8	66.1	66.1	0.0
Min	66.1	66.1	-0.1
Max	92.2	92.2	0.1
Mean	85.4	85.4	0.0
Median	85.7	85.7	0.0

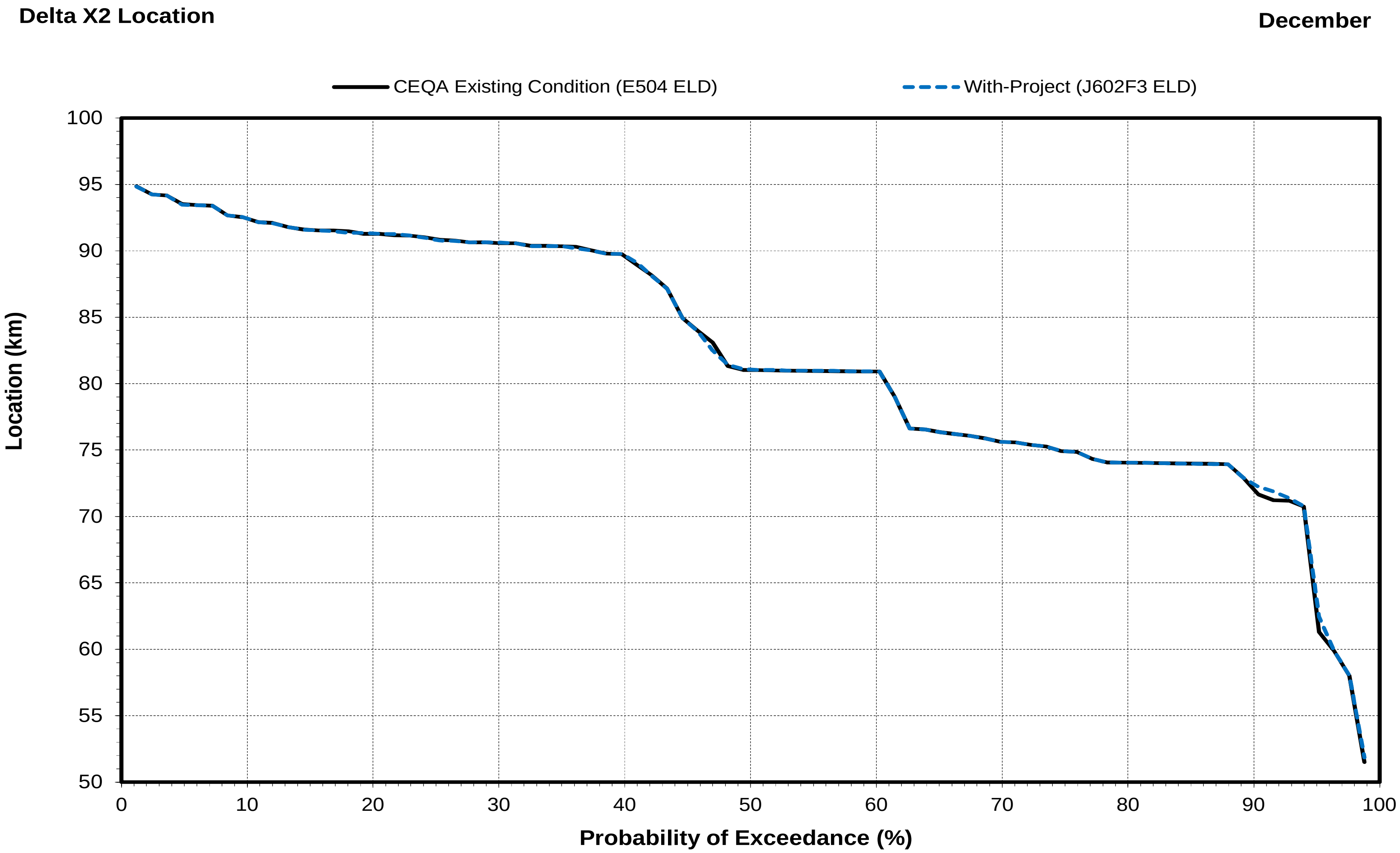
Delta X2 Location **October**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

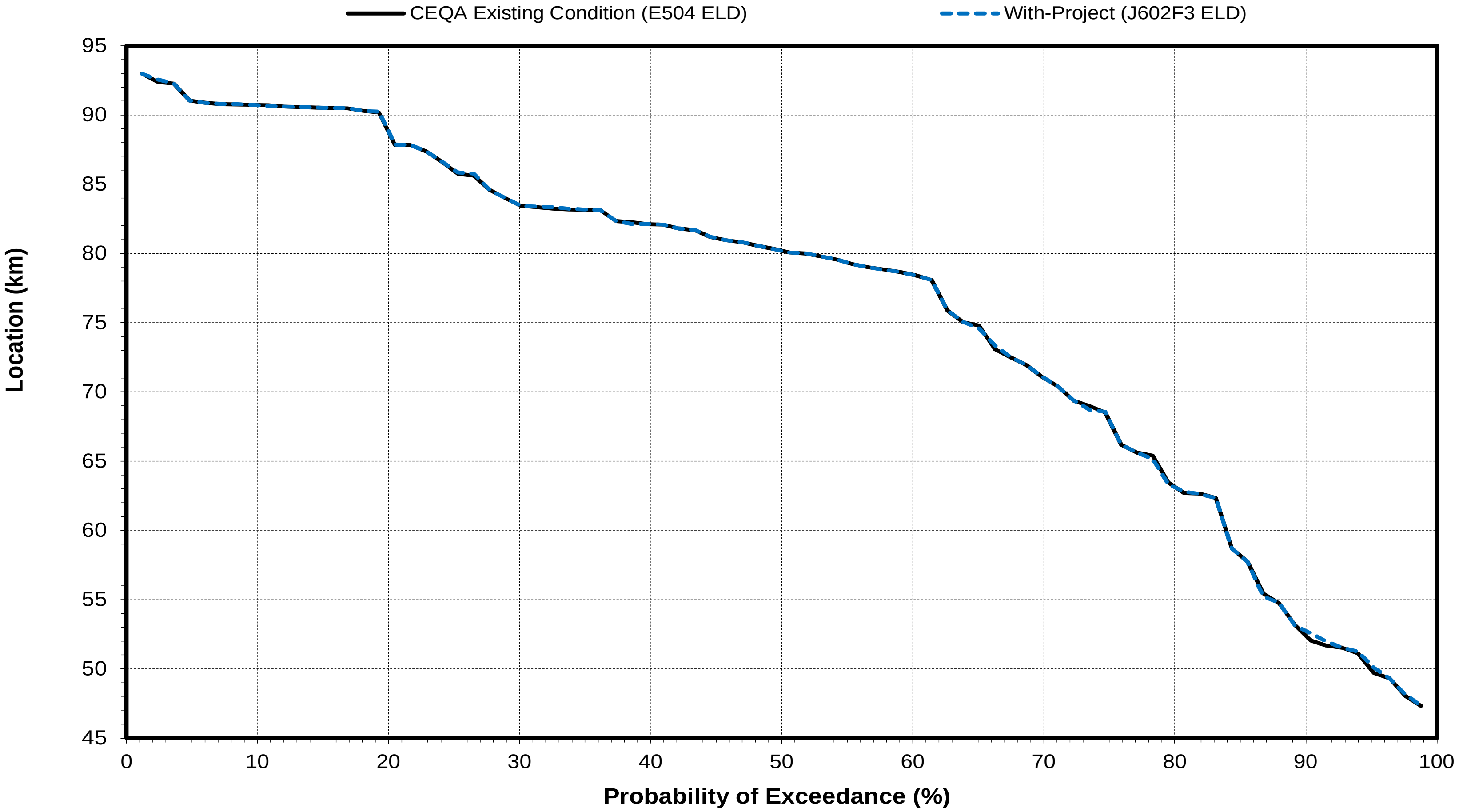


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

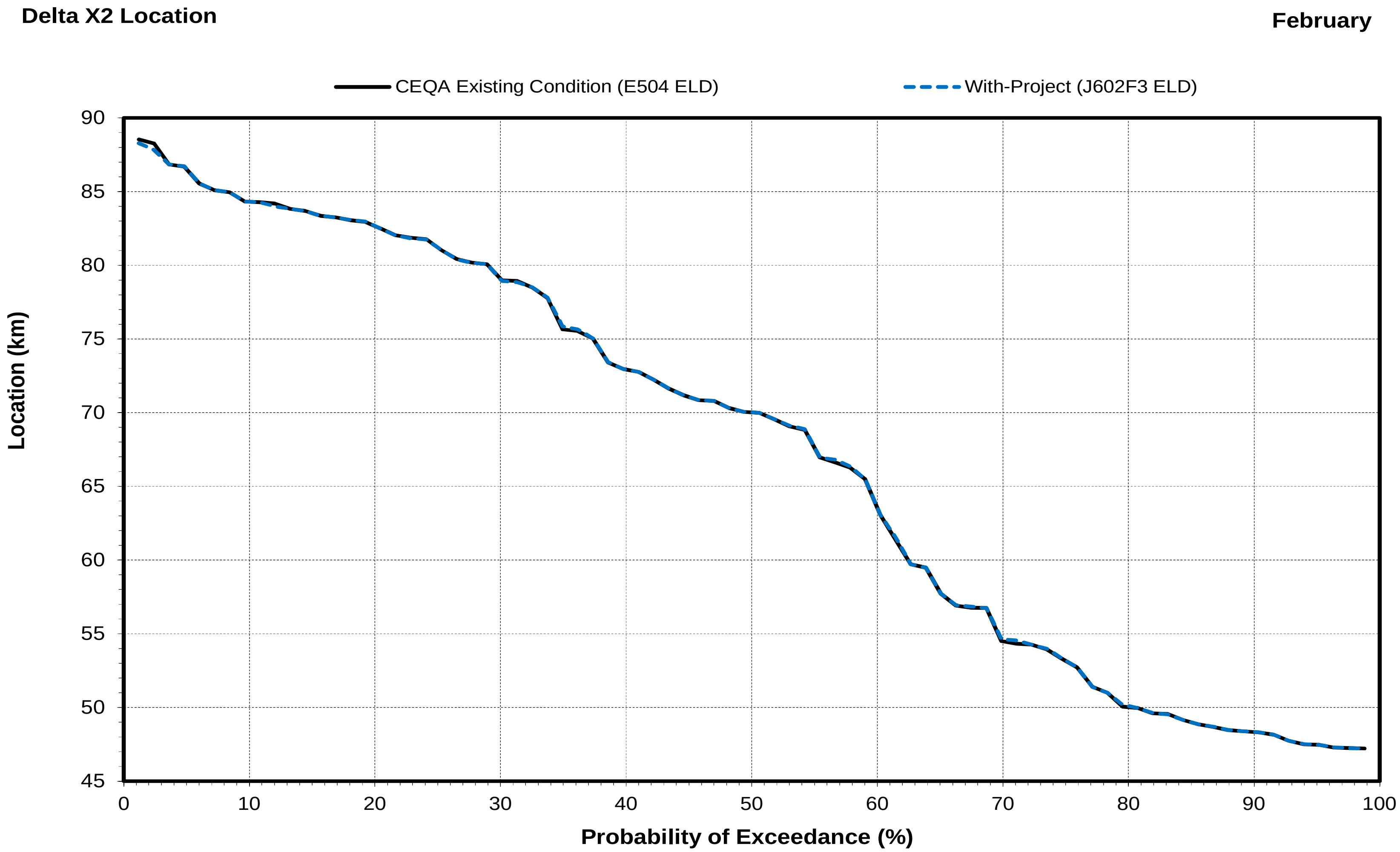
Delta X2 Location

January



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

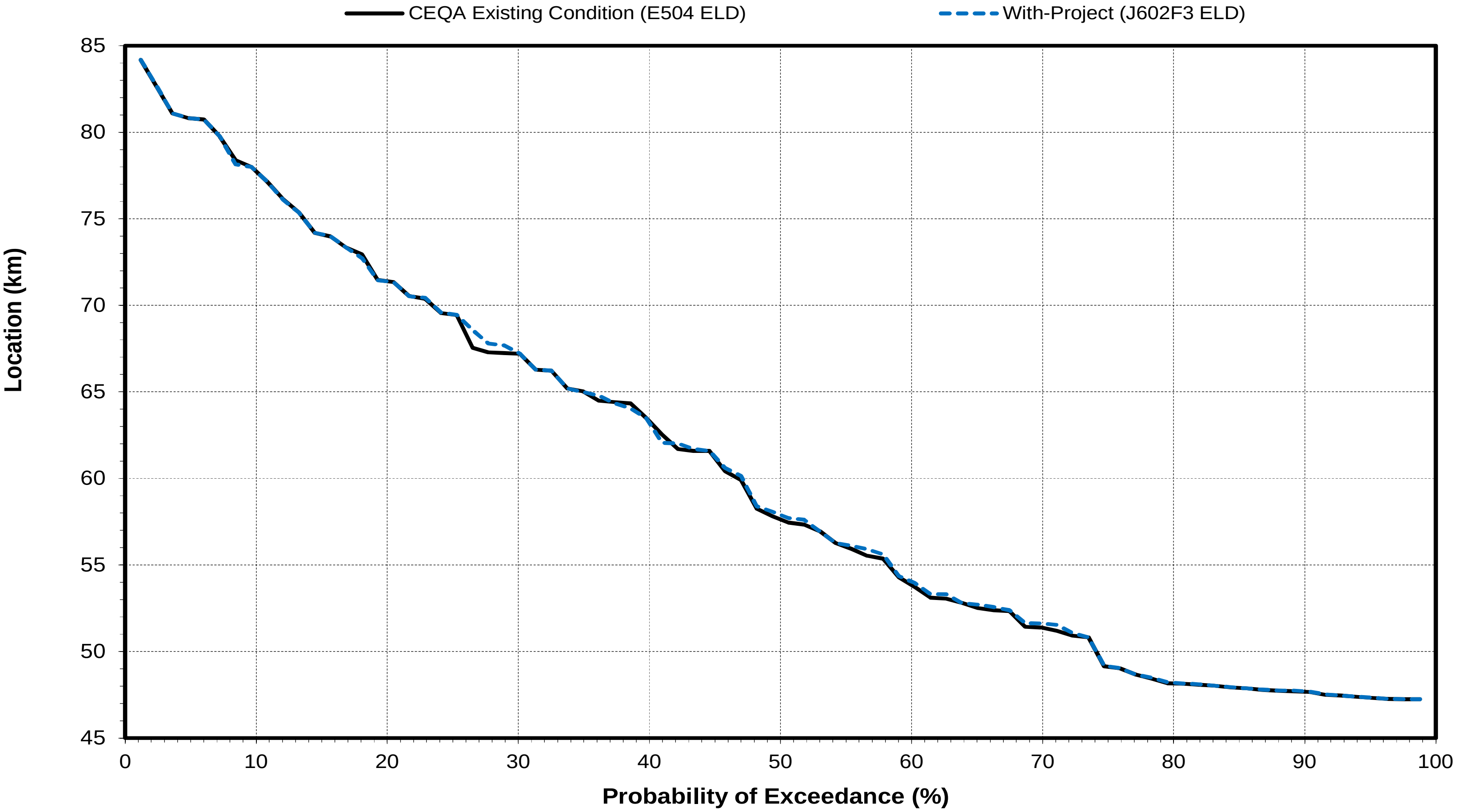
Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Delta X2 Location

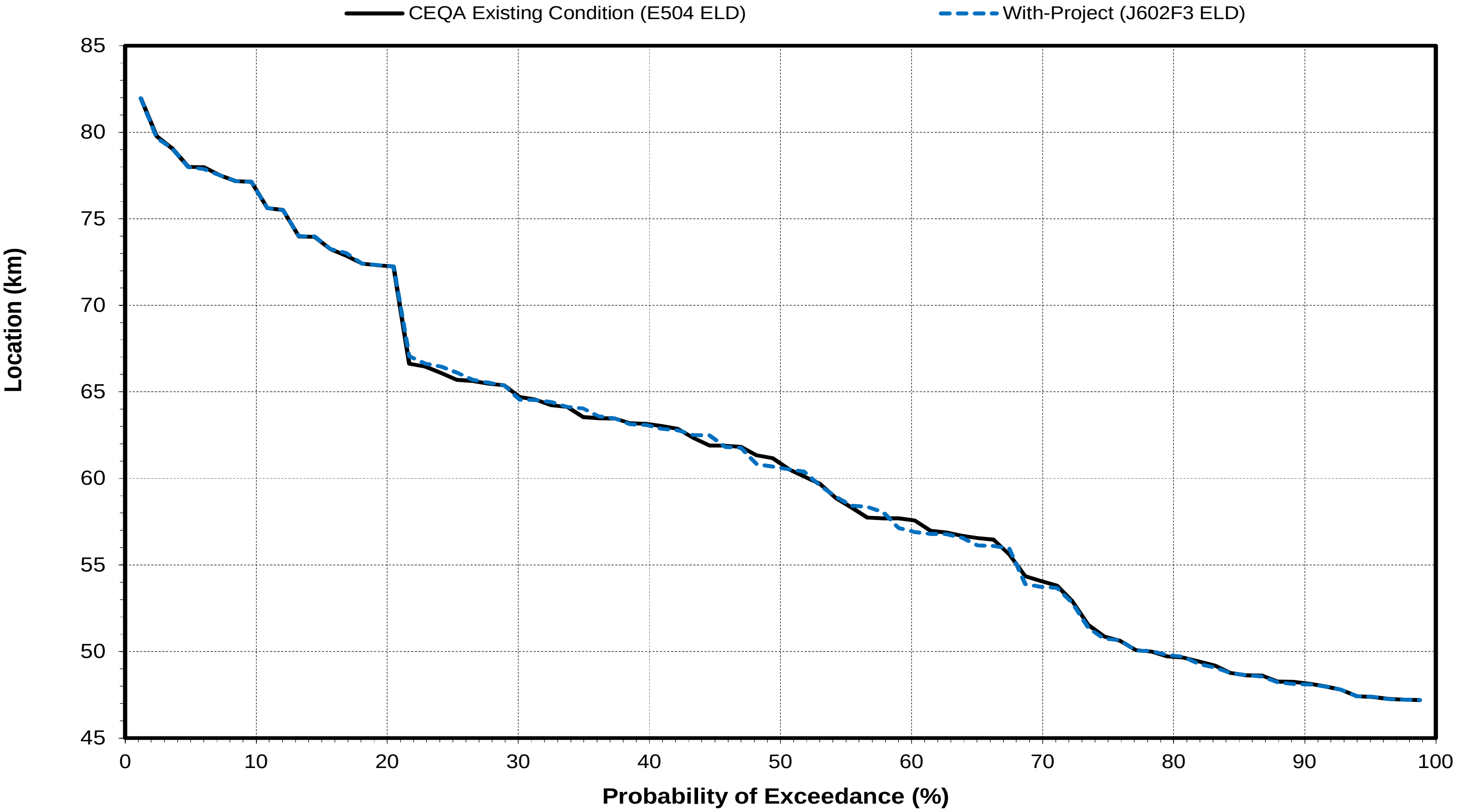
March



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Delta X2 Location

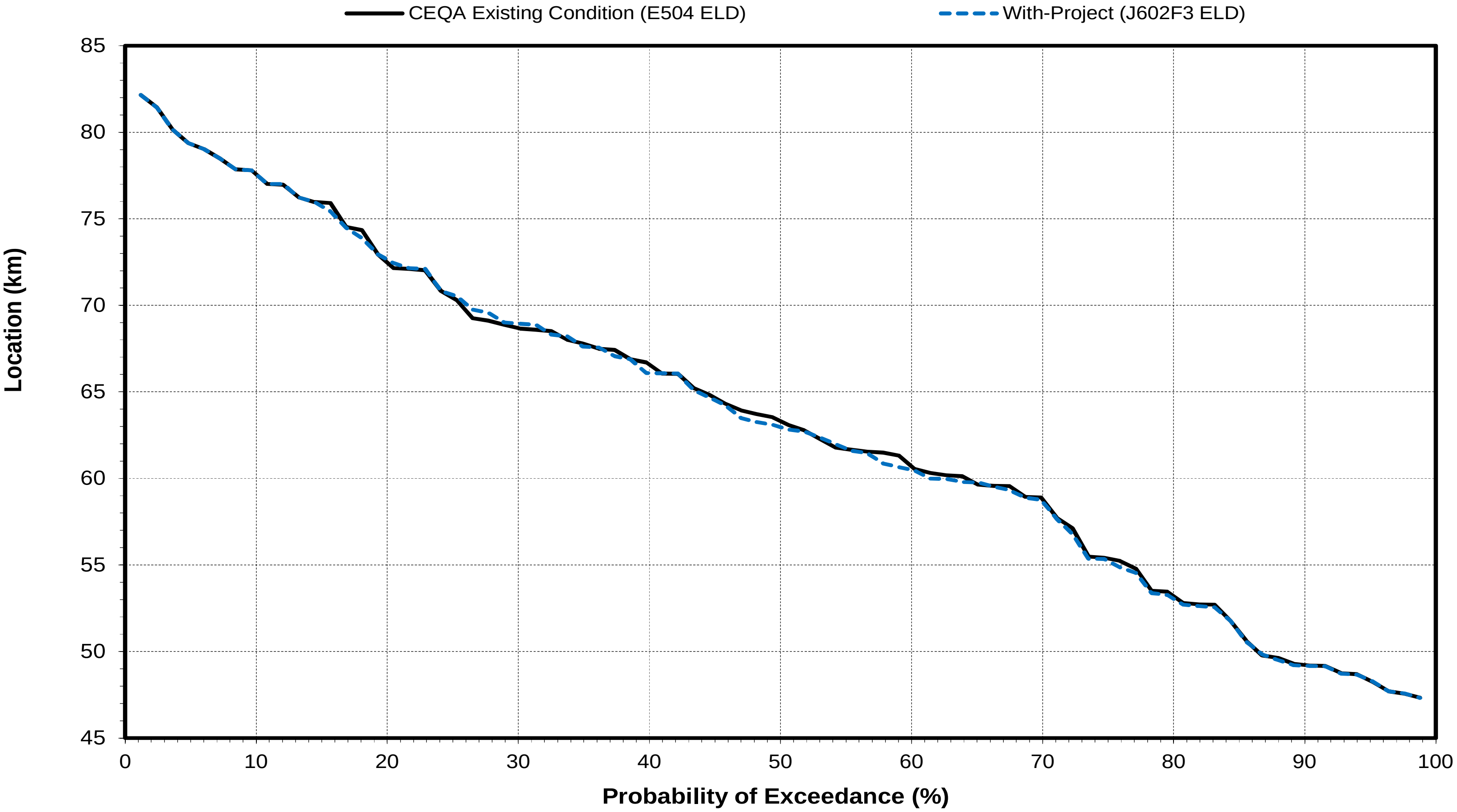
April



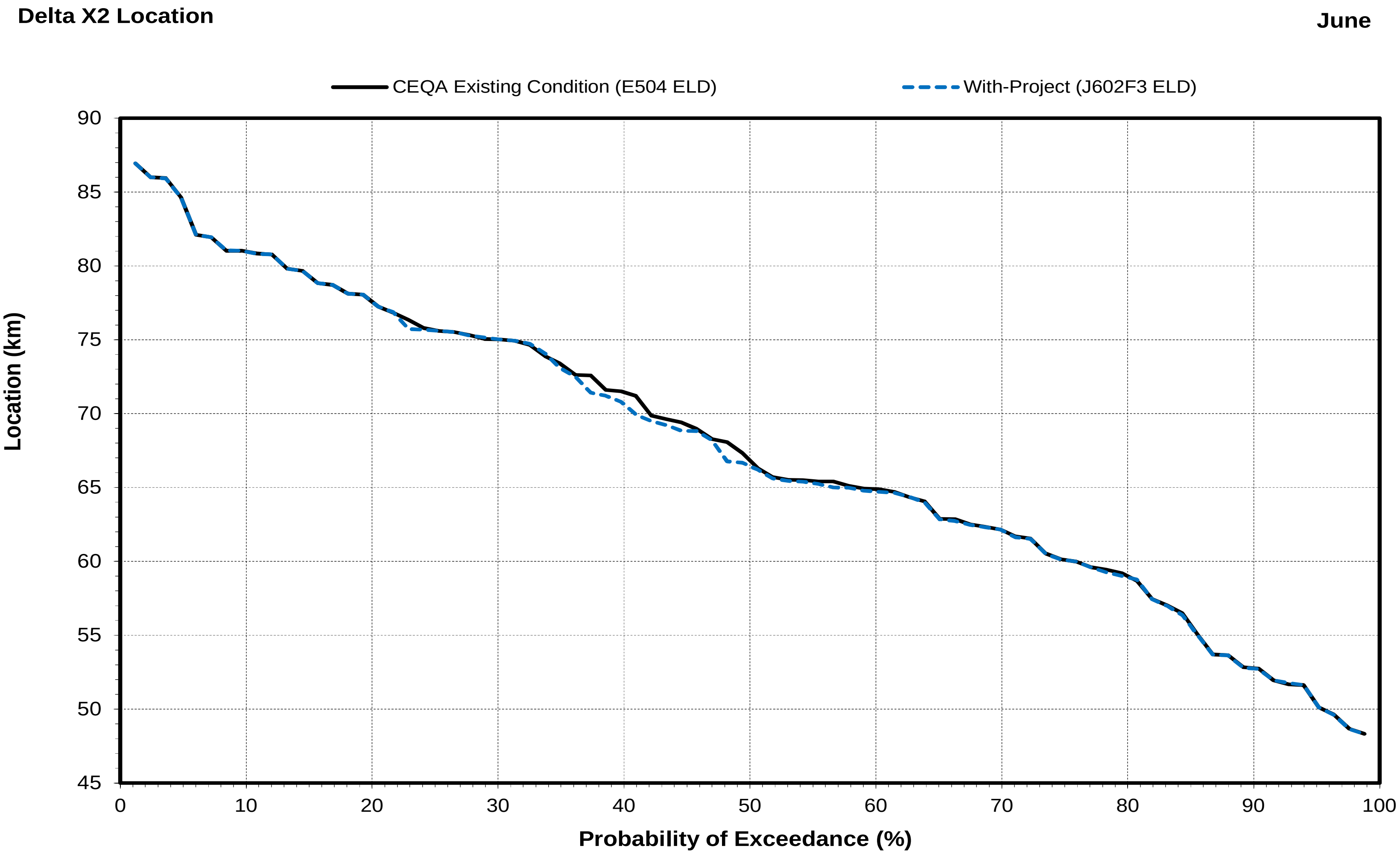
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Delta X2 Location

May



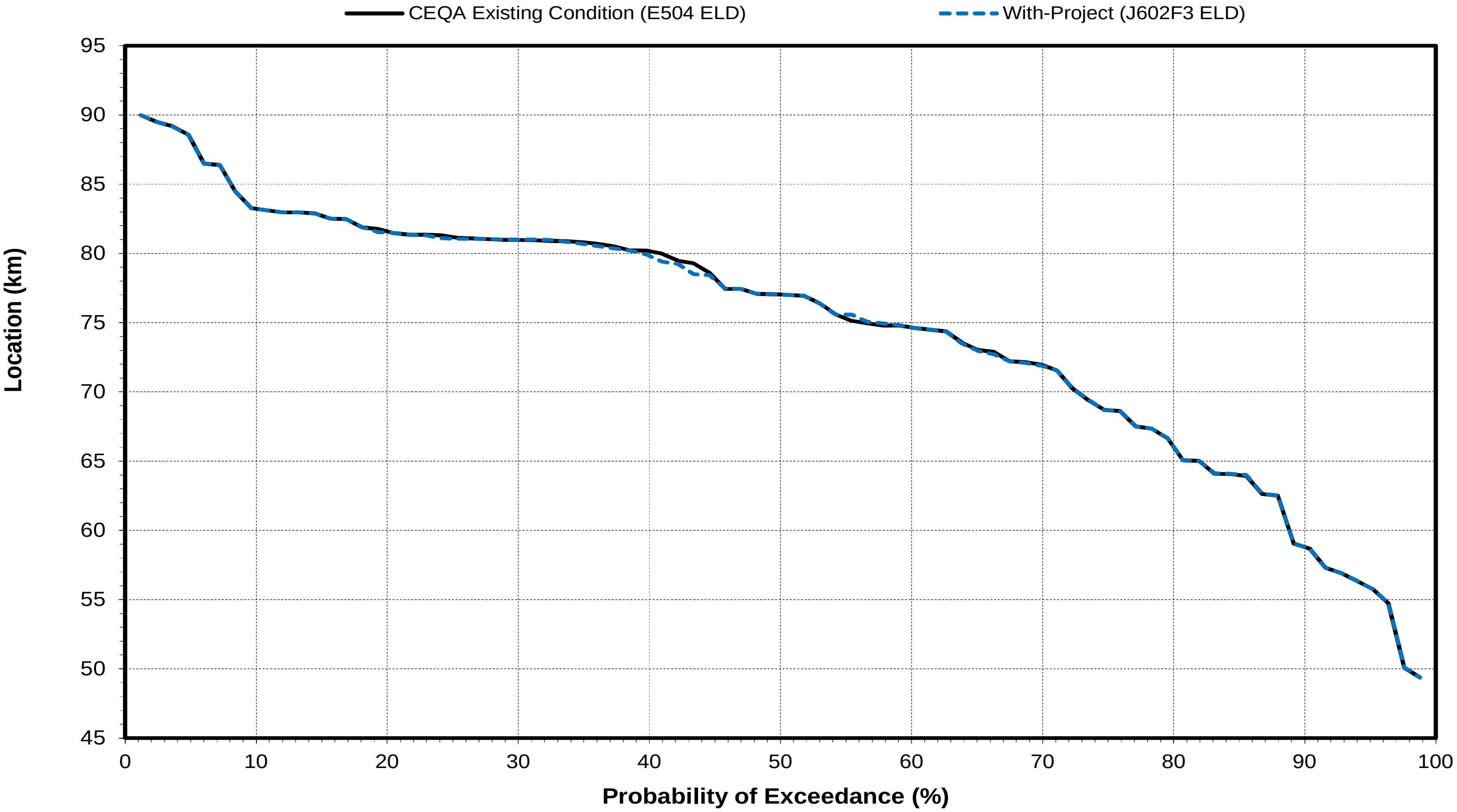
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Delta X2 Location

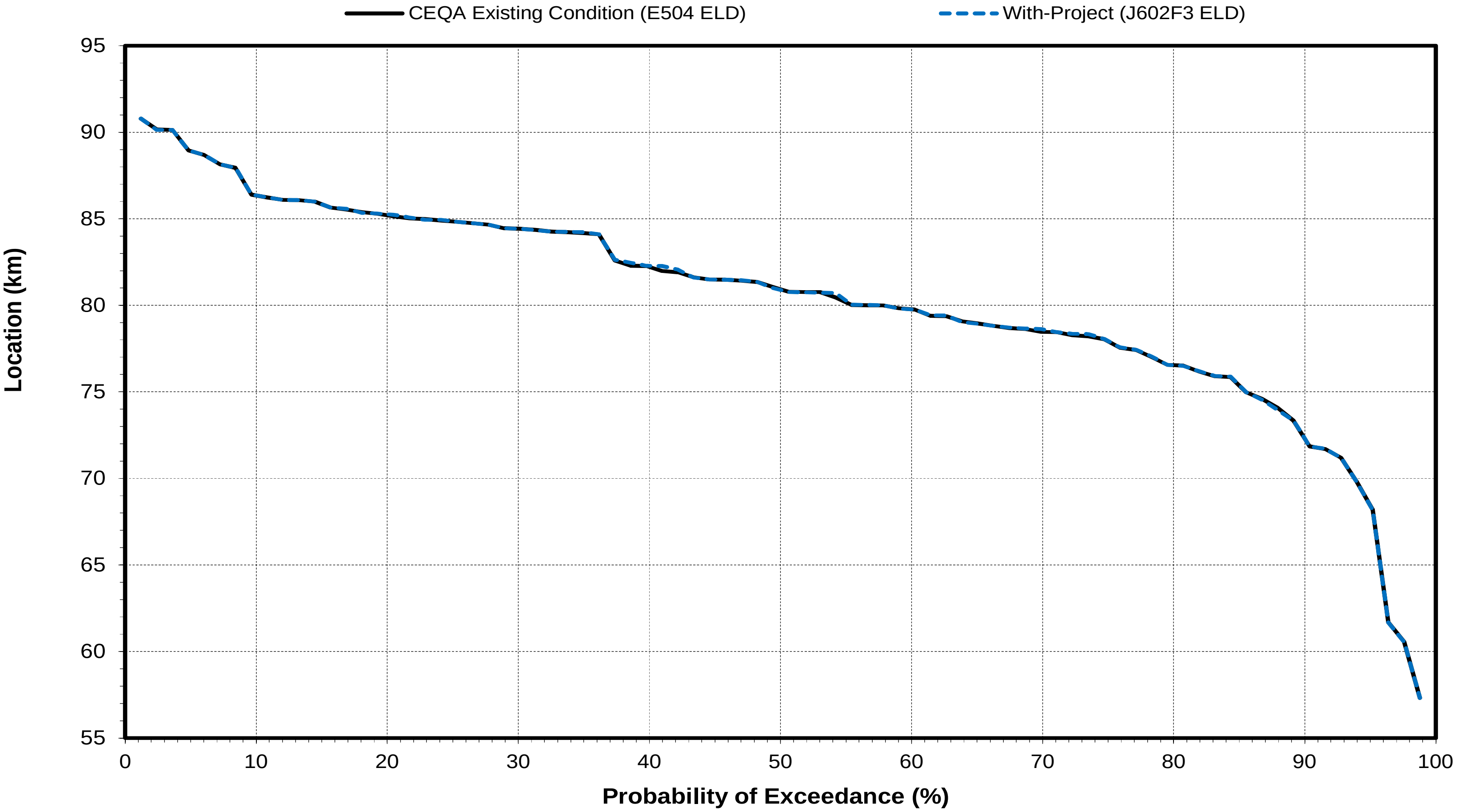
July



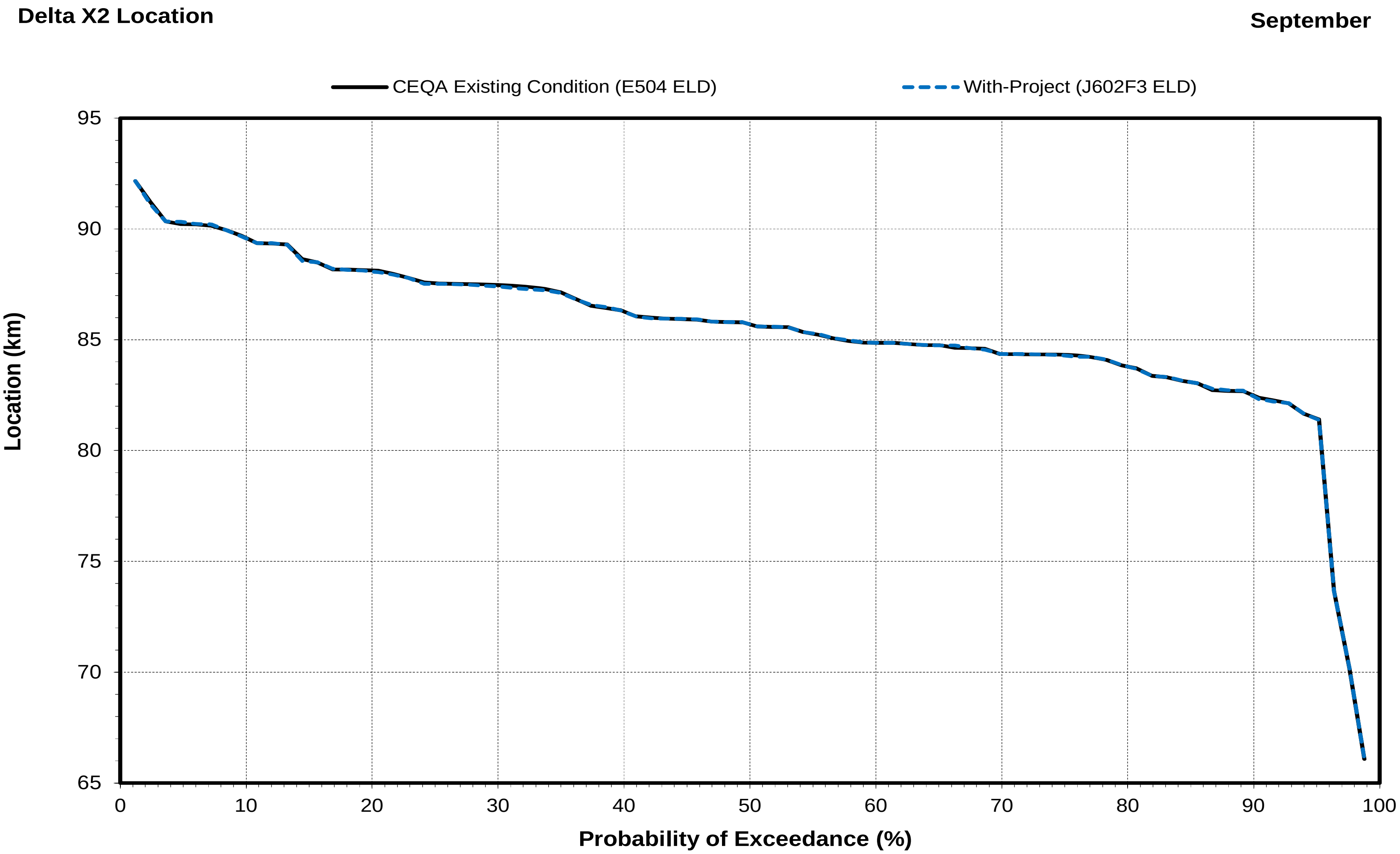
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Delta X2 Location

August



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Flow in Old and Middle River (OMR) - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	-2035	-2034	1	0.0
2.4	-2134	-2133	1	0.0
3.6	-2403	-2407	-4	-0.2
4.8	-2980	-2983	-3	-0.1
6.0	-3379	-3473	-94	-2.8
7.2	-3473	-3543	-70	-2.0
8.4	-3836	-3836	0	0.0
9.6	-3962	-3962	0	0.0
10.8	-3987	-3987	0	0.0
12.0	-4070	-4035	35	0.9
13.3	-4125	-4070	55	1.3
14.5	-4198	-4194	4	0.1
15.7	-4400	-4333	67	1.5
16.9	-4422	-4401	21	0.5
18.1	-4462	-4462	0	0.0
19.3	-4495	-4495	0	0.0
20.5	-4568	-4568	0	0.0
21.7	-4624	-4625	-1	0.0
22.9	-4745	-4643	102	2.1
24.1	-4761	-4746	15	0.3
25.3	-4781	-4763	18	0.4
26.5	-4790	-4781	9	0.2
27.7	-4831	-4788	43	0.9
28.9	-4876	-4831	45	0.9
30.1	-4946	-4931	15	0.3
31.3	-5102	-4950	152	3.0
32.5	-5254	-5039	215	4.1
33.7	-5369	-5259	110	2.0
34.9	-5711	-5712	-1	0.0
36.1	-5751	-5830	-79	-1.4
37.3	-5871	-5872	-1	0.0
38.6	-5934	-5934	0	0.0
39.8	-6161	-6059	102	1.7
41.0	-6225	-6161	64	1.0
42.2	-6232	-6225	7	0.1
43.4	-6319	-6315	4	0.1
44.6	-6394	-6406	-12	-0.2
45.8	-6409	-6444	-35	-0.5
47.0	-6540	-6540	0	0.0
48.2	-6624	-6625	-1	0.0
49.4	-6676	-6676	0	0.0
50.6	-6677	-6677	0	0.0
51.8	-6765	-6836	-71	-1.0
53.0	-6835	-7006	-171	-2.5
54.2	-6989	-7063	-74	-1.1
55.4	-7006	-7099	-93	-1.3
56.6	-7043	-7118	-75	-1.1
57.8	-7063	-7147	-84	-1.2
59.0	-7101	-7210	-109	-1.5
60.2	-7156	-7226	-70	-1.0
61.4	-7210	-7253	-43	-0.6
62.7	-7221	-7270	-49	-0.7
63.9	-7278	-7294	-16	-0.2
65.1	-7294	-7303	-9	-0.1
66.3	-7301	-7343	-42	-0.6
67.5	-7338	-7375	-37	-0.5
68.7	-7395	-7401	-6	-0.1
69.9	-7401	-7441	-40	-0.5
71.1	-7440	-7615	-175	-2.4
72.3	-7635	-7632	3	0.0
73.5	-7646	-7635	11	0.1
74.7	-7688	-7645	43	0.6
75.9	-7721	-7721	0	0.0
77.1	-7746	-7746	0	0.0
78.3	-7817	-7817	0	0.0
79.5	-8071	-8070	1	0.0
80.7	-8116	-8153	-37	-0.5
81.9	-8659	-8666	-7	-0.1
83.1	-8698	-8698	0	0.0
84.3	-8726	-8726	0	0.0
85.5	-8734	-8807	-73	-0.8
86.7	-8851	-8851	0	0.0
88.0	-8995	-8995	0	0.0
89.2	-9063	-9063	0	0.0
90.4	-9326	-9326	0	0.0
91.6	-9493	-9539	-46	-0.5
92.8	-9592	-9591	1	0.0
94.0	-9773	-9801	-28	-0.3
95.2	-9841	-9841	0	0.0
96.4	-9883	-9863	20	0.2
97.6	-10314	-10314	0	0.0
98.8	-10416	-10416	0	0.0
Min	-10416	-10416	-175	-2.8
Max	-2035	-2034	215	4.1
Mean	-6453	-6459	-6	0.0
Median	-6677	-6677	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	79.3
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		12.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	-2467	-2467	0	0.0
2.4	-3042	-3061	-19	-0.6
3.6	-3061	-3118	-57	-1.9
4.8	-3341	-3327	14	0.4
6.0	-3444	-3341	103	3.0
7.2	-3510	-3444	66	1.9
8.4	-3540	-3540	0	0.0
9.6	-3780	-3780	0	0.0
10.8	-3805	-3804	1	0.0
12.0	-3811	-3811	0	0.0
13.3	-3861	-3849	12	0.3
14.5	-4093	-4142	-49	-1.2
15.7	-4142	-4184	-42	-1.0
16.9	-4184	-4283	-99	-2.4
18.1	-4282	-4341	-59	-1.4
19.3	-4348	-4435	-87	-2.0
20.5	-4714	-4905	-191	-4.1
21.7	-4743	-4925	-182	-3.8
22.9	-4871	-5088	-217	-4.5
24.1	-5144	-5287	-143	-2.8
25.3	-5288	-5382	-94	-1.8
26.5	-5364	-5520	-156	-2.9
27.7	-5520	-5580	-60	-1.1
28.9	-5580	-5595	-15	-0.3
30.1	-5580	-5619	-39	-0.7
31.3	-5648	-5648	0	0.0
32.5	-5651	-5652	-1	0.0
33.7	-5735	-5736	-1	0.0
34.9	-5849	-5849	0	0.0
36.1	-5924	-5924	0	0.0
37.3	-5956	-5947	9	0.2
38.6	-5995	-5994	1	0.0
39.8	-6091	-6017	74	1.2
41.0	-6108	-6108	0	0.0
42.2	-6186	-6186	0	0.0
43.4	-6256	-6313	-57	-0.9
44.6	-6315	-6345	-30	-0.5
45.8	-6372	-6370	2	0.0
47.0	-6385	-6376	9	0.1
48.2	-6396	-6406	-10	-0.2
49.4	-6640	-6452	188	2.8
50.6	-6704	-6639	65	1.0
51.8	-6710	-6690	20	0.3
53.0	-6739	-6738	1	0.0
54.2	-6806	-6774	32	0.5
55.4	-6808	-6806	2	0.0
56.6	-6904	-6808	96	1.4
57.8	-6969	-6903	66	0.9
59.0	-6991	-6991	0	0.0
60.2	-7041	-7005	36	0.5
61.4	-7171	-7041	130	1.8
62.7	-7179	-7172	7	0.1
63.9	-7193	-7179	14	0.2
65.1	-7228	-7217	11	0.2
66.3	-7265	-7414	-149	-2.1
67.5	-7432	-7463	-31	-0.4
68.7	-7497	-7503	-6	-0.1
69.9	-7582	-7570	12	0.2
71.1	-7747	-7740	7	0.1
72.3	-7748	-7762	-14	-0.2
73.5	-7936	-7936	0	0.0
74.7	-8229	-8229	0	0.0
75.9	-8313	-8315	-2	0.0
77.1	-8707	-8508	199	2.3
78.3	-8875	-8877	-2	0.0
79.5	-9012	-9012	0	0.0
80.7	-9275	-9275	0	0.0
81.9	-9381	-9411	-30	-0.3
83.1	-9460	-9454	6	0.1
84.3	-9933	-9922	11	0.1
85.5	-9963	-9933	30	0.3
86.7	-10006	-10006	0	0.0
88.0	-10024	-10024	0	0.0
89.2	-10035	-10035	0	0.0
90.4	-10130	-10130	0	0.0
91.6	-10152	-10152	0	0.0
92.8	-10171	-10171	0	0.0
94.0	-10181	-10181	0	0.0
95.2	-10189	-10189	0	0.0
96.4	-10223	-10223	0	0.0
97.6	-10266	-10266	0	0.0
98.8	-10491	-10491	0	0.0
Min	-10491	-10491	-217	-4.5
Max	-2467	-2467	199	3.0
Mean	-6704	-6711	-8	-0.2
Median	-6672	-6546	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	75.6
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	4686	4686	0	0.0
2.4	-453	-453	0	0.0
3.6	-744	-744	0	0.0
4.8	-2274	-2560	-286	-12.6
6.0	-3041	-3032	9	0.3
7.2	-3345	-3505	-160	-4.8
8.4	-3407	-3616	-209	-6.1
9.6	-4126	-4126	0	0.0
10.8	-4614	-4580	34	0.7
12.0	-4648	-4648	0	0.0
13.3	-4680	-4666	14	0.3
14.5	-4701	-4742	-41	-0.9
15.7	-4796	-4795	1	0.0
16.9	-4802	-4802	0	0.0
18.1	-5009	-5008	1	0.0
19.3	-5036	-5036	0	0.0
20.5	-5107	-5109	-2	0.0
21.7	-5139	-5136	3	0.1
22.9	-5288	-5183	105	2.0
24.1	-5299	-5287	12	0.2
25.3	-5359	-5359	0	0.0
26.5	-5379	-5379	0	0.0
27.7	-5574	-5574	0	0.0
28.9	-5762	-5764	-2	0.0
30.1	-5846	-5848	-2	0.0
31.3	-5871	-5871	0	0.0
32.5	-5871	-5871	0	0.0
33.7	-5871	-5871	0	0.0
34.9	-5871	-5871	0	0.0
36.1	-5871	-5871	0	0.0
37.3	-5871	-5871	0	0.0
38.6	-5871	-5871	0	0.0
39.8	-5871	-5871	0	0.0
41.0	-5871	-5871	0	0.0
42.2	-5871	-5871	0	0.0
43.4	-5871	-5871	0	0.0
44.6	-5871	-5871	0	0.0
45.8	-5871	-5871	0	0.0
47.0	-5871	-5871	0	0.0
48.2	-5871	-5871	0	0.0
49.4	-5871	-5871	0	0.0
50.6	-5871	-5871	0	0.0
51.8	-5871	-5871	0	0.0
53.0	-5871	-5871	0	0.0
54.2	-5871	-5871	0	0.0
55.4	-5871	-5871	0	0.0
56.6	-5871	-5871	0	0.0
57.8	-5913	-5913	0	0.0
59.0	-6164	-6172	-8	-0.1
60.2	-6363	-6370	-7	-0.1
61.4	-6786	-6728	58	0.9
62.7	-6832	-6835	-3	0.0
63.9	-6869	-6869	0	0.0
65.1	-7129	-7129	0	0.0
66.3	-7664	-7723	-59	-0.8
67.5	-8107	-8108	-1	0.0
68.7	-8168	-8165	3	0.0
69.9	-8817	-8791	26	0.3
71.1	-8903	-8903	0	0.0
72.3	-9101	-9101	0	0.0
73.5	-9296	-9305	-9	-0.1
74.7	-9491	-9491	0	0.0
75.9	-9495	-9495	0	0.0
77.1	-9509	-9509	0	0.0
78.3	-9548	-9548	0	0.0
79.5	-9562	-9562	0	0.0
80.7	-9600	-9600	0	0.0
81.9	-9611	-9613	-2	0.0
83.1	-9653	-9653	0	0.0
84.3	-9693	-9693	0	0.0
85.5	-9711	-9711	0	0.0
86.7	-9714	-9714	0	0.0
88.0	-9715	-9715	0	0.0
89.2	-9717	-9717	0	0.0
90.4	-9737	-9737	0	0.0
91.6	-9741	-9741	0	0.0
92.8	-9754	-9754	0	0.0
94.0	-9830	-9830	0	0.0
95.2	-9862	-9862	0	0.0
96.4	-9888	-9888	0	0.0
97.6	-9935	-9953	-18	-0.2
98.8	-9953	-9967	-14	-0.1
Min	-9953	-9967	-286	-12.6
Max	4686	4686	105	2.0
Mean	-6570	-6577	-7	-0.3
Median	-5871	-5871	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	95.1
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		2.4
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	24818	24818	0	0.0
2.4	4517	4601	84	1.9
3.6	-467	-467	0	0.0
4.8	-505	-506	-1	-0.2
6.0	-544	-544	0	0.0
7.2	-2823	-2823	0	0.0
8.4	-2823	-2823	0	0.0
9.6	-2823	-2823	0	0.0
10.8	-2823	-2823	0	0.0
12.0	-2823	-2823	0	0.0
13.3	-2823	-2823	0	0.0
14.5	-2823	-2823	0	0.0
15.7	-2823	-2823	0	0.0
16.9	-2823	-2823	0	0.0
18.1	-2823	-2823	0	0.0
19.3	-2823	-2823	0	0.0
20.5	-2823	-2823	0	0.0
21.7	-2823	-2823	0	0.0
22.9	-2823	-2823	0	0.0
24.1	-3355	-2925	430	12.8
25.3	-3355	-3355	0	0.0
26.5	-3355	-3355	0	0.0
27.7	-3355	-3355	0	0.0
28.9	-3355	-3355	0	0.0
30.1	-3355	-3355	0	0.0
31.3	-3355	-3355	0	0.0
32.5	-3355	-3355	0	0.0
33.7	-3355	-3355	0	0.0
34.9	-3355	-3355	0	0.0
36.1	-3355	-3355	0	0.0
37.3	-3355	-3355	0	0.0
38.6	-3437	-3355	82	2.4
39.8	-3718	-3437	281	7.6
41.0	-3905	-3919	-14	-0.4
42.2	-4703	-4710	-7	-0.1
43.4	-4710	-4710	0	0.0
44.6	-4710	-4710	0	0.0
45.8	-4710	-4710	0	0.0
47.0	-4710	-4710	0	0.0
48.2	-4710	-4710	0	0.0
49.4	-4710	-4710	0	0.0
50.6	-4710	-4710	0	0.0
51.8	-4710	-4710	0	0.0
53.0	-4710	-4710	0	0.0
54.2	-4710	-4710	0	0.0
55.4	-4710	-4710	0	0.0
56.6	-4710	-4748	-38	-0.8
57.8	-5000	-5000	0	0.0
59.0	-5000	-5000	0	0.0
60.2	-5000	-5000	0	0.0
61.4	-5000	-5000	0	0.0
62.7	-5000	-5000	0	0.0
63.9	-5000	-5000	0	0.0
65.1	-5000	-5000	0	0.0
66.3	-5000	-5000	0	0.0
67.5	-5000	-5000	0	0.0
68.7	-5000	-5000	0	0.0
69.9	-5000	-5000	0	0.0
71.1	-5000	-5000	0	0.0
72.3	-5000	-5000	0	0.0
73.5	-5000	-5000	0	0.0
74.7	-5000	-5000	0	0.0
75.9	-5000	-5000	0	0.0
77.1	-5000	-5000	0	0.0
78.3	-5000	-5000	0	0.0
79.5	-5000	-5000	0	0.0
80.7	-5000	-5000	0	0.0
81.9	-5000	-5000	0	0.0
83.1	-5000	-5000	0	0.0
84.3	-5000	-5000	0	0.0
85.5	-5000	-5000	0	0.0
86.7	-5000	-5000	0	0.0
88.0	-5000	-5000	0	0.0
89.2	-5000	-5000	0	0.0
90.4	-5000	-5000	0	0.0
91.6	-5000	-5000	0	0.0
92.8	-5000	-5000	0	0.0
94.0	-5000	-5000	0	0.0
95.2	-5000	-5000	0	0.0
96.4	-5000	-5000	0	0.0
97.6	-5000	-5000	0	0.0
98.8	-5000	-5000	0	0.0
Min	-5000	-5000	-38	-0.8
Max	24818	24818	430	12.8
Mean	-3649	-3639	10	0.3
Median	-4710	-4710	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	95.1
1.1<=X<10.0		3.7
X>=5.0		2.4
X>=10.0		1.2
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	14508	14508	0	0.0
2.4	4888	4972	84	1.7
3.6	3962	3853	-109	-2.8
4.8	3085	3079	-6	-0.2
6.0	2026	2027	1	0.0
7.2	493	493	0	0.0
8.4	-223	-223	0	0.0
9.6	-950	-982	-32	-3.4
10.8	-1375	-1375	0	0.0
12.0	-1531	-1531	0	0.0
13.3	-1788	-1819	-31	-1.7
14.5	-1874	-1873	1	0.1
15.7	-2027	-2027	0	0.0
16.9	-2054	-2054	0	0.0
18.1	-2109	-2122	-13	-0.6
19.3	-2233	-2233	0	0.0
20.5	-2268	-2268	0	0.0
21.7	-2750	-2750	0	0.0
22.9	-2750	-2750	0	0.0
24.1	-2750	-2750	0	0.0
25.3	-2750	-2750	0	0.0
26.5	-2750	-2750	0	0.0
27.7	-2750	-2750	0	0.0
28.9	-2776	-2776	0	0.0
30.1	-2776	-2776	0	0.0
31.3	-2931	-2931	0	0.0
32.5	-2983	-2983	0	0.0
33.7	-3289	-3289	0	0.0
34.9	-3358	-3352	6	0.2
36.1	-3500	-3500	0	0.0
37.3	-3500	-3500	0	0.0
38.6	-3500	-3500	0	0.0
39.8	-3500	-3500	0	0.0
41.0	-3500	-3500	0	0.0
42.2	-3500	-3500	0	0.0
43.4	-3500	-3500	0	0.0
44.6	-3527	-3527	0	0.0
45.8	-3535	-4145	-610	-17.3
47.0	-4196	-4196	0	0.0
48.2	-4196	-4196	0	0.0
49.4	-4612	-4334	278	6.0
50.6	-4629	-4612	17	0.4
51.8	-4835	-4836	-1	0.0
53.0	-5000	-5000	0	0.0
54.2	-5000	-5000	0	0.0
55.4	-5000	-5000	0	0.0
56.6	-5000	-5000	0	0.0
57.8	-5000	-5000	0	0.0
59.0	-5000	-5000	0	0.0
60.2	-5000	-5000	0	0.0
61.4	-5000	-5000	0	0.0
62.7	-5000	-5000	0	0.0
63.9	-5000	-5000	0	0.0
65.1	-5000	-5000	0	0.0
66.3	-5000	-5000	0	0.0
67.5	-5000	-5000	0	0.0
68.7	-5000	-5000	0	0.0
69.9	-5000	-5000	0	0.0
71.1	-5000	-5000	0	0.0
72.3	-5000	-5000	0	0.0
73.5	-5000	-5000	0	0.0
74.7	-5000	-5000	0	0.0
75.9	-5000	-5000	0	0.0
77.1	-5000	-5000	0	0.0
78.3	-5000	-5000	0	0.0
79.5	-5000	-5000	0	0.0
80.7	-5000	-5000	0	0.0
81.9	-5000	-5000	0	0.0
83.1	-5000	-5000	0	0.0
84.3	-5000	-5000	0	0.0
85.5	-5000	-5000	0	0.0
86.7	-5000	-5000	0	0.0
88.0	-5000	-5000	0	0.0
89.2	-5000	-5000	0	0.0
90.4	-5000	-5000	0	0.0
91.6	-5000	-5000	0	0.0
92.8	-5000	-5000	0	0.0
94.0	-5000	-5000	0	0.0
95.2	-5000	-5000	0	0.0
96.4	-5000	-5000	0	0.0
97.6	-5000	-5000	0	0.0
98.8	-5000	-5000	0	0.0
Min	-5000	-5000	-610	-17.3
Max	14508	14508	278	6.0
Mean	-3331	-3336	-5	-0.2
Median	-4621	-4473	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	92.7
1.1<=X<10.0		2.4
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		1.2
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	25389	25389	0	0.0
2.4	9648	9648	0	0.0
3.6	6348	6348	0	0.0
4.8	3302	3299	-3	-0.1
6.0	3184	3063	-121	-3.8
7.2	-109	-109	0	0.0
8.4	-650	-650	0	0.0
9.6	-792	-815	-23	-2.9
10.8	-1095	-1124	-29	-2.6
12.0	-1150	-1150	0	0.0
13.3	-1150	-1150	0	0.0
14.5	-1238	-1238	0	0.0
15.7	-1269	-1269	0	0.0
16.9	-1328	-1328	0	0.0
18.1	-1506	-1506	0	0.0
19.3	-1566	-1566	0	0.0
20.5	-1600	-1597	3	0.2
21.7	-1739	-1739	0	0.0
22.9	-1993	-1917	76	3.8
24.1	-2024	-2024	0	0.0
25.3	-2823	-2823	0	0.0
26.5	-2823	-2823	0	0.0
27.7	-2823	-2823	0	0.0
28.9	-3113	-3113	0	0.0
30.1	-3177	-3177	0	0.0
31.3	-3306	-3306	0	0.0
32.5	-3386	-3386	0	0.0
33.7	-3397	-3395	2	0.1
34.9	-3500	-3500	0	0.0
36.1	-3500	-3500	0	0.0
37.3	-3500	-3500	0	0.0
38.6	-3500	-3500	0	0.0
39.8	-3500	-3500	0	0.0
41.0	-3500	-3500	0	0.0
42.2	-3500	-3500	0	0.0
43.4	-3500	-3500	0	0.0
44.6	-3500	-3500	0	0.0
45.8	-3500	-3500	0	0.0
47.0	-3511	-3511	0	0.0
48.2	-3604	-3604	0	0.0
49.4	-3645	-3645	0	0.0
50.6	-3769	-3770	-1	0.0
51.8	-3858	-3858	0	0.0
53.0	-3879	-3879	0	0.0
54.2	-4032	-4032	0	0.0
55.4	-4177	-4177	0	0.0
56.6	-4226	-4226	0	0.0
57.8	-4284	-4284	0	0.0
59.0	-4299	-4371	-72	-1.7
60.2	-4516	-4516	0	0.0
61.4	-4565	-4568	-3	-0.1
62.7	-4747	-4752	-5	-0.1
63.9	-4813	-4813	0	0.0
65.1	-4974	-4974	0	0.0
66.3	-5000	-5000	0	0.0
67.5	-5000	-5000	0	0.0
68.7	-5000	-5000	0	0.0
69.9	-5000	-5000	0	0.0
71.1	-5000	-5000	0	0.0
72.3	-5000	-5000	0	0.0
73.5	-5000	-5000	0	0.0
74.7	-5000	-5000	0	0.0
75.9	-5000	-5000	0	0.0
77.1	-5000	-5000	0	0.0
78.3	-5000	-5000	0	0.0
79.5	-5000	-5000	0	0.0
80.7	-5000	-5000	0	0.0
81.9	-5000	-5000	0	0.0
83.1	-5000	-5000	0	0.0
84.3	-5000	-5000	0	0.0
85.5	-5000	-5000	0	0.0
86.7	-5000	-5000	0	0.0
88.0	-5000	-5000	0	0.0
89.2	-5000	-5000	0	0.0
90.4	-5000	-5000	0	0.0
91.6	-5000	-5000	0	0.0
92.8	-5000	-5000	0	0.0
94.0	-5000	-5000	0	0.0
95.2	-5000	-5000	0	0.0
96.4	-5000	-5000	0	0.0
97.6	-5000	-5000	0	0.0
98.8	-5000	-5000	0	0.0
Min	-5000	-5000	-121	-3.8
Max	25389	25389	76	3.8
Mean	-2903	-2906	-2	-0.1
Median	-3707	-3708	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	7742	7742	0	0.0
2.4	6872	6865	-7	-0.1
3.6	5989	5989	0	0.0
4.8	5890	5890	0	0.0
6.0	5044	5044	0	0.0
7.2	4473	4473	0	0.0
8.4	3398	3398	0	0.0
9.6	2934	2934	0	0.0
10.8	2793	2793	0	0.0
12.0	2753	2753	0	0.0
13.3	2495	2494	-1	0.0
14.5	2465	2465	0	0.0
15.7	2083	2083	0	0.0
16.9	2033	2033	0	0.0
18.1	1914	1914	0	0.0
19.3	1827	1828	1	0.1
20.5	1787	1787	0	0.0
21.7	1729	1729	0	0.0
22.9	1700	1700	0	0.0
24.1	1574	1574	0	0.0
25.3	1482	1482	0	0.0
26.5	1394	1394	0	0.0
27.7	1382	1382	0	0.0
28.9	1360	1360	0	0.0
30.1	1350	1351	1	0.1
31.3	1335	1335	0	0.0
32.5	1288	1288	0	0.0
33.7	1208	1208	0	0.0
34.9	1208	1208	0	0.0
36.1	1165	1165	0	0.0
37.3	1152	1152	0	0.0
38.6	1120	1120	0	0.0
39.8	1102	1102	0	0.0
41.0	1061	1061	0	0.0
42.2	1051	1051	0	0.0
43.4	845	845	0	0.0
44.6	785	785	0	0.0
45.8	587	587	0	0.0
47.0	586	587	1	0.2
48.2	490	490	0	0.0
49.4	481	481	0	0.0
50.6	480	480	0	0.0
51.8	442	442	0	0.0
53.0	412	412	0	0.0
54.2	401	401	0	0.0
55.4	238	238	0	0.0
56.6	167	167	0	0.0
57.8	159	159	0	0.0
59.0	152	152	0	0.0
60.2	143	143	0	0.0
61.4	61	61	0	0.0
62.7	-47	-47	0	0.0
63.9	-130	-130	0	0.0
65.1	-155	-155	0	0.0
66.3	-207	-207	0	0.0
67.5	-209	-209	0	0.0
68.7	-222	-222	0	0.0
69.9	-277	-277	0	0.0
71.1	-339	-339	0	0.0
72.3	-368	-368	0	0.0
73.5	-381	-385	-4	-1.0
74.7	-385	-385	0	0.0
75.9	-393	-393	0	0.0
77.1	-445	-445	0	0.0
78.3	-455	-455	0	0.0
79.5	-580	-580	0	0.0
80.7	-645	-645	0	0.0
81.9	-696	-696	0	0.0
83.1	-889	-889	0	0.0
84.3	-906	-906	0	0.0
85.5	-990	-990	0	0.0
86.7	-1150	-1150	0	0.0
88.0	-1150	-1150	0	0.0
89.2	-1150	-1150	0	0.0
90.4	-1150	-1150	0	0.0
91.6	-1150	-1150	0	0.0
92.8	-1204	-1204	0	0.0
94.0	-1207	-1207	0	0.0
95.2	-1230	-1230	0	0.0
96.4	-1239	-1238	1	0.1
97.6	-1275	-1275	0	0.0
98.8	-1520	-1520	0	0.0
Min	-1520	-1520	-7	-1.0
Max	7742	7742	1	0.2
Mean	859	859	0	0.0
Median	481	481	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	5534	5534	0	0.0
2.4	5254	5254	0	0.0
3.6	4125	4125	0	0.0
4.8	3955	3955	0	0.0
6.0	3778	3778	0	0.0
7.2	3115	3115	0	0.0
8.4	2999	2999	0	0.0
9.6	2687	2687	0	0.0
10.8	2519	2519	0	0.0
12.0	2250	2250	0	0.0
13.3	1929	1929	0	0.0
14.5	1843	1843	0	0.0
15.7	1548	1548	0	0.0
16.9	1453	1453	0	0.0
18.1	1239	1239	0	0.0
19.3	1173	1173	0	0.0
20.5	1133	1133	0	0.0
21.7	1100	1100	0	0.0
22.9	956	957	1	0.1
24.1	818	818	0	0.0
25.3	775	775	0	0.0
26.5	667	667	0	0.0
27.7	578	578	0	0.0
28.9	455	456	1	0.2
30.1	441	441	0	0.0
31.3	438	438	0	0.0
32.5	412	412	0	0.0
33.7	372	372	0	0.0
34.9	369	369	0	0.0
36.1	365	365	0	0.0
37.3	146	146	0	0.0
38.6	134	134	0	0.0
39.8	99	99	0	0.0
41.0	94	94	0	0.0
42.2	81	81	0	0.0
43.4	-10	-10	0	0.0
44.6	-22	-22	0	0.0
45.8	-28	-28	0	0.0
47.0	-42	-42	0	0.0
48.2	-115	-115	0	0.0
49.4	-277	-278	-1	-0.4
50.6	-282	-282	0	0.0
51.8	-300	-300	0	0.0
53.0	-315	-315	0	0.0
54.2	-316	-316	0	0.0
55.4	-340	-340	0	0.0
56.6	-372	-372	0	0.0
57.8	-430	-430	0	0.0
59.0	-444	-444	0	0.0
60.2	-481	-481	0	0.0
61.4	-501	-501	0	0.0
62.7	-549	-549	0	0.0
63.9	-569	-569	0	0.0
65.1	-606	-606	0	0.0
66.3	-615	-615	0	0.0
67.5	-629	-629	0	0.0
68.7	-640	-639	1	0.2
69.9	-646	-646	0	0.0
71.1	-657	-657	0	0.0
72.3	-690	-690	0	0.0
73.5	-692	-692	0	0.0
74.7	-700	-700	0	0.0
75.9	-702	-702	0	0.0
77.1	-758	-758	0	0.0
78.3	-761	-761	0	0.0
79.5	-764	-764	0	0.0
80.7	-768	-768	0	0.0
81.9	-902	-902	0	0.0
83.1	-982	-982	0	0.0
84.3	-1013	-1013	0	0.0
85.5	-1030	-1030	0	0.0
86.7	-1150	-1150	0	0.0
88.0	-1150	-1150	0	0.0
89.2	-1150	-1150	0	0.0
90.4	-1150	-1150	0	0.0
91.6	-1150	-1150	0	0.0
92.8	-1287	-1287	0	0.0
94.0	-1314	-1372	-58	-4.4
95.2	-1445	-1445	0	0.0
96.4	-1527	-1526	1	0.1
97.6	-1598	-1598	0	0.0
98.8	-1851	-1851	0	0.0
Min	-1851	-1851	-58	-4.4
Max	5534	5534	1	0.2
Mean	257	257	-1	-0.1
Median	-280	-280	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	350	350	0	0.0
2.4	-1150	-1150	0	0.0
3.6	-1150	-1150	0	0.0
4.8	-1150	-1150	0	0.0
6.0	-1150	-1150	0	0.0
7.2	-1150	-1150	0	0.0
8.4	-1150	-1150	0	0.0
9.6	-1150	-1150	0	0.0
10.8	-1150	-1150	0	0.0
12.0	-1150	-1150	0	0.0
13.3	-1150	-1150	0	0.0
14.5	-1150	-1150	0	0.0
15.7	-1150	-1150	0	0.0
16.9	-1150	-1150	0	0.0
18.1	-1150	-1150	0	0.0
19.3	-1150	-1254	-104	-9.0
20.5	-1254	-3304	-2050	-163.5
21.7	-3226	-3340	-114	-3.5
22.9	-3340	-3500	-160	-4.8
24.1	-3500	-3500	0	0.0
25.3	-3500	-3500	0	0.0
26.5	-3500	-3500	0	0.0
27.7	-3500	-3500	0	0.0
28.9	-3500	-3500	0	0.0
30.1	-3500	-3500	0	0.0
31.3	-3500	-3500	0	0.0
32.5	-3500	-3500	0	0.0
33.7	-3500	-3500	0	0.0
34.9	-3500	-3500	0	0.0
36.1	-3500	-3500	0	0.0
37.3	-3500	-3500	0	0.0
38.6	-3500	-3500	0	0.0
39.8	-3500	-3500	0	0.0
41.0	-3500	-3500	0	0.0
42.2	-3500	-3500	0	0.0
43.4	-3500	-3500	0	0.0
44.6	-3500	-3500	0	0.0
45.8	-3500	-3500	0	0.0
47.0	-3500	-3500	0	0.0
48.2	-3500	-3500	0	0.0
49.4	-3500	-3500	0	0.0
50.6	-4286	-4285	1	0.0
51.8	-4541	-4559	-18	-0.4
53.0	-4559	-4582	-23	-0.5
54.2	-4695	-4694	1	0.0
55.4	-4776	-4776	0	0.0
56.6	-4875	-4875	0	0.0
57.8	-4976	-4981	-5	-0.1
59.0	-4989	-4989	0	0.0
60.2	-5000	-5000	0	0.0
61.4	-5000	-5000	0	0.0
62.7	-5000	-5000	0	0.0
63.9	-5000	-5000	0	0.0
65.1	-5000	-5000	0	0.0
66.3	-5000	-5000	0	0.0
67.5	-5000	-5000	0	0.0
68.7	-5000	-5000	0	0.0
69.9	-5000	-5000	0	0.0
71.1	-5000	-5000	0	0.0
72.3	-5000	-5000	0	0.0
73.5	-5000	-5000	0	0.0
74.7	-5000	-5000	0	0.0
75.9	-5000	-5000	0	0.0
77.1	-5000	-5000	0	0.0
78.3	-5000	-5000	0	0.0
79.5	-5000	-5000	0	0.0
80.7	-5000	-5000	0	0.0
81.9	-5000	-5000	0	0.0
83.1	-5000	-5000	0	0.0
84.3	-5000	-5000	0	0.0
85.5	-5000	-5000	0	0.0
86.7	-5000	-5000	0	0.0
88.0	-5000	-5000	0	0.0
89.2	-5000	-5000	0	0.0
90.4	-5000	-5000	0	0.0
91.6	-5000	-5000	0	0.0
92.8	-5000	-5000	0	0.0
94.0	-5000	-5000	0	0.0
95.2	-5000	-5000	0	0.0
96.4	-5000	-5000	0	0.0
97.6	-5000	-5000	0	0.0
98.8	-5000	-5000	0	0.0
Min	-5000	-5000	-2050	-163.5
Max	350	350	1	0.0
Mean	-3712	-3743	-30	-2.2
Median	-3893	-3893	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	95.1
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		2.4
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	-1394	-1394	0	0.0
2.4	-2056	-2060	-4	-0.2
3.6	-2166	-2167	-1	0.0
4.8	-2354	-2208	146	6.2
6.0	-2366	-2354	12	0.5
7.2	-2867	-2365	502	17.5
8.4	-3012	-2998	14	0.5
9.6	-3443	-3443	0	0.0
10.8	-3464	-3464	0	0.0
12.0	-5488	-5481	7	0.1
13.3	-5648	-5648	0	0.0
14.5	-5699	-5858	-159	-2.8
15.7	-6564	-6340	224	3.4
16.9	-6613	-6445	168	2.5
18.1	-6858	-6654	204	3.0
19.3	-7687	-6859	828	10.8
20.5	-7717	-7617	100	1.3
21.7	-7943	-7943	0	0.0
22.9	-8261	-8301	-40	-0.5
24.1	-8301	-8332	-31	-0.4
25.3	-8332	-8491	-159	-1.9
26.5	-8491	-8713	-222	-2.6
27.7	-8782	-8780	2	0.0
28.9	-9019	-8993	26	0.3
30.1	-9044	-9044	0	0.0
31.3	-9052	-9052	0	0.0
32.5	-9187	-9122	65	0.7
33.7	-9290	-9290	0	0.0
34.9	-9299	-9299	0	0.0
36.1	-9359	-9359	0	0.0
37.3	-9748	-9748	0	0.0
38.6	-9755	-9755	0	0.0
39.8	-9834	-9852	-18	-0.2
41.0	-9910	-9913	-3	0.0
42.2	-10104	-10130	-26	-0.3
43.4	-10126	-10149	-23	-0.2
44.6	-10149	-10173	-24	-0.2
45.8	-10175	-10175	0	0.0
47.0	-10199	-10192	7	0.1
48.2	-10264	-10287	-23	-0.2
49.4	-10280	-10342	-62	-0.6
50.6	-10342	-10464	-122	-1.2
51.8	-10356	-10496	-140	-1.4
53.0	-10464	-10529	-65	-0.6
54.2	-10496	-10533	-37	-0.4
55.4	-10521	-10549	-28	-0.3
56.6	-10550	-10557	-7	-0.1
57.8	-10573	-10588	-15	-0.1
59.0	-10609	-10617	-8	-0.1
60.2	-10617	-10621	-4	0.0
61.4	-10635	-10673	-38	-0.4
62.7	-10673	-10728	-55	-0.5
63.9	-10756	-10755	1	0.0
65.1	-10796	-10860	-64	-0.6
66.3	-10860	-10867	-7	-0.1
67.5	-10878	-10878	0	0.0
68.7	-10944	-10944	0	0.0
69.9	-10959	-10958	1	0.0
71.1	-11142	-11142	0	0.0
72.3	-11150	-11150	0	0.0
73.5	-11184	-11184	0	0.0
74.7	-11235	-11235	0	0.0
75.9	-11307	-11307	0	0.0
77.1	-11312	-11312	0	0.0
78.3	-11322	-11322	0	0.0
79.5	-11335	-11335	0	0.0
80.7	-11355	-11355	0	0.0
81.9	-11380	-11380	0	0.0
83.1	-11392	-11383	9	0.1
84.3	-11410	-11411	-1	0.0
85.5	-11418	-11418	0	0.0
86.7	-11428	-11428	0	0.0
88.0	-11438	-11438	0	0.0
89.2	-11475	-11475	0	0.0
90.4	-11507	-11507	0	0.0
91.6	-11521	-11521	0	0.0
92.8	-11547	-11547	0	0.0
94.0	-11595	-11594	1	0.0
95.2	-11611	-11611	0	0.0
96.4	-11619	-11619	0	0.0
97.6	-11665	-11647	18	0.2
98.8	-11772	-11752	20	0.2
Min	-11772	-11752	-222	-2.8
Max	-1394	-1394	828	17.5
Mean	-9213	-9201	12	0.4
Median	-10311	-10403	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		6.1
X>=5.0		3.7
X>=10.0		2.4
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	-2011	-2011	0	0.0
2.4	-2459	-2412	47	1.9
3.6	-2544	-2543	1	0.0
4.8	-2901	-2543	358	12.3
6.0	-2947	-2898	49	1.7
7.2	-3001	-2938	63	2.1
8.4	-3683	-3683	0	0.0
9.6	-4004	-3859	145	3.6
10.8	-4182	-4021	161	3.8
12.0	-4367	-4668	-301	-6.9
13.3	-4661	-4904	-243	-5.2
14.5	-5044	-5044	0	0.0
15.7	-5250	-5250	0	0.0
16.9	-5345	-5343	2	0.0
18.1	-5408	-5396	12	0.2
19.3	-5592	-5534	58	1.0
20.5	-5631	-5592	39	0.7
21.7	-5663	-5682	-19	-0.3
22.9	-5874	-6029	-155	-2.6
24.1	-6081	-6107	-26	-0.4
25.3	-6169	-6320	-151	-2.4
26.5	-6318	-6339	-21	-0.3
27.7	-6536	-7064	-528	-8.1
28.9	-6999	-7118	-119	-1.7
30.1	-7175	-7172	3	0.0
31.3	-7195	-7271	-76	-1.1
32.5	-7324	-7290	34	0.5
33.7	-7345	-7313	32	0.4
34.9	-7393	-7423	-30	-0.4
36.1	-7475	-7475	0	0.0
37.3	-8311	-8299	12	0.1
38.6	-8900	-8903	-3	0.0
39.8	-9527	-9527	0	0.0
41.0	-9794	-9803	-9	-0.1
42.2	-9816	-9816	0	0.0
43.4	-9859	-9859	0	0.0
44.6	-9942	-9972	-30	-0.3
45.8	-10127	-10125	2	0.0
47.0	-10158	-10158	0	0.0
48.2	-10191	-10191	0	0.0
49.4	-10223	-10222	1	0.0
50.6	-10237	-10237	0	0.0
51.8	-10307	-10307	0	0.0
53.0	-10428	-10428	0	0.0
54.2	-10530	-10530	0	0.0
55.4	-10536	-10535	1	0.0
56.6	-10572	-10572	0	0.0
57.8	-10581	-10581	0	0.0
59.0	-10589	-10589	0	0.0
60.2	-10603	-10603	0	0.0
61.4	-10608	-10608	0	0.0
62.7	-10622	-10622	0	0.0
63.9	-10662	-10662	0	0.0
65.1	-10678	-10678	0	0.0
66.3	-10700	-10700	0	0.0
67.5	-10725	-10725	0	0.0
68.7	-10727	-10727	0	0.0
69.9	-10744	-10744	0	0.0
71.1	-10754	-10754	0	0.0
72.3	-10759	-10759	0	0.0
73.5	-10769	-10769	0	0.0
74.7	-10770	-10770	0	0.0
75.9	-10783	-10783	0	0.0
77.1	-10788	-10787	1	0.0
78.3	-10859	-10859	0	0.0
79.5	-10877	-10876	1	0.0
80.7	-10886	-10886	0	0.0
81.9	-10934	-10934	0	0.0
83.1	-10988	-10988	0	0.0
84.3	-11029	-11027	2	0.0
85.5	-11032	-11032	0	0.0
86.7	-11080	-11080	0	0.0
88.0	-11084	-11084	0	0.0
89.2	-11095	-11095	0	0.0
90.4	-11127	-11127	0	0.0
91.6	-11137	-11137	0	0.0
92.8	-11138	-11157	-19	-0.2
94.0	-11162	-11162	0	0.0
95.2	-11246	-11246	0	0.0
96.4	-11261	-11261	0	0.0
97.6	-11282	-11282	0	0.0
98.8	-11302	-11302	0	0.0
Min	-11302	-11302	-528	-8.1
Max	-2011	-2011	358	12.3
Mean	-8627	-8636	-9	0.0
Median	-10230	-10230	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		6.1
X>=5.0		1.2
X>=10.0		1.2
-10.0<X<=-1.1		8.5
X<=-5.0		3.7
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR) - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	-2910	-2911	-1	0.0
2.4	-3032	-3032	0	0.0
3.6	-3064	-3062	2	0.1
4.8	-3116	-3116	0	0.0
6.0	-3281	-3279	2	0.1
7.2	-3353	-3353	0	0.0
8.4	-3376	-3376	0	0.0
9.6	-3505	-3501	4	0.1
10.8	-3657	-3660	-3	-0.1
12.0	-3933	-3932	1	0.0
13.3	-4370	-4373	-3	-0.1
14.5	-5057	-5049	8	0.2
15.7	-5064	-5055	9	0.2
16.9	-5097	-5097	0	0.0
18.1	-5365	-5384	-19	-0.4
19.3	-5582	-5577	5	0.1
20.5	-6086	-6143	-57	-0.9
21.7	-6144	-6515	-371	-6.0
22.9	-6554	-6554	0	0.0
24.1	-6714	-6651	63	0.9
25.3	-6774	-6685	89	1.3
26.5	-6973	-6744	229	3.3
27.7	-7019	-7023	-4	-0.1
28.9	-7449	-7431	18	0.2
30.1	-7644	-7910	-266	-3.5
31.3	-7800	-8150	-350	-4.5
32.5	-8150	-8263	-113	-1.4
33.7	-8263	-8265	-2	0.0
34.9	-8265	-8289	-24	-0.3
36.1	-8518	-8552	-34	-0.4
37.3	-8550	-8582	-32	-0.4
38.6	-8579	-8788	-209	-2.4
39.8	-8869	-8830	39	0.4
41.0	-8938	-8938	0	0.0
42.2	-9042	-9019	23	0.3
43.4	-9091	-9162	-71	-0.8
44.6	-9162	-9252	-90	-1.0
45.8	-9348	-9348	0	0.0
47.0	-9371	-9371	0	0.0
48.2	-9426	-9425	1	0.0
49.4	-9491	-9456	35	0.4
50.6	-9533	-9491	42	0.4
51.8	-9542	-9541	1	0.0
53.0	-9561	-9561	0	0.0
54.2	-9592	-9592	0	0.0
55.4	-9604	-9596	8	0.1
56.6	-9625	-9605	20	0.2
57.8	-9629	-9629	0	0.0
59.0	-9684	-9648	36	0.4
60.2	-9765	-9827	-62	-0.6
61.4	-9824	-9830	-6	-0.1
62.7	-9830	-9840	-10	-0.1
63.9	-9833	-9868	-35	-0.4
65.1	-9868	-9870	-2	0.0
66.3	-9876	-9873	3	0.0
67.5	-9886	-9893	-7	-0.1
68.7	-9893	-9904	-11	-0.1
69.9	-9904	-9939	-35	-0.4
71.1	-9939	-9955	-16	-0.2
72.3	-9955	-9960	-5	-0.1
73.5	-9960	-9968	-8	-0.1
74.7	-9968	-9973	-5	-0.1
75.9	-9971	-9976	-5	-0.1
77.1	-9973	-9986	-13	-0.1
78.3	-9984	-9986	-2	0.0
79.5	-9986	-9988	-2	0.0
80.7	-9986	-10013	-27	-0.3
81.9	-10013	-10020	-7	-0.1
83.1	-10015	-10033	-18	-0.2
84.3	-10051	-10051	0	0.0
85.5	-10095	-10095	0	0.0
86.7	-10119	-10119	0	0.0
88.0	-10124	-10124	0	0.0
89.2	-10127	-10127	0	0.0
90.4	-10136	-10136	0	0.0
91.6	-10205	-10189	16	0.2
92.8	-10231	-10244	-13	-0.1
94.0	-10242	-10297	-55	-0.5
95.2	-10297	-10302	-5	0.0
96.4	-10347	-10347	0	0.0
97.6	-10383	-10383	0	0.0
98.8	-10390	-10390	0	0.0
Min	-10390	-10390	-371	-6.0
Max	-2910	-2911	229	3.3
Mean	-8219	-8235	-16	-0.2
Median	-9512	-9474	0	0.0

Entire 82-Year Simulation Period

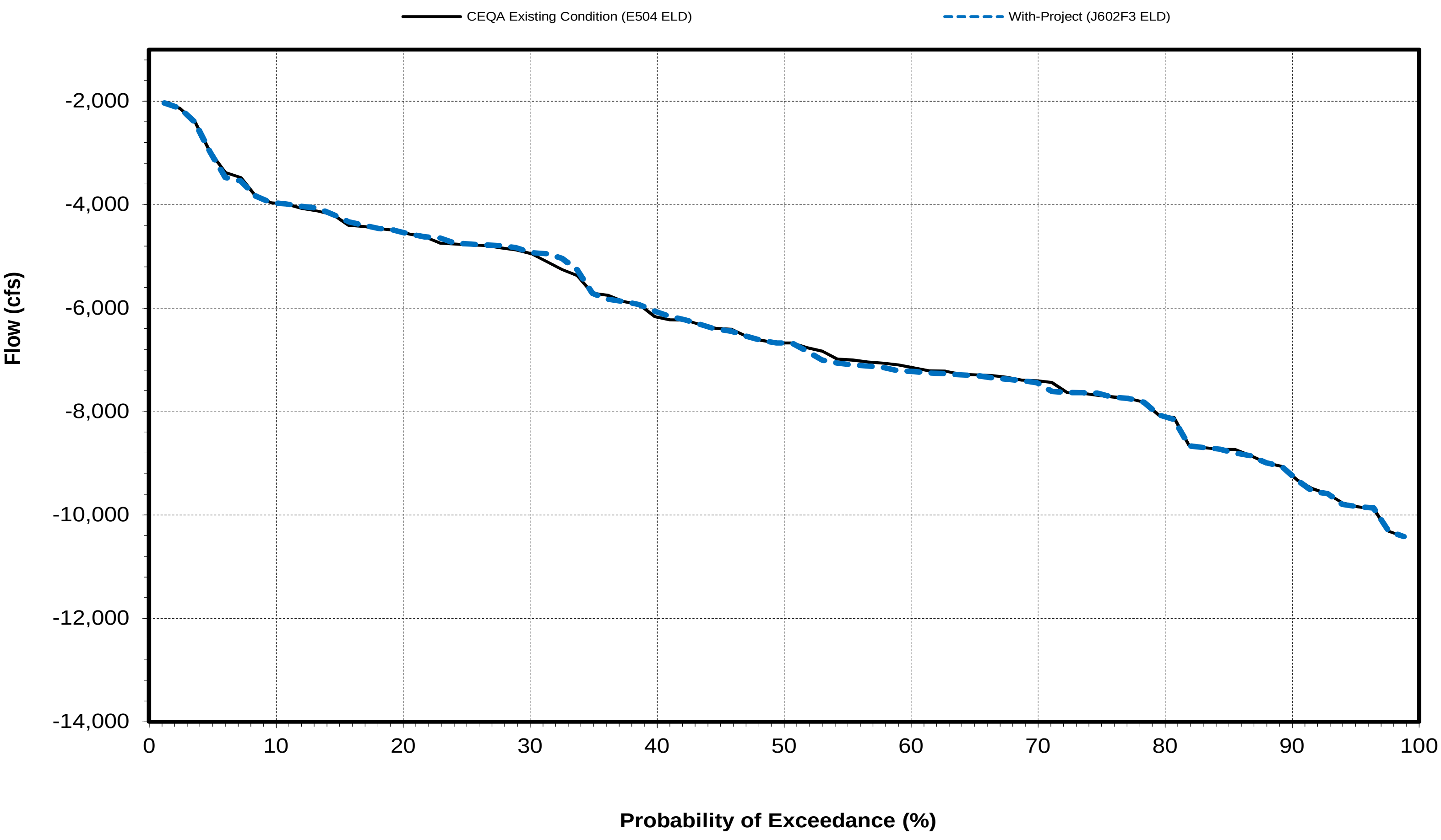
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	91.5
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Flow in Old and Middle River (OMR)

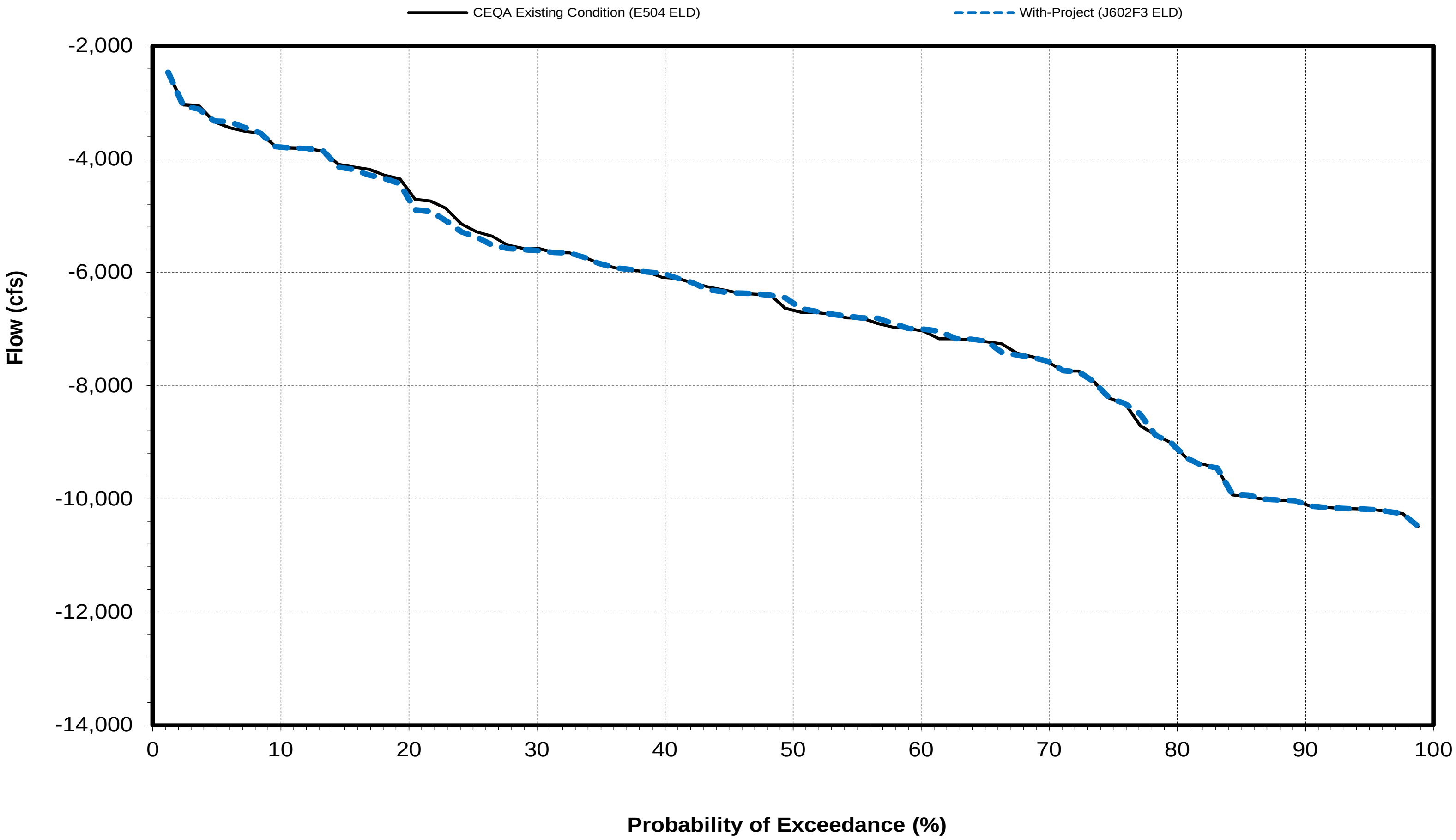
October



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Flow in Old and Middle River (OMR)

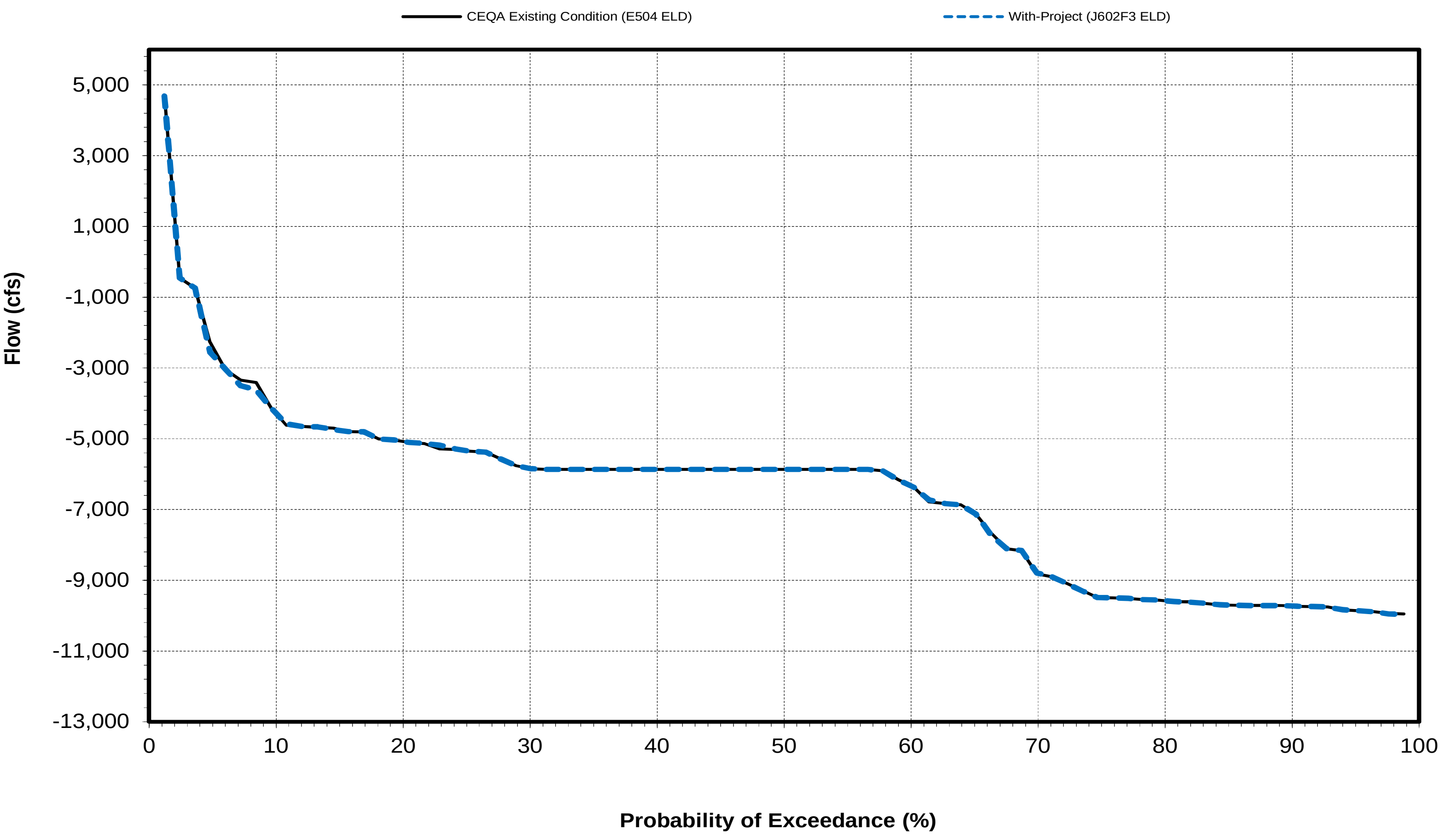
November



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Flow in Old and Middle River (OMR)

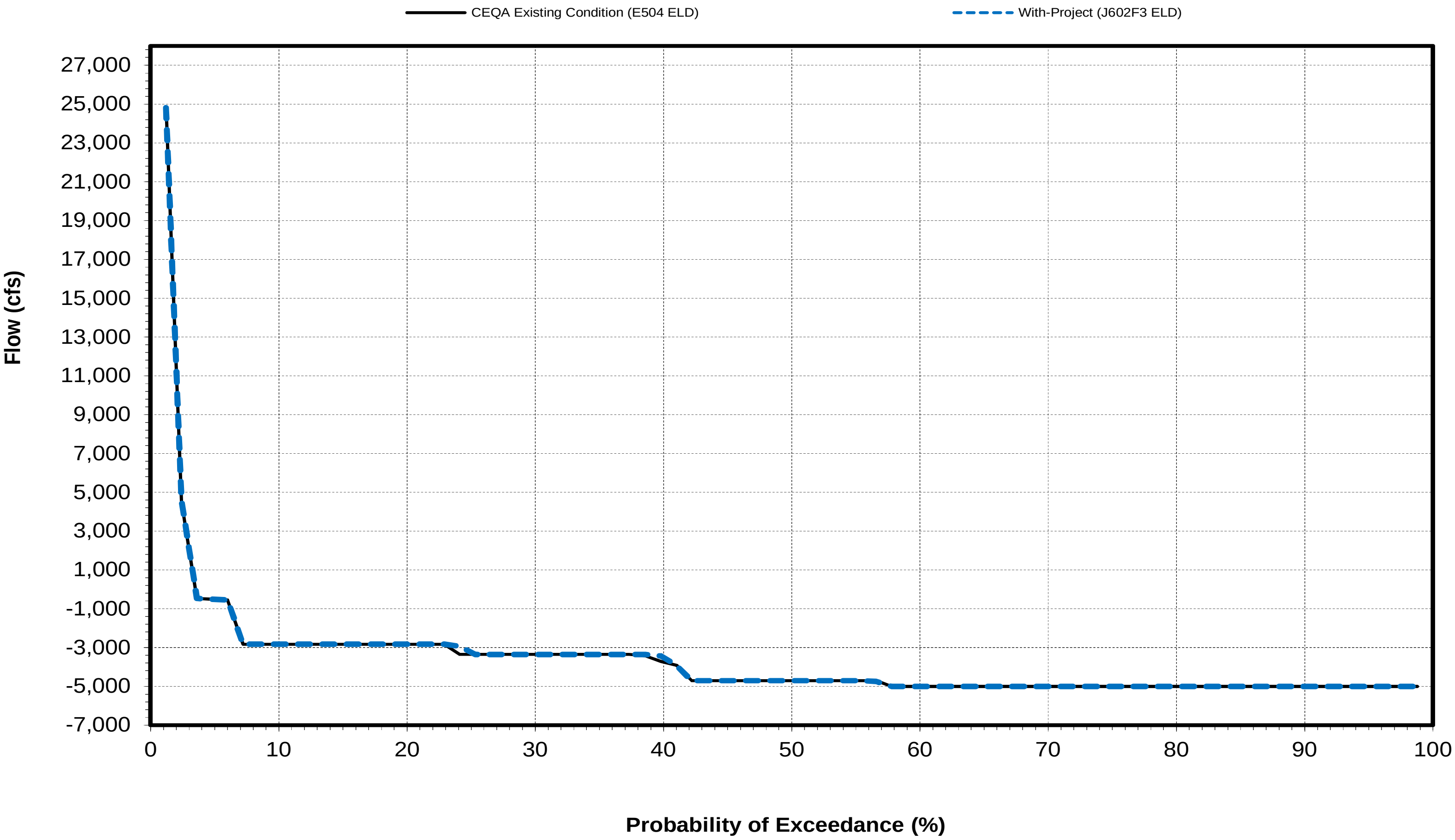
December



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

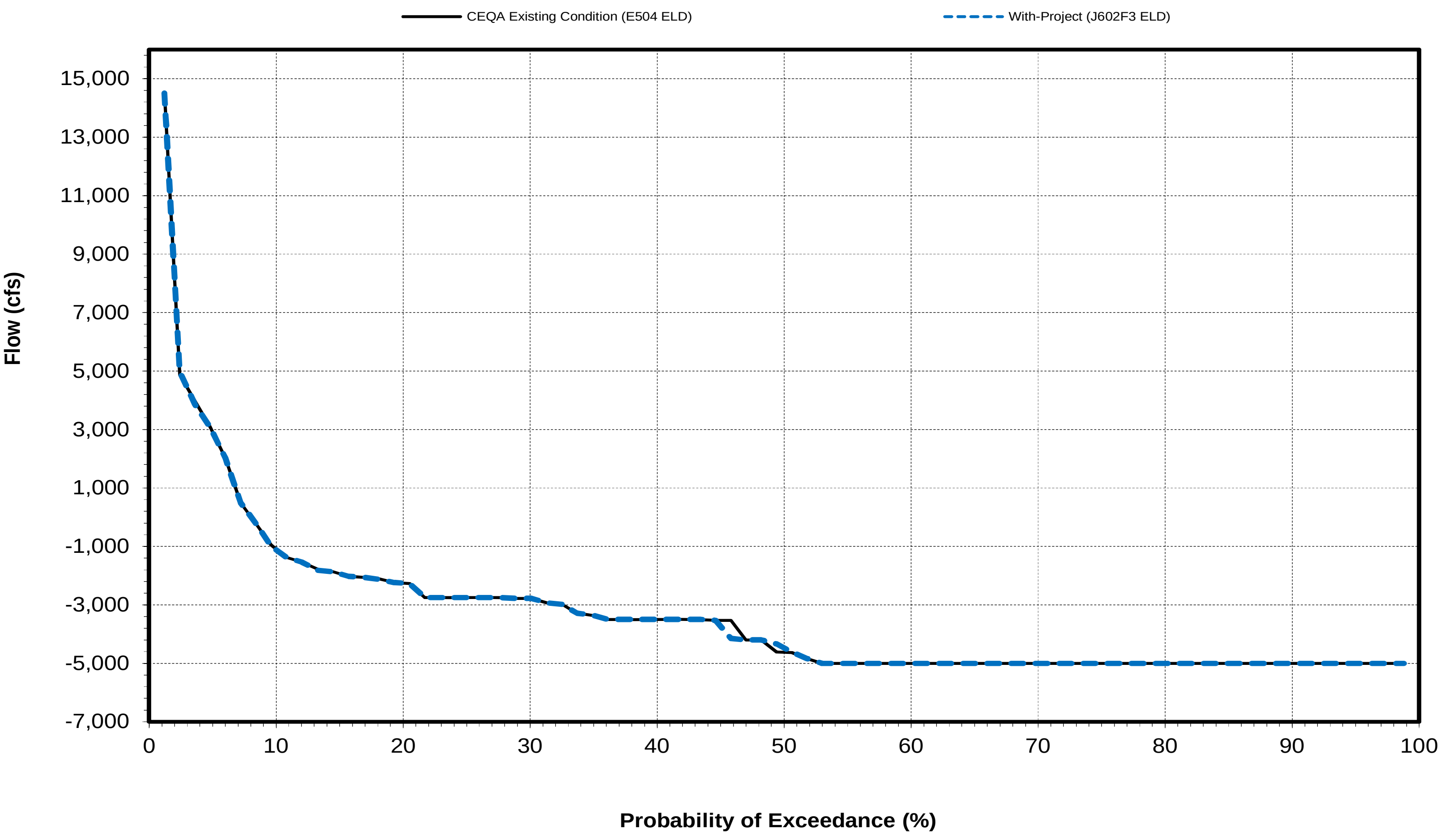
Flow in Old and Middle River (OMR)

January



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Flow in Old and Middle River (OMR) **February**

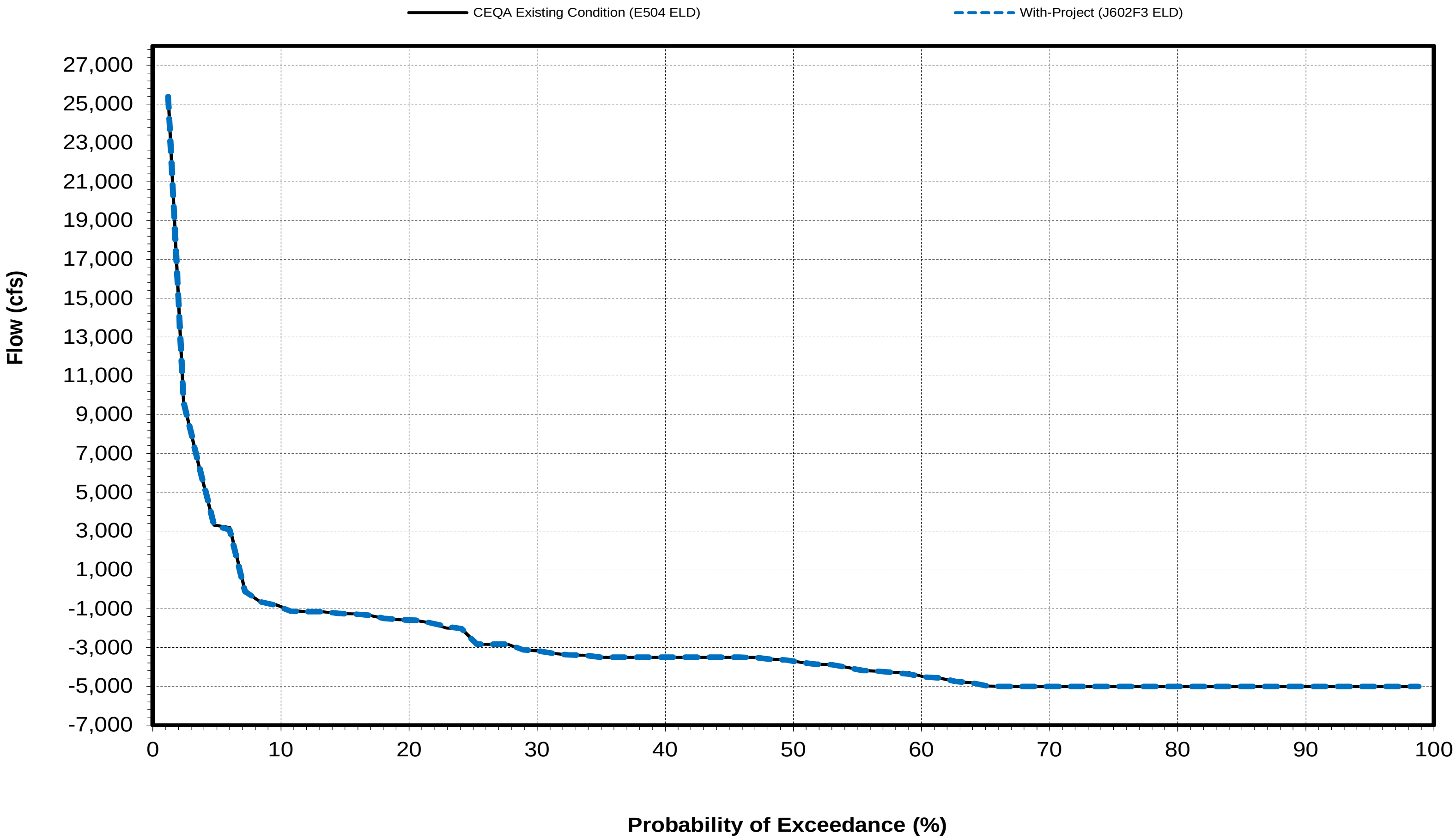


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Flow in Old and Middle River (OMR)

March

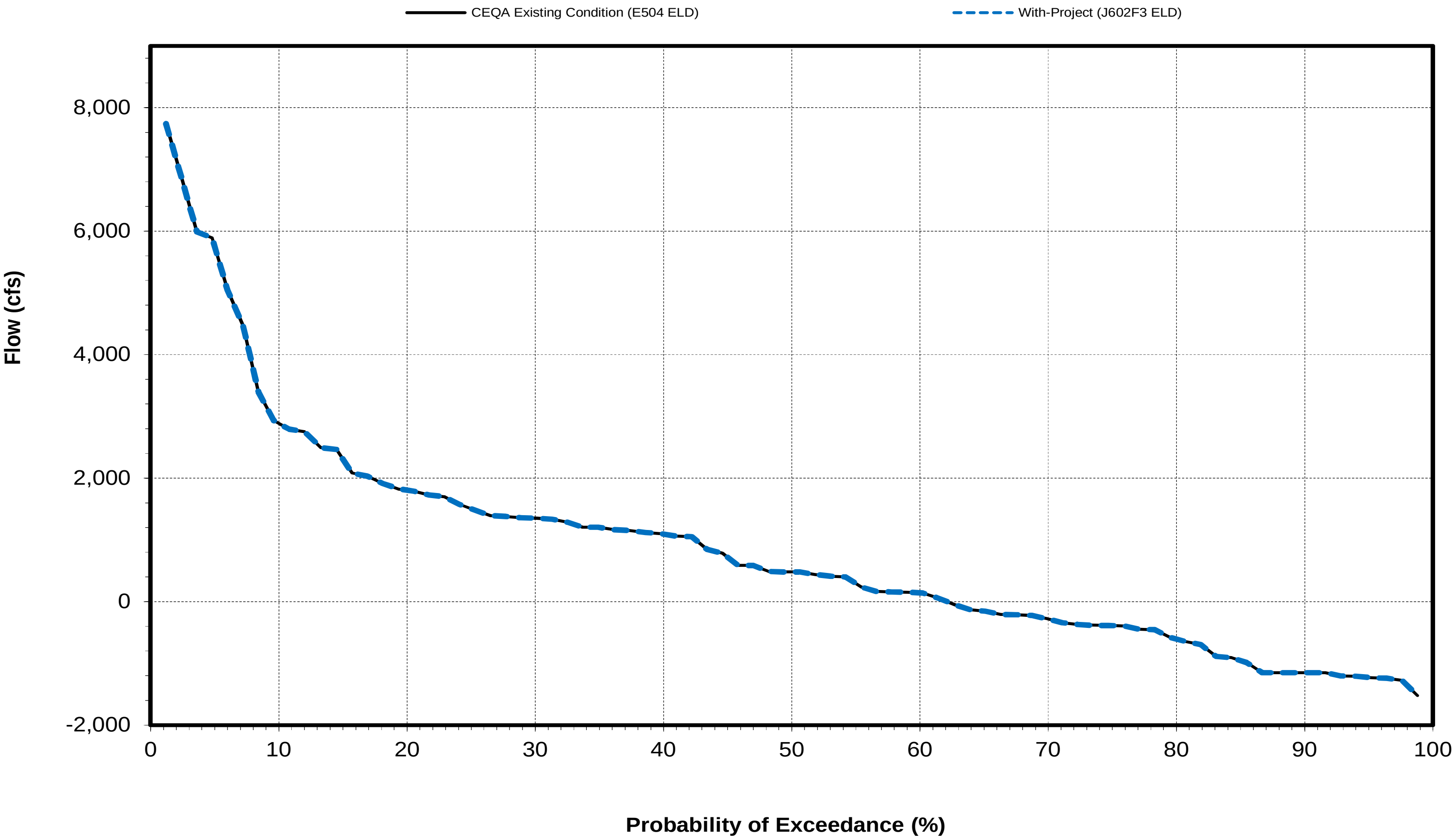


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Flow in Old and Middle River (OMR)

April

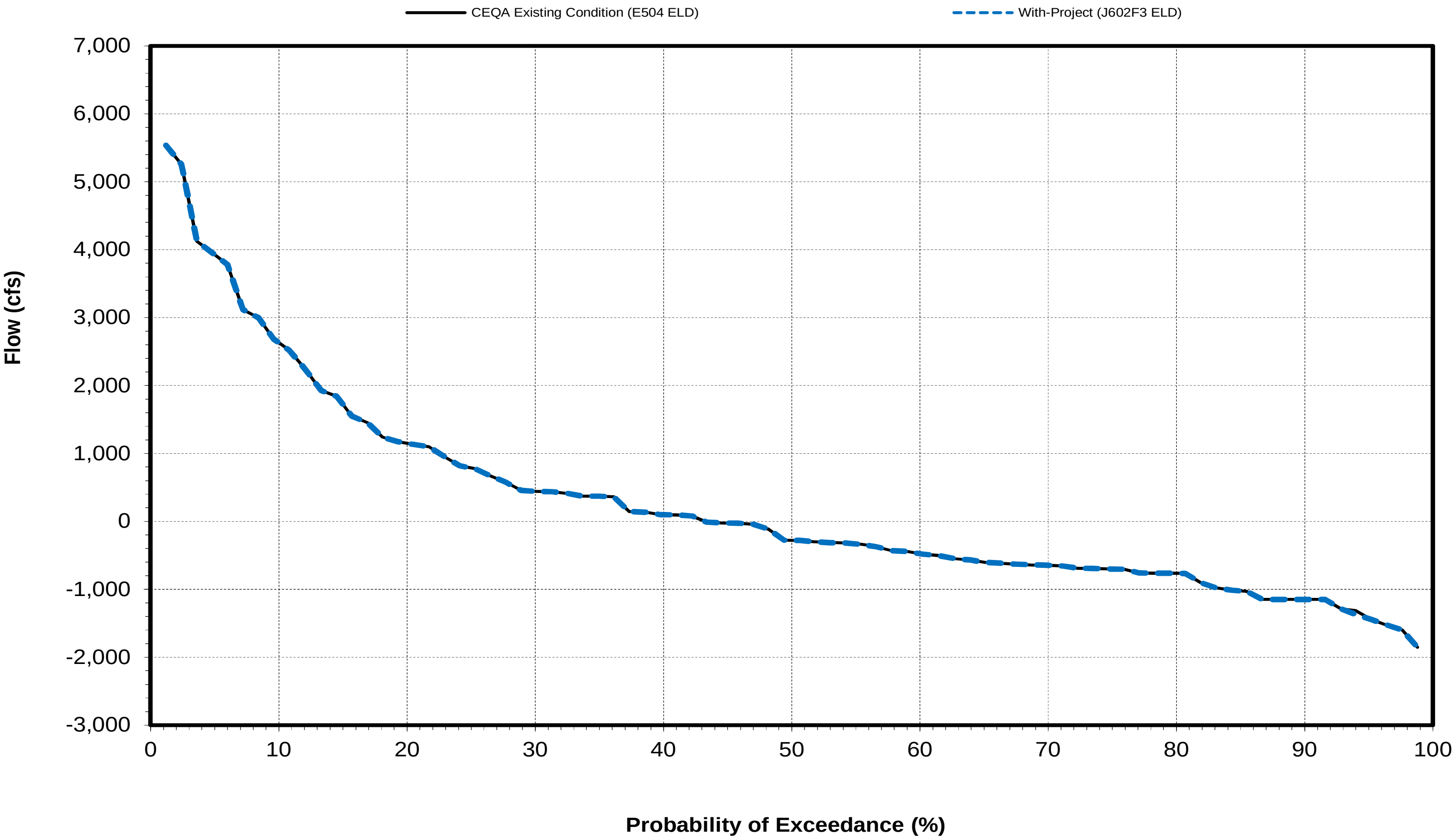


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Flow in Old and Middle River (OMR)

May

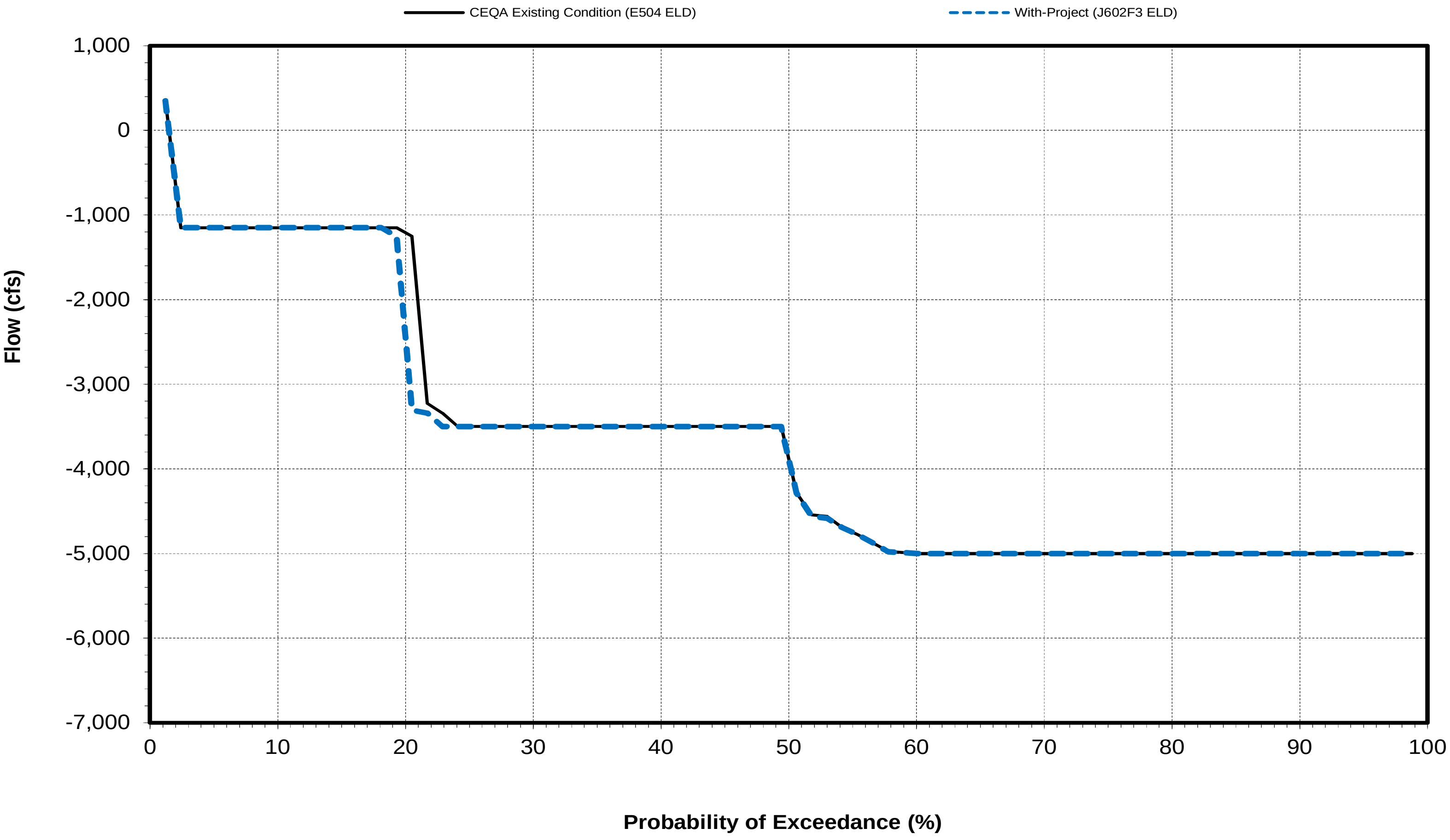


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Flow in Old and Middle River (OMR)

June

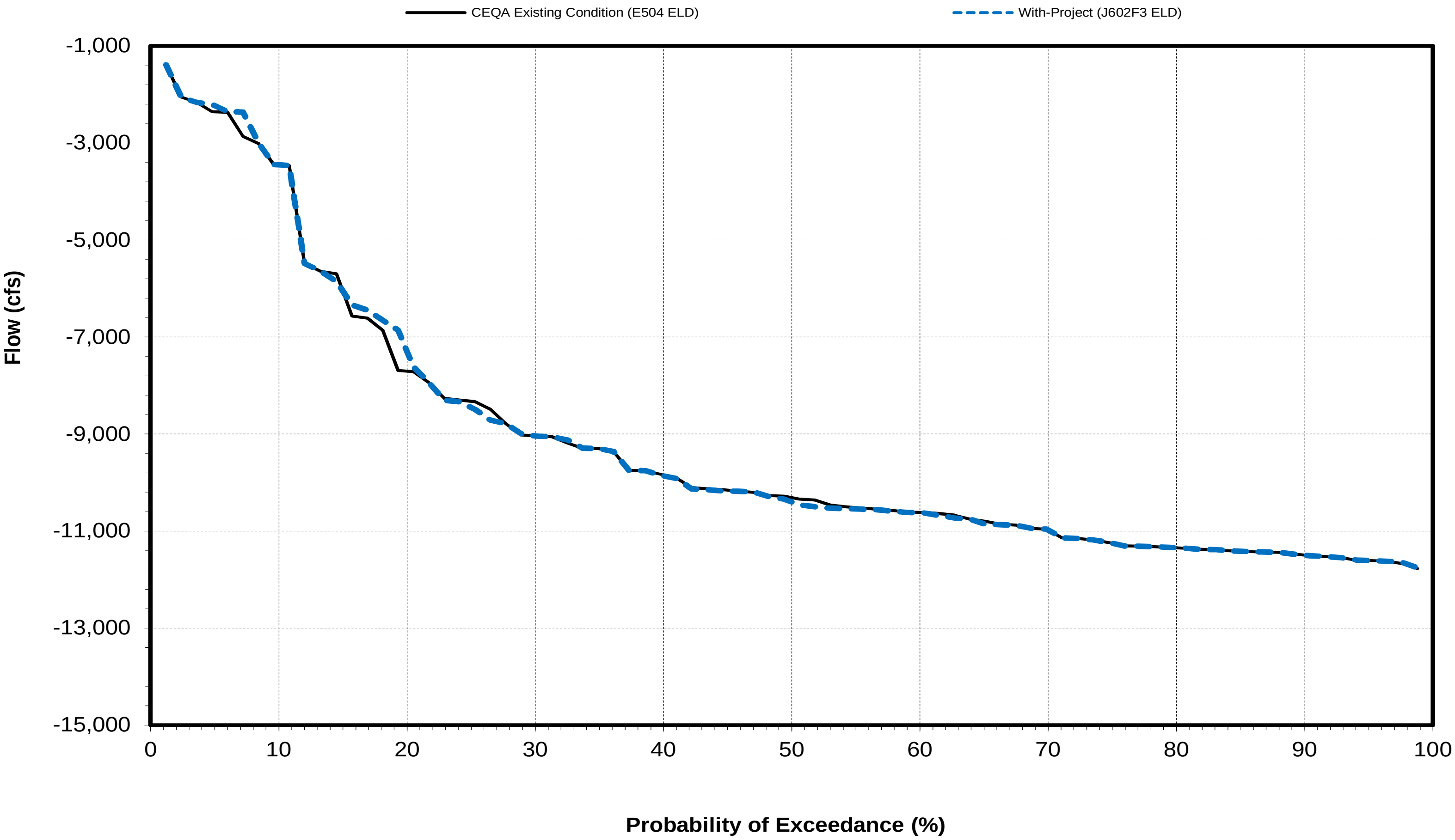


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Flow in Old and Middle River (OMR)

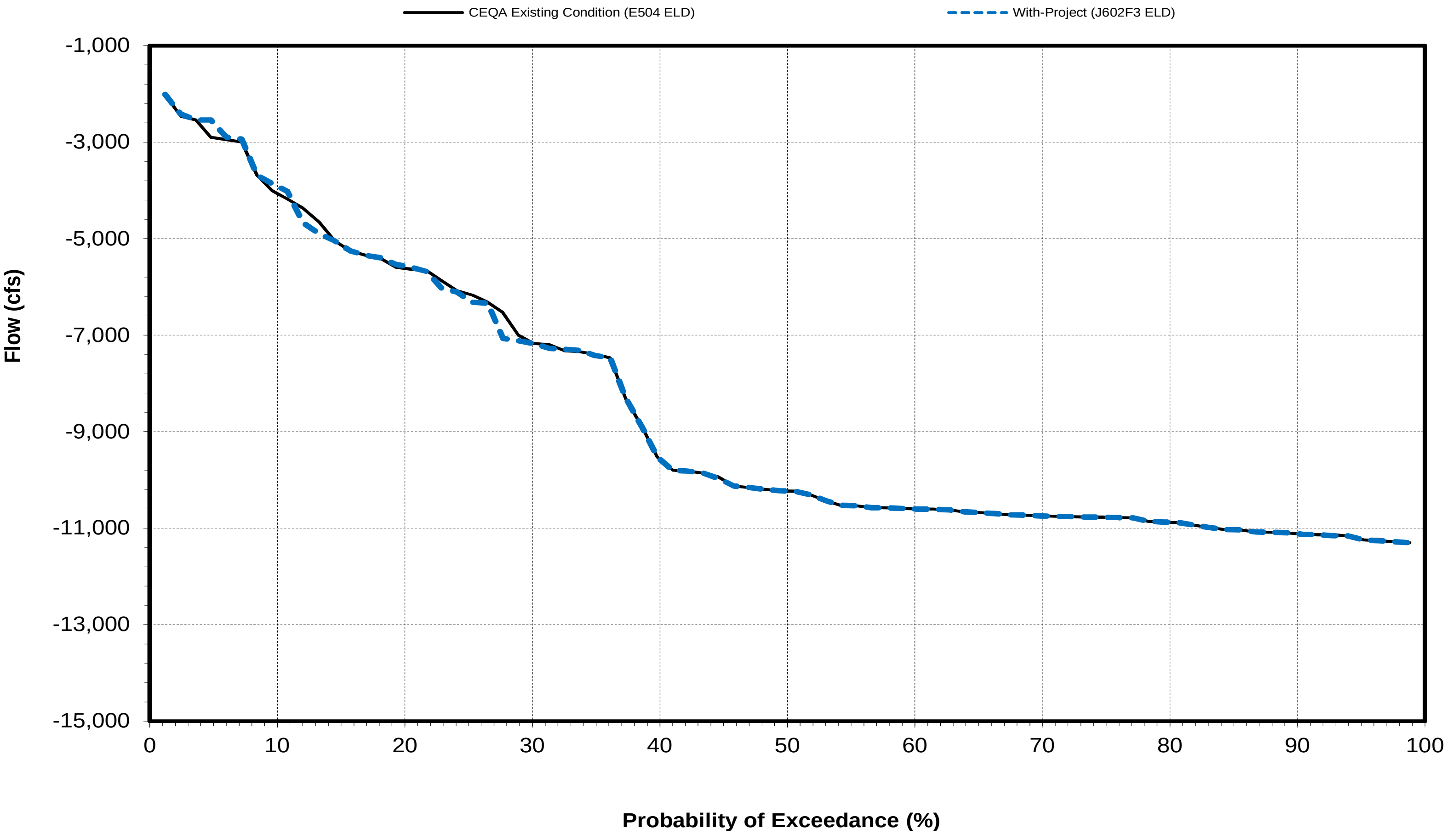
July



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

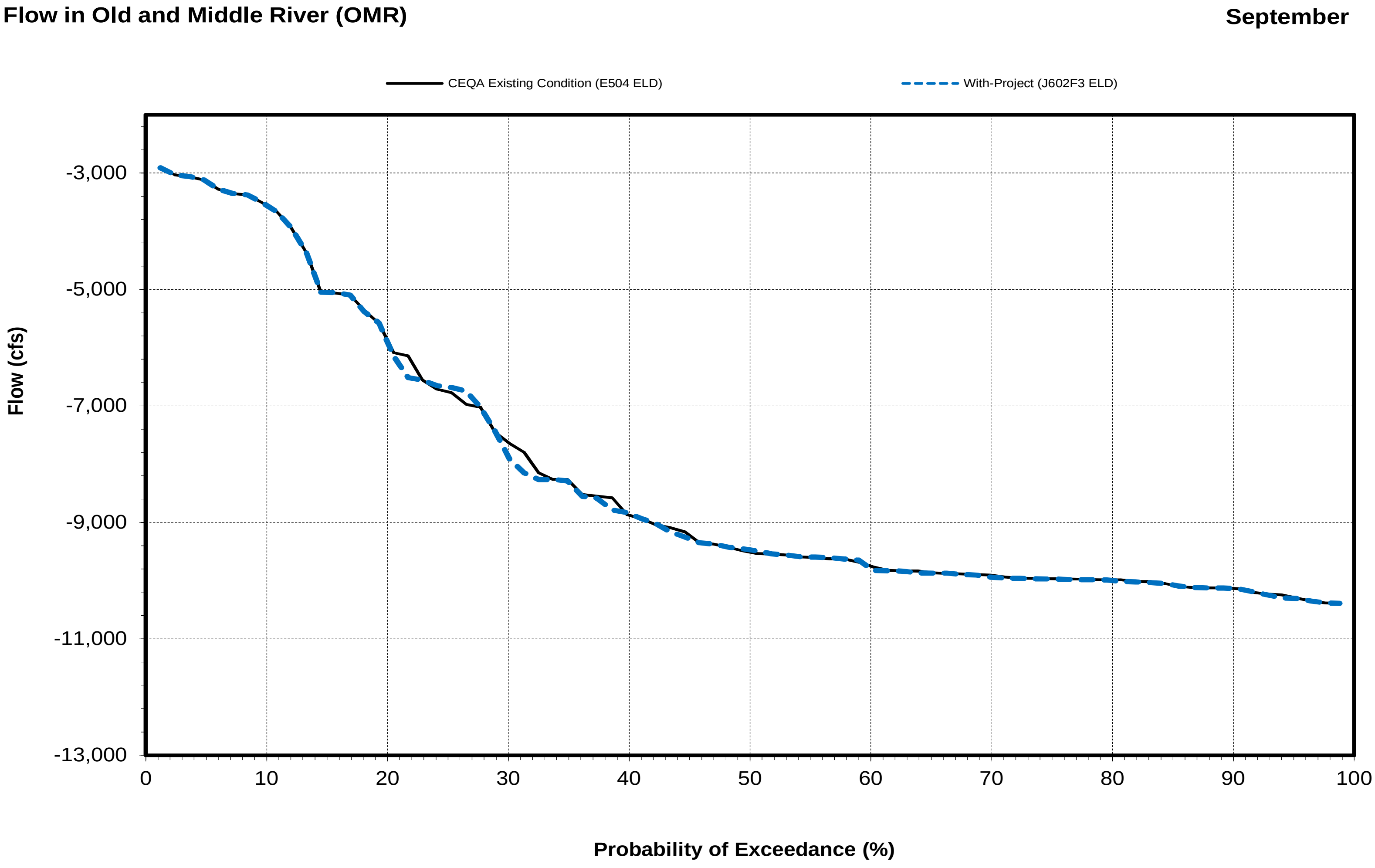
Created: 7/26/2016

Flow in Old and Middle River (OMR) **August**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Jones Pumping Plant Export - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	283	283	0	0.0
2.4	283	283	0	0.0
3.6	283	283	0	0.0
4.8	283	283	0	0.0
6.0	283	283	0	0.0
7.2	283	283	0	0.0
8.4	283	283	0	0.0
9.6	283	283	0	0.0
10.8	283	283	0	0.0
12.0	283	283	0	0.0
13.3	283	283	0	0.0
14.5	283	283	0	0.0
15.7	283	283	0	0.0
16.9	283	283	0	0.0
18.1	283	283	0	0.0
19.3	283	283	0	0.0
20.5	283	283	0	0.0
21.7	283	283	0	0.0
22.9	283	283	0	0.0
24.1	283	283	0	0.0
25.3	283	283	0	0.0
26.5	283	283	0	0.0
27.7	281	283	2	0.7
28.9	280	283	3	1.1
30.1	276	281	5	1.8
31.3	273	276	3	1.1
32.5	269	273	4	1.5
33.7	266	265	-1	-0.4
34.9	261	261	0	0.0
36.1	259	261	2	0.8
37.3	258	259	1	0.4
38.6	257	257	0	0.0
39.8	257	257	0	0.0
41.0	247	251	4	1.6
42.2	246	245	-1	-0.4
43.4	245	244	-1	-0.4
44.6	243	243	0	0.0
45.8	240	240	0	0.0
47.0	234	235	1	0.4
48.2	234	234	0	0.0
49.4	229	234	5	2.2
50.6	226	230	4	1.8
51.8	225	226	1	0.4
53.0	224	226	2	0.9
54.2	223	224	1	0.4
55.4	220	223	3	1.4
56.6	217	221	4	1.8
57.8	215	216	1	0.5
59.0	212	215	3	1.4
60.2	210	214	4	1.9
61.4	210	210	0	0.0
62.7	209	210	1	0.5
63.9	208	208	0	0.0
65.1	208	207	-1	-0.5
66.3	204	206	2	1.0
67.5	204	204	0	0.0
68.7	202	201	-1	-0.5
69.9	201	199	-2	-1.0
71.1	199	198	-1	-0.5
72.3	198	197	-1	-0.5
73.5	193	192	-1	-0.5
74.7	191	191	0	0.0
75.9	190	191	1	0.5
77.1	188	183	-5	-2.7
78.3	183	182	-1	-0.5
79.5	181	182	1	0.6
80.7	179	181	2	1.1
81.9	179	180	1	0.6
83.1	175	175	0	0.0
84.3	174	174	0	0.0
85.5	171	171	0	0.0
86.7	170	170	0	0.0
88.0	169	169	0	0.0
89.2	166	164	-2	-1.2
90.4	161	162	1	0.6
91.6	155	155	0	0.0
92.8	147	146	-1	-0.7
94.0	129	135	6	4.7
95.2	128	128	0	0.0
96.4	111	112	1	0.9
97.6	108	108	0	0.0
98.8	97	93	-4	-4.1
Min	97	93	-5	-4.1
Max	283	283	6	4.7
Mean	227	228	1	0.2
Median	228	232	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	80.5
1.1<=X<10.0		15.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Jones Pumping Plant Export - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	274	274	0	0.0
2.4	274	274	0	0.0
3.6	274	274	0	0.0
4.8	274	274	0	0.0
6.0	274	274	0	0.0
7.2	274	274	0	0.0
8.4	274	274	0	0.0
9.6	274	274	0	0.0
10.8	274	274	0	0.0
12.0	274	274	0	0.0
13.3	274	274	0	0.0
14.5	274	274	0	0.0
15.7	274	274	0	0.0
16.9	274	274	0	0.0
18.1	274	274	0	0.0
19.3	274	274	0	0.0
20.5	274	274	0	0.0
21.7	274	274	0	0.0
22.9	274	274	0	0.0
24.1	274	274	0	0.0
25.3	274	274	0	0.0
26.5	274	274	0	0.0
27.7	274	274	0	0.0
28.9	274	274	0	0.0
30.1	274	274	0	0.0
31.3	274	274	0	0.0
32.5	274	274	0	0.0
33.7	274	274	0	0.0
34.9	274	274	0	0.0
36.1	274	274	0	0.0
37.3	274	270	-4	-1.5
38.6	274	270	-4	-1.5
39.8	271	267	-4	-1.5
41.0	268	265	-3	-1.1
42.2	267	259	-8	-3.0
43.4	259	259	0	0.0
44.6	250	250	0	0.0
45.8	249	249	0	0.0
47.0	243	246	3	1.2
48.2	240	244	4	1.7
49.4	237	240	3	1.3
50.6	236	237	1	0.4
51.8	236	236	0	0.0
53.0	235	235	0	0.0
54.2	234	235	1	0.4
55.4	233	234	1	0.4
56.6	225	226	1	0.4
57.8	224	225	1	0.4
59.0	223	224	1	0.4
60.2	223	223	0	0.0
61.4	219	219	0	0.0
62.7	212	217	5	2.4
63.9	200	212	12	6.0
65.1	198	208	10	5.1
66.3	197	200	3	1.5
67.5	197	197	0	0.0
68.7	188	196	8	4.3
69.9	187	188	1	0.5
71.1	181	187	6	3.3
72.3	178	178	0	0.0
73.5	178	178	0	0.0
74.7	177	177	0	0.0
75.9	177	177	0	0.0
77.1	171	171	0	0.0
78.3	166	165	-1	-0.6
79.5	155	155	0	0.0
80.7	148	148	0	0.0
81.9	147	147	0	0.0
83.1	145	145	0	0.0
84.3	143	144	1	0.7
85.5	141	144	3	2.1
86.7	136	142	6	4.4
88.0	135	139	4	3.0
89.2	131	138	7	5.3
90.4	127	136	9	7.1
91.6	123	131	8	6.5
92.8	98	100	2	2.0
94.0	82	98	16	19.5
95.2	73	76	3	4.1
96.4	64	73	9	14.1
97.6	48	48	0	0.0
98.8	48	48	0	0.0
Min	48	48	-8	-3.0
Max	274	274	16	19.5
Mean	218	219	1	1.1
Median	237	239	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	70.7
1.1<=X<10.0		20.7
X>=5.0		8.5
X>=10.0		2.4
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		40.0
X>=5.0		25.0
X>=10.0		10.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**10.0**

Jones Pumping Plant Export - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	283	283	0	0.0
2.4	283	283	0	0.0
3.6	283	283	0	0.0
4.8	283	283	0	0.0
6.0	283	283	0	0.0
7.2	283	283	0	0.0
8.4	283	283	0	0.0
9.6	283	283	0	0.0
10.8	283	283	0	0.0
12.0	283	283	0	0.0
13.3	283	283	0	0.0
14.5	283	283	0	0.0
15.7	283	283	0	0.0
16.9	283	283	0	0.0
18.1	283	283	0	0.0
19.3	283	283	0	0.0
20.5	283	283	0	0.0
21.7	283	283	0	0.0
22.9	283	283	0	0.0
24.1	283	283	0	0.0
25.3	283	283	0	0.0
26.5	283	283	0	0.0
27.7	283	283	0	0.0
28.9	283	283	0	0.0
30.1	281	281	0	0.0
31.3	278	278	0	0.0
32.5	266	266	0	0.0
33.7	263	263	0	0.0
34.9	261	261	0	0.0
36.1	261	261	0	0.0
37.3	259	261	2	0.8
38.6	259	260	1	0.4
39.8	257	258	1	0.4
41.0	256	256	0	0.0
42.2	256	254	-2	-0.8
43.4	254	254	0	0.0
44.6	254	253	-1	-0.4
45.8	253	252	-1	-0.4
47.0	252	252	0	0.0
48.2	252	251	-1	-0.4
49.4	248	248	0	0.0
50.6	245	245	0	0.0
51.8	242	242	0	0.0
53.0	242	242	0	0.0
54.2	241	241	0	0.0
55.4	241	241	0	0.0
56.6	240	240	0	0.0
57.8	239	239	0	0.0
59.0	235	235	0	0.0
60.2	235	235	0	0.0
61.4	235	235	0	0.0
62.7	232	232	0	0.0
63.9	231	231	0	0.0
65.1	229	229	0	0.0
66.3	228	228	0	0.0
67.5	227	227	0	0.0
68.7	225	225	0	0.0
69.9	224	224	0	0.0
71.1	223	223	0	0.0
72.3	221	221	0	0.0
73.5	219	219	0	0.0
74.7	217	217	0	0.0
75.9	216	216	0	0.0
77.1	215	215	0	0.0
78.3	213	213	0	0.0
79.5	209	208	-1	-0.5
80.7	204	204	0	0.0
81.9	204	204	0	0.0
83.1	202	202	0	0.0
84.3	199	192	-7	-3.5
85.5	191	191	0	0.0
86.7	190	190	0	0.0
88.0	173	181	8	4.6
89.2	170	173	3	1.8
90.4	166	172	6	3.6
91.6	164	166	2	1.2
92.8	156	159	3	1.9
94.0	145	154	9	6.2
95.2	144	143	-1	-0.7
96.4	116	116	0	0.0
97.6	90	90	0	0.0
98.8	70	81	11	15.7
Min	70	81	-7	-3.5
Max	283	283	11	15.7
Mean	238	238	0	0.4
Median	247	247	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	90.2
1.1<=X<10.0		7.3
X>=5.0		2.4
X>=10.0		1.2
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		30.0
X>=5.0		10.0
X>=10.0		5.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**5.0**

Jones Pumping Plant Export - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	283	283	0	0.0
2.4	283	283	0	0.0
3.6	283	283	0	0.0
4.8	283	283	0	0.0
6.0	283	283	0	0.0
7.2	283	283	0	0.0
8.4	283	283	0	0.0
9.6	283	283	0	0.0
10.8	283	283	0	0.0
12.0	282	283	1	0.4
13.3	270	270	0	0.0
14.5	264	264	0	0.0
15.7	250	256	6	2.4
16.9	250	250	0	0.0
18.1	247	247	0	0.0
19.3	242	242	0	0.0
20.5	239	239	0	0.0
21.7	238	238	0	0.0
22.9	234	234	0	0.0
24.1	228	228	0	0.0
25.3	219	219	0	0.0
26.5	219	219	0	0.0
27.7	218	218	0	0.0
28.9	218	218	0	0.0
30.1	211	211	0	0.0
31.3	211	211	0	0.0
32.5	211	211	0	0.0
33.7	211	211	0	0.0
34.9	210	210	0	0.0
36.1	208	208	0	0.0
37.3	208	208	0	0.0
38.6	208	208	0	0.0
39.8	208	208	0	0.0
41.0	208	208	0	0.0
42.2	207	207	0	0.0
43.4	207	207	0	0.0
44.6	206	206	0	0.0
45.8	206	206	0	0.0
47.0	202	202	0	0.0
48.2	201	201	0	0.0
49.4	201	201	0	0.0
50.6	200	200	0	0.0
51.8	200	200	0	0.0
53.0	199	199	0	0.0
54.2	198	198	0	0.0
55.4	198	198	0	0.0
56.6	197	197	0	0.0
57.8	197	197	0	0.0
59.0	196	196	0	0.0
60.2	196	196	0	0.0
61.4	195	195	0	0.0
62.7	194	194	0	0.0
63.9	188	188	0	0.0
65.1	184	184	0	0.0
66.3	178	181	3	1.7
67.5	177	177	0	0.0
68.7	177	177	0	0.0
69.9	177	175	-2	-1.1
71.1	174	174	0	0.0
72.3	172	173	1	0.6
73.5	172	172	0	0.0
74.7	162	169	7	4.3
75.9	162	162	0	0.0
77.1	158	158	0	0.0
78.3	155	155	0	0.0
79.5	146	146	0	0.0
80.7	145	145	0	0.0
81.9	144	144	0	0.0
83.1	144	142	-2	-1.4
84.3	142	138	-4	-2.8
85.5	138	138	0	0.0
86.7	138	133	-5	-3.6
88.0	133	131	-2	-1.5
89.2	131	131	0	0.0
90.4	131	130	-1	-0.8
91.6	130	126	-4	-3.1
92.8	126	123	-3	-2.4
94.0	123	121	-2	-1.6
95.2	121	115	-6	-5.0
96.4	65	74	9	13.8
97.6	51	51	0	0.0
98.8	49	49	0	0.0
Min	49	49	-6	-5.0
Max	283	283	9	13.8
Mean	197	197	0	0.0
Median	201	201	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		3.7
X>=5.0		1.2
X>=10.0		1.2
-10.0<X<=-1.1		11.0
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		0.0
X>=5.0		5.0
X>=10.0		5.0
-10.0<X<=-1.1		40.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**5.0**

Jones Pumping Plant Export - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	265	265	0	0.0
2.4	265	265	0	0.0
3.6	265	265	0	0.0
4.8	255	255	0	0.0
6.0	255	255	0	0.0
7.2	255	255	0	0.0
8.4	255	255	0	0.0
9.6	255	255	0	0.0
10.8	255	255	0	0.0
12.0	255	255	0	0.0
13.3	255	255	0	0.0
14.5	255	255	0	0.0
15.7	255	255	0	0.0
16.9	255	255	0	0.0
18.1	255	255	0	0.0
19.3	255	255	0	0.0
20.5	254	254	0	0.0
21.7	245	245	0	0.0
22.9	242	245	3	1.2
24.1	241	242	1	0.4
25.3	240	241	1	0.4
26.5	229	240	11	4.8
27.7	229	229	0	0.0
28.9	219	229	10	4.6
30.1	214	219	5	2.3
31.3	212	214	2	0.9
32.5	212	212	0	0.0
33.7	211	212	1	0.5
34.9	206	211	5	2.4
36.1	198	198	0	0.0
37.3	197	198	1	0.5
38.6	196	197	1	0.5
39.8	196	196	0	0.0
41.0	193	196	3	1.6
42.2	192	193	1	0.5
43.4	192	192	0	0.0
44.6	190	192	2	1.1
45.8	188	190	2	1.1
47.0	186	188	2	1.1
48.2	185	186	1	0.5
49.4	184	185	1	0.5
50.6	184	184	0	0.0
51.8	184	184	0	0.0
53.0	182	182	0	0.0
54.2	182	182	0	0.0
55.4	178	178	0	0.0
56.6	177	177	0	0.0
57.8	175	175	0	0.0
59.0	174	174	0	0.0
60.2	171	171	0	0.0
61.4	169	169	0	0.0
62.7	162	163	1	0.6
63.9	159	159	0	0.0
65.1	158	158	0	0.0
66.3	155	155	0	0.0
67.5	153	153	0	0.0
68.7	143	143	0	0.0
69.9	139	139	0	0.0
71.1	137	137	0	0.0
72.3	131	131	0	0.0
73.5	128	128	0	0.0
74.7	128	128	0	0.0
75.9	128	128	0	0.0
77.1	126	126	0	0.0
78.3	119	119	0	0.0
79.5	110	110	0	0.0
80.7	109	110	1	0.9
81.9	104	104	0	0.0
83.1	100	100	0	0.0
84.3	97	97	0	0.0
85.5	96	96	0	0.0
86.7	84	84	0	0.0
88.0	72	74	2	2.8
89.2	70	70	0	0.0
90.4	67	67	0	0.0
91.6	62	64	2	3.2
92.8	57	58	1	1.8
94.0	56	57	1	1.8
95.2	55	55	0	0.0
96.4	52	52	0	0.0
97.6	46	46	0	0.0
98.8	45	45	0	0.0
Min	45	45	0	0.0
Max	265	265	11	4.8
Mean	175	176	1	0.4
Median	184	185	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		15.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Jones Pumping Plant Export - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	283	283	0	0.0
2.4	283	283	0	0.0
3.6	283	283	0	0.0
4.8	283	283	0	0.0
6.0	283	283	0	0.0
7.2	283	283	0	0.0
8.4	283	283	0	0.0
9.6	283	283	0	0.0
10.8	283	283	0	0.0
12.0	283	283	0	0.0
13.3	283	283	0	0.0
14.5	283	283	0	0.0
15.7	283	283	0	0.0
16.9	283	283	0	0.0
18.1	283	283	0	0.0
19.3	283	283	0	0.0
20.5	283	283	0	0.0
21.7	281	281	0	0.0
22.9	276	281	5	1.8
24.1	275	277	2	0.7
25.3	273	273	0	0.0
26.5	268	265	-3	-1.1
27.7	260	260	0	0.0
28.9	254	254	0	0.0
30.1	253	253	0	0.0
31.3	243	243	0	0.0
32.5	235	235	0	0.0
33.7	230	230	0	0.0
34.9	227	227	0	0.0
36.1	222	222	0	0.0
37.3	221	221	0	0.0
38.6	215	215	0	0.0
39.8	213	213	0	0.0
41.0	211	211	0	0.0
42.2	206	206	0	0.0
43.4	203	203	0	0.0
44.6	203	203	0	0.0
45.8	200	200	0	0.0
47.0	198	198	0	0.0
48.2	192	192	0	0.0
49.4	189	192	3	1.6
50.6	183	191	8	4.4
51.8	181	183	2	1.1
53.0	181	181	0	0.0
54.2	179	181	2	1.1
55.4	172	179	7	4.1
56.6	164	164	0	0.0
57.8	163	163	0	0.0
59.0	159	159	0	0.0
60.2	156	156	0	0.0
61.4	156	156	0	0.0
62.7	156	156	0	0.0
63.9	156	155	-1	-0.6
65.1	155	155	0	0.0
66.3	155	152	-3	-1.9
67.5	152	147	-5	-3.3
68.7	149	144	-5	-3.4
69.9	147	143	-4	-2.7
71.1	144	141	-3	-2.1
72.3	143	134	-9	-6.3
73.5	141	131	-10	-7.1
74.7	131	131	0	0.0
75.9	130	127	-3	-2.3
77.1	127	122	-5	-3.9
78.3	122	122	0	0.0
79.5	122	119	-3	-2.5
80.7	119	114	-5	-4.2
81.9	114	112	-2	-1.8
83.1	110	110	0	0.0
84.3	104	109	5	4.8
85.5	92	92	0	0.0
86.7	86	86	0	0.0
88.0	84	84	0	0.0
89.2	84	82	-2	-2.4
90.4	82	79	-3	-3.7
91.6	79	76	-3	-3.8
92.8	74	74	0	0.0
94.0	71	73	2	2.8
95.2	64	64	0	0.0
96.4	49	49	0	0.0
97.6	49	49	0	0.0
98.8	49	49	0	0.0
Min	49	49	-10	-7.1
Max	283	283	8	4.8
Mean	189	189	0	-0.4
Median	186	192	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	70.7
1.1<=X<10.0		9.8
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		19.5
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		40.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Jones Pumping Plant Export - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	199	199	0	0.0
2.4	162	162	0	0.0
3.6	160	160	0	0.0
4.8	152	152	0	0.0
6.0	144	144	0	0.0
7.2	128	128	0	0.0
8.4	115	115	0	0.0
9.6	101	101	0	0.0
10.8	99	99	0	0.0
12.0	94	94	0	0.0
13.3	90	90	0	0.0
14.5	88	88	0	0.0
15.7	85	85	0	0.0
16.9	79	79	0	0.0
18.1	75	75	0	0.0
19.3	74	74	0	0.0
20.5	73	73	0	0.0
21.7	72	72	0	0.0
22.9	72	72	0	0.0
24.1	69	69	0	0.0
25.3	69	69	0	0.0
26.5	68	68	0	0.0
27.7	67	67	0	0.0
28.9	66	66	0	0.0
30.1	66	66	0	0.0
31.3	64	64	0	0.0
32.5	62	62	0	0.0
33.7	62	62	0	0.0
34.9	61	61	0	0.0
36.1	61	61	0	0.0
37.3	61	61	0	0.0
38.6	61	61	0	0.0
39.8	61	61	0	0.0
41.0	60	59	-1	-1.7
42.2	59	58	-1	-1.7
43.4	58	58	0	0.0
44.6	58	58	0	0.0
45.8	56	56	0	0.0
47.0	55	55	0	0.0
48.2	55	55	0	0.0
49.4	55	55	0	0.0
50.6	55	55	0	0.0
51.8	54	54	0	0.0
53.0	54	54	0	0.0
54.2	54	54	0	0.0
55.4	53	53	0	0.0
56.6	52	52	0	0.0
57.8	52	52	0	0.0
59.0	52	52	0	0.0
60.2	51	51	0	0.0
61.4	51	51	0	0.0
62.7	51	51	0	0.0
63.9	51	51	0	0.0
65.1	51	51	0	0.0
66.3	50	50	0	0.0
67.5	50	50	0	0.0
68.7	49	49	0	0.0
69.9	48	48	0	0.0
71.1	48	48	0	0.0
72.3	48	48	0	0.0
73.5	48	48	0	0.0
74.7	48	48	0	0.0
75.9	48	48	0	0.0
77.1	48	48	0	0.0
78.3	48	48	0	0.0
79.5	48	48	0	0.0
80.7	48	48	0	0.0
81.9	48	48	0	0.0
83.1	48	48	0	0.0
84.3	48	48	0	0.0
85.5	48	48	0	0.0
86.7	48	48	0	0.0
88.0	48	48	0	0.0
89.2	48	48	0	0.0
90.4	48	48	0	0.0
91.6	48	48	0	0.0
92.8	48	48	0	0.0
94.0	48	48	0	0.0
95.2	48	48	0	0.0
96.4	48	48	0	0.0
97.6	48	48	0	0.0
98.8	48	48	0	0.0
Min	48	48	-1	-1.7
Max	199	199	0	0.0
Mean	66	66	0	0.0
Median	55	55	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	97.6
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Jones Pumping Plant Export - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	214	214	0	0.0
2.4	214	214	0	0.0
3.6	214	214	0	0.0
4.8	160	160	0	0.0
6.0	138	138	0	0.0
7.2	124	124	0	0.0
8.4	120	120	0	0.0
9.6	111	111	0	0.0
10.8	102	102	0	0.0
12.0	90	90	0	0.0
13.3	85	85	0	0.0
14.5	82	82	0	0.0
15.7	77	74	-3	-3.9
16.9	74	74	0	0.0
18.1	69	69	0	0.0
19.3	66	66	0	0.0
20.5	63	63	0	0.0
21.7	62	62	0	0.0
22.9	59	59	0	0.0
24.1	58	58	0	0.0
25.3	57	57	0	0.0
26.5	55	55	0	0.0
27.7	53	54	1	1.9
28.9	53	53	0	0.0
30.1	51	53	2	3.9
31.3	50	52	2	4.0
32.5	50	51	1	2.0
33.7	49	50	1	2.0
34.9	49	49	0	0.0
36.1	49	49	0	0.0
37.3	49	49	0	0.0
38.6	49	49	0	0.0
39.8	49	49	0	0.0
41.0	49	49	0	0.0
42.2	49	49	0	0.0
43.4	49	49	0	0.0
44.6	49	49	0	0.0
45.8	49	49	0	0.0
47.0	49	49	0	0.0
48.2	49	49	0	0.0
49.4	49	49	0	0.0
50.6	49	49	0	0.0
51.8	49	49	0	0.0
53.0	49	49	0	0.0
54.2	49	49	0	0.0
55.4	49	49	0	0.0
56.6	49	49	0	0.0
57.8	49	49	0	0.0
59.0	49	49	0	0.0
60.2	49	49	0	0.0
61.4	49	49	0	0.0
62.7	49	49	0	0.0
63.9	49	49	0	0.0
65.1	49	49	0	0.0
66.3	49	49	0	0.0
67.5	49	49	0	0.0
68.7	49	49	0	0.0
69.9	49	49	0	0.0
71.1	49	49	0	0.0
72.3	49	49	0	0.0
73.5	49	49	0	0.0
74.7	49	49	0	0.0
75.9	49	49	0	0.0
77.1	49	49	0	0.0
78.3	49	49	0	0.0
79.5	49	49	0	0.0
80.7	49	49	0	0.0
81.9	49	49	0	0.0
83.1	49	49	0	0.0
84.3	49	49	0	0.0
85.5	49	49	0	0.0
86.7	49	49	0	0.0
88.0	49	49	0	0.0
89.2	49	49	0	0.0
90.4	49	49	0	0.0
91.6	49	49	0	0.0
92.8	49	49	0	0.0
94.0	49	49	0	0.0
95.2	49	49	0	0.0
96.4	49	49	0	0.0
97.6	49	49	0	0.0
98.8	49	49	0	0.0
Min	49	49	-3	-3.9
Max	214	214	2	4.0
Mean	64	64	0	0.1
Median	49	49	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	92.7
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Jones Pumping Plant Export - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	274	274	0	0.0
2.4	274	274	0	0.0
3.6	274	274	0	0.0
4.8	274	274	0	0.0
6.0	274	274	0	0.0
7.2	274	274	0	0.0
8.4	274	274	0	0.0
9.6	274	274	0	0.0
10.8	274	274	0	0.0
12.0	274	274	0	0.0
13.3	271	271	0	0.0
14.5	266	266	0	0.0
15.7	261	261	0	0.0
16.9	259	259	0	0.0
18.1	244	244	0	0.0
19.3	236	236	0	0.0
20.5	233	233	0	0.0
21.7	215	222	7	3.3
22.9	211	211	0	0.0
24.1	203	205	2	1.0
25.3	202	202	0	0.0
26.5	200	200	0	0.0
27.7	186	186	0	0.0
28.9	186	185	-1	-0.5
30.1	182	182	0	0.0
31.3	179	181	2	1.1
32.5	175	175	0	0.0
33.7	174	175	1	0.6
34.9	172	174	2	1.2
36.1	171	172	1	0.6
37.3	170	170	0	0.0
38.6	169	169	0	0.0
39.8	167	166	-1	-0.6
41.0	163	165	2	1.2
42.2	161	163	2	1.2
43.4	160	161	1	0.6
44.6	160	160	0	0.0
45.8	159	160	1	0.6
47.0	159	159	0	0.0
48.2	158	159	1	0.6
49.4	157	157	0	0.0
50.6	153	153	0	0.0
51.8	150	150	0	0.0
53.0	141	141	0	0.0
54.2	140	140	0	0.0
55.4	136	139	3	2.2
56.6	133	136	3	2.3
57.8	117	117	0	0.0
59.0	115	115	0	0.0
60.2	115	115	0	0.0
61.4	111	111	0	0.0
62.7	110	110	0	0.0
63.9	109	109	0	0.0
65.1	105	105	0	0.0
66.3	101	101	0	0.0
67.5	101	101	0	0.0
68.7	100	101	1	1.0
69.9	99	100	1	1.0
71.1	99	99	0	0.0
72.3	98	99	1	1.0
73.5	98	98	0	0.0
74.7	98	98	0	0.0
75.9	97	98	1	1.0
77.1	96	97	1	1.0
78.3	96	96	0	0.0
79.5	93	96	3	3.2
80.7	91	93	2	2.2
81.9	48	91	43	89.6
83.1	40	48	8	20.0
84.3	39	39	0	0.0
85.5	31	31	0	0.0
86.7	30	30	0	0.0
88.0	26	26	0	0.0
89.2	25	25	0	0.0
90.4	22	22	0	0.0
91.6	20	20	0	0.0
92.8	17	17	0	0.0
94.0	17	17	0	0.0
95.2	15	15	0	0.0
96.4	14	14	0	0.0
97.6	13	13	0	0.0
98.8	7	7	0	0.0
Min	7	7	-1	-0.6
Max	274	274	43	89.6
Mean	147	148	1	1.7
Median	155	155	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		11.0
X>=5.0		2.4
X>=10.0		2.4
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		10.0
X>=5.0		10.0
X>=10.0		10.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**10.0**

Jones Pumping Plant Export - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	283	283	0	0.0
2.4	283	283	0	0.0
3.6	283	283	0	0.0
4.8	283	283	0	0.0
6.0	283	283	0	0.0
7.2	283	283	0	0.0
8.4	283	283	0	0.0
9.6	283	283	0	0.0
10.8	283	283	0	0.0
12.0	283	283	0	0.0
13.3	283	283	0	0.0
14.5	283	283	0	0.0
15.7	283	283	0	0.0
16.9	283	283	0	0.0
18.1	283	283	0	0.0
19.3	283	283	0	0.0
20.5	283	283	0	0.0
21.7	283	283	0	0.0
22.9	283	283	0	0.0
24.1	283	283	0	0.0
25.3	283	283	0	0.0
26.5	283	283	0	0.0
27.7	283	283	0	0.0
28.9	283	283	0	0.0
30.1	283	283	0	0.0
31.3	283	283	0	0.0
32.5	283	283	0	0.0
33.7	283	283	0	0.0
34.9	283	283	0	0.0
36.1	283	283	0	0.0
37.3	283	283	0	0.0
38.6	283	283	0	0.0
39.8	283	283	0	0.0
41.0	283	283	0	0.0
42.2	283	283	0	0.0
43.4	283	283	0	0.0
44.6	283	283	0	0.0
45.8	283	283	0	0.0
47.0	283	283	0	0.0
48.2	283	283	0	0.0
49.4	283	283	0	0.0
50.6	283	283	0	0.0
51.8	283	283	0	0.0
53.0	283	283	0	0.0
54.2	283	283	0	0.0
55.4	283	282	-1	-0.4
56.6	283	282	-1	-0.4
57.8	282	282	0	0.0
59.0	282	282	0	0.0
60.2	282	282	0	0.0
61.4	276	276	0	0.0
62.7	267	272	5	1.9
63.9	262	269	7	2.7
65.1	261	263	2	0.8
66.3	261	261	0	0.0
67.5	260	261	1	0.4
68.7	257	257	0	0.0
69.9	254	250	-4	-1.6
71.1	253	248	-5	-2.0
72.3	247	247	0	0.0
73.5	238	239	1	0.4
74.7	237	239	2	0.8
75.9	229	231	2	0.9
77.1	225	228	3	1.3
78.3	224	224	0	0.0
79.5	218	214	-4	-1.8
80.7	209	212	3	1.4
81.9	204	204	0	0.0
83.1	203	204	1	0.5
84.3	191	190	-1	-0.5
85.5	179	179	0	0.0
86.7	177	174	-3	-1.7
88.0	173	166	-7	-4.0
89.2	164	164	0	0.0
90.4	128	130	2	1.6
91.6	119	118	-1	-0.8
92.8	95	76	-19	-20.0
94.0	76	52	-24	-31.6
95.2	53	51	-2	-3.8
96.4	49	49	0	0.0
97.6	40	40	0	0.0
98.8	37	37	0	0.0
Min	37	37	-24	-31.6
Max	283	283	7	2.7
Mean	247	246	-1	-0.7
Median	283	283	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		2.4
X<=-10.0		2.4
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		10.0
X<=-10.0		10.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-10.0**

Jones Pumping Plant Export - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	283	283	0	0.0
2.4	283	283	0	0.0
3.6	283	283	0	0.0
4.8	283	283	0	0.0
6.0	283	283	0	0.0
7.2	283	283	0	0.0
8.4	283	283	0	0.0
9.6	283	283	0	0.0
10.8	283	283	0	0.0
12.0	283	283	0	0.0
13.3	283	283	0	0.0
14.5	283	283	0	0.0
15.7	283	283	0	0.0
16.9	283	283	0	0.0
18.1	283	283	0	0.0
19.3	283	283	0	0.0
20.5	283	283	0	0.0
21.7	283	283	0	0.0
22.9	283	283	0	0.0
24.1	283	283	0	0.0
25.3	283	283	0	0.0
26.5	283	283	0	0.0
27.7	283	283	0	0.0
28.9	283	283	0	0.0
30.1	283	283	0	0.0
31.3	283	283	0	0.0
32.5	283	283	0	0.0
33.7	283	283	0	0.0
34.9	283	283	0	0.0
36.1	283	283	0	0.0
37.3	283	283	0	0.0
38.6	283	283	0	0.0
39.8	283	283	0	0.0
41.0	283	283	0	0.0
42.2	283	283	0	0.0
43.4	283	283	0	0.0
44.6	283	283	0	0.0
45.8	283	283	0	0.0
47.0	283	283	0	0.0
48.2	283	283	0	0.0
49.4	283	283	0	0.0
50.6	283	283	0	0.0
51.8	283	283	0	0.0
53.0	283	283	0	0.0
54.2	283	283	0	0.0
55.4	283	283	0	0.0
56.6	283	283	0	0.0
57.8	283	283	0	0.0
59.0	283	283	0	0.0
60.2	279	279	0	0.0
61.4	277	279	2	0.7
62.7	275	275	0	0.0
63.9	274	274	0	0.0
65.1	268	270	2	0.7
66.3	261	268	7	2.7
67.5	257	261	4	1.6
68.7	253	253	0	0.0
69.9	246	243	-3	-1.2
71.1	243	238	-5	-2.1
72.3	239	236	-3	-1.3
73.5	234	234	0	0.0
74.7	234	231	-3	-1.3
75.9	213	221	8	3.8
77.1	212	210	-2	-0.9
78.3	209	210	1	0.5
79.5	207	208	1	0.5
80.7	205	208	3	1.5
81.9	200	207	7	3.5
83.1	194	195	1	0.5
84.3	174	191	17	9.8
85.5	166	166	0	0.0
86.7	158	158	0	0.0
88.0	154	145	-9	-5.8
89.2	134	136	2	1.5
90.4	128	134	6	4.7
91.6	124	129	5	4.0
92.8	116	123	7	6.0
94.0	111	116	5	4.5
95.2	111	110	-1	-0.9
96.4	106	108	2	1.9
97.6	76	76	0	0.0
98.8	54	54	0	0.0
Min	54	54	-9	-5.8
Max	283	283	17	9.8
Mean	247	248	1	0.4
Median	283	283	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	79.3
1.1<=X<10.0		14.6
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	45.0
1.1<=X<10.0		50.0
X>=5.0		10.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Jones Pumping Plant Export - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	274	274	0	0.0
2.4	274	274	0	0.0
3.6	274	274	0	0.0
4.8	274	274	0	0.0
6.0	274	274	0	0.0
7.2	274	274	0	0.0
8.4	274	274	0	0.0
9.6	274	274	0	0.0
10.8	274	274	0	0.0
12.0	274	274	0	0.0
13.3	274	274	0	0.0
14.5	274	274	0	0.0
15.7	274	274	0	0.0
16.9	274	274	0	0.0
18.1	274	274	0	0.0
19.3	274	274	0	0.0
20.5	274	274	0	0.0
21.7	274	274	0	0.0
22.9	274	274	0	0.0
24.1	274	274	0	0.0
25.3	274	274	0	0.0
26.5	274	274	0	0.0
27.7	274	274	0	0.0
28.9	274	274	0	0.0
30.1	274	274	0	0.0
31.3	274	274	0	0.0
32.5	274	274	0	0.0
33.7	274	274	0	0.0
34.9	274	274	0	0.0
36.1	274	274	0	0.0
37.3	274	274	0	0.0
38.6	274	274	0	0.0
39.8	273	274	1	0.4
41.0	269	274	5	1.9
42.2	267	273	6	2.2
43.4	266	271	5	1.9
44.6	265	267	2	0.8
45.8	265	267	2	0.8
47.0	263	265	2	0.8
48.2	263	263	0	0.0
49.4	263	263	0	0.0
50.6	262	262	0	0.0
51.8	262	262	0	0.0
53.0	259	261	2	0.8
54.2	255	259	4	1.6
55.4	250	253	3	1.2
56.6	246	250	4	1.6
57.8	245	249	4	1.6
59.0	241	248	7	2.9
60.2	240	246	6	2.5
61.4	236	246	10	4.2
62.7	235	241	6	2.6
63.9	235	240	5	2.1
65.1	235	236	1	0.4
66.3	229	235	6	2.6
67.5	222	235	13	5.9
68.7	219	228	9	4.1
69.9	218	222	4	1.8
71.1	218	219	1	0.5
72.3	216	212	-4	-1.9
73.5	213	210	-3	-1.4
74.7	207	207	0	0.0
75.9	207	203	-4	-1.9
77.1	202	202	0	0.0
78.3	197	197	0	0.0
79.5	189	189	0	0.0
80.7	186	188	2	1.1
81.9	181	185	4	2.2
83.1	174	174	0	0.0
84.3	172	170	-2	-1.2
85.5	169	169	0	0.0
86.7	168	169	1	0.6
88.0	168	168	0	0.0
89.2	165	164	-1	-0.6
90.4	163	162	-1	-0.6
91.6	146	147	1	0.7
92.8	145	145	0	0.0
94.0	133	133	0	0.0
95.2	124	124	0	0.0
96.4	117	117	0	0.0
97.6	85	85	0	0.0
98.8	48	48	0	0.0
Min	48	48	-4	-1.9
Max	274	274	13	5.9
Mean	235	236	1	0.5
Median	263	263	0	0.0

Entire 82-Year Simulation Period

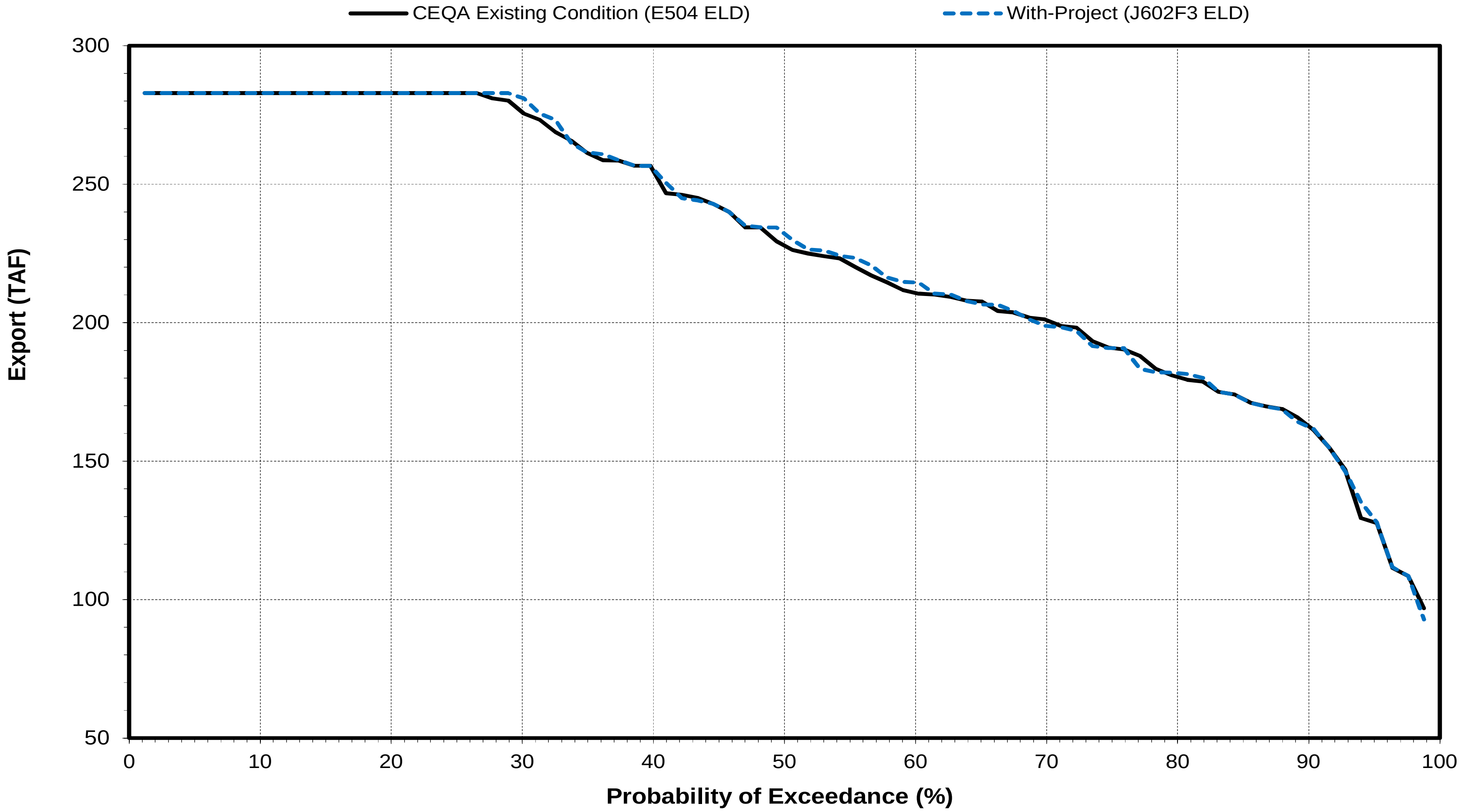
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	73.2
1.1<=X<10.0		22.0
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

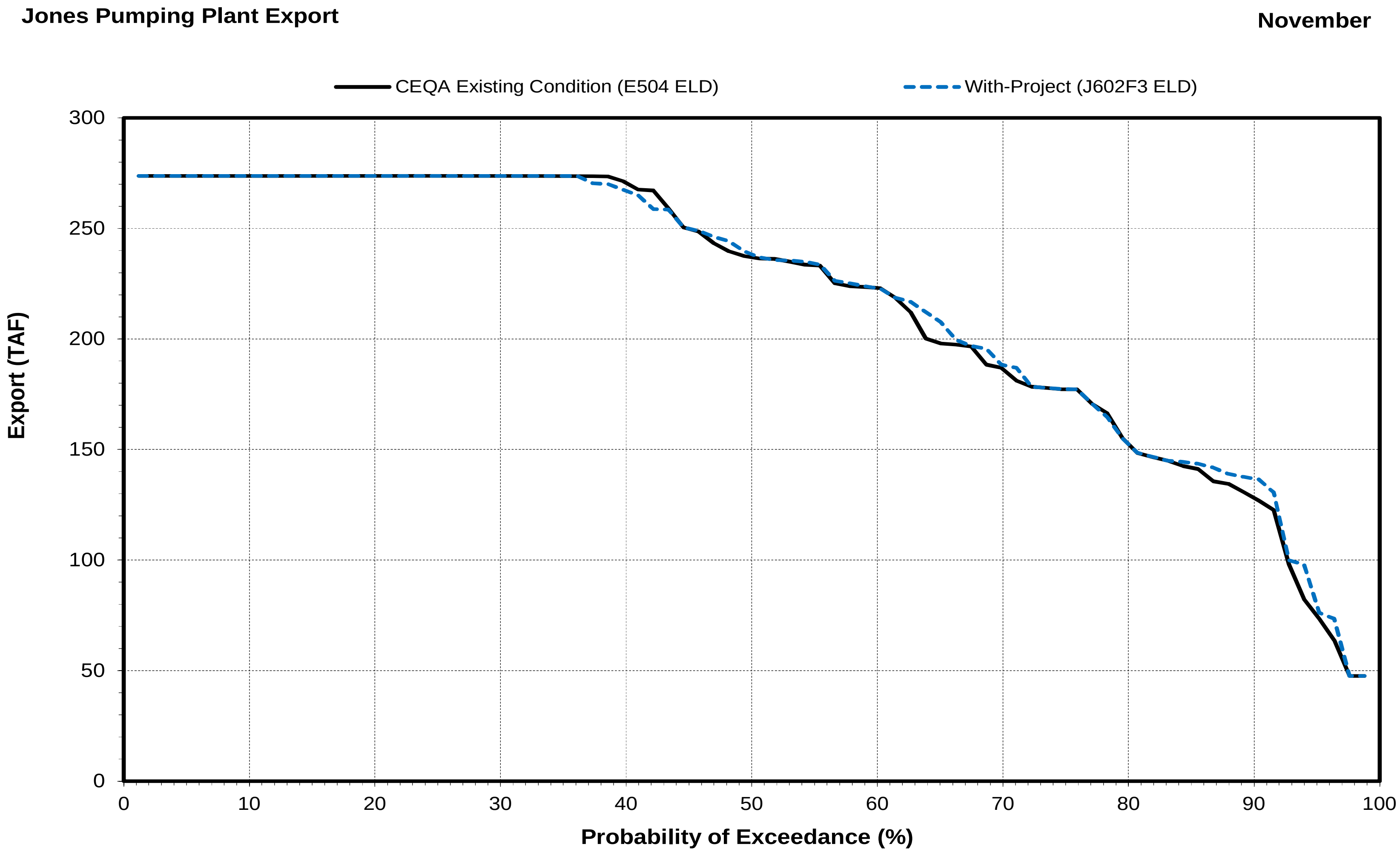
Jones Pumping Plant Export

October



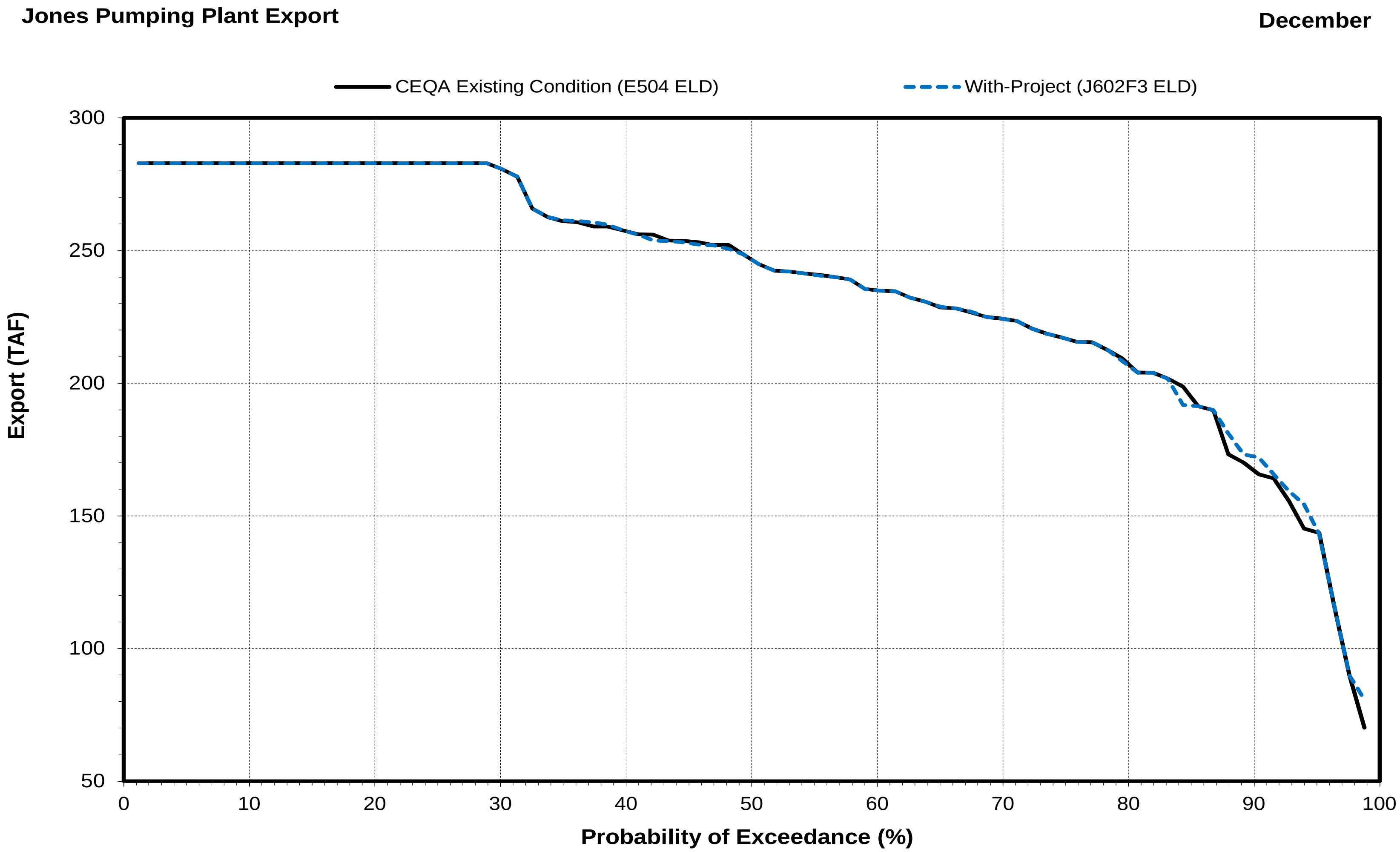
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

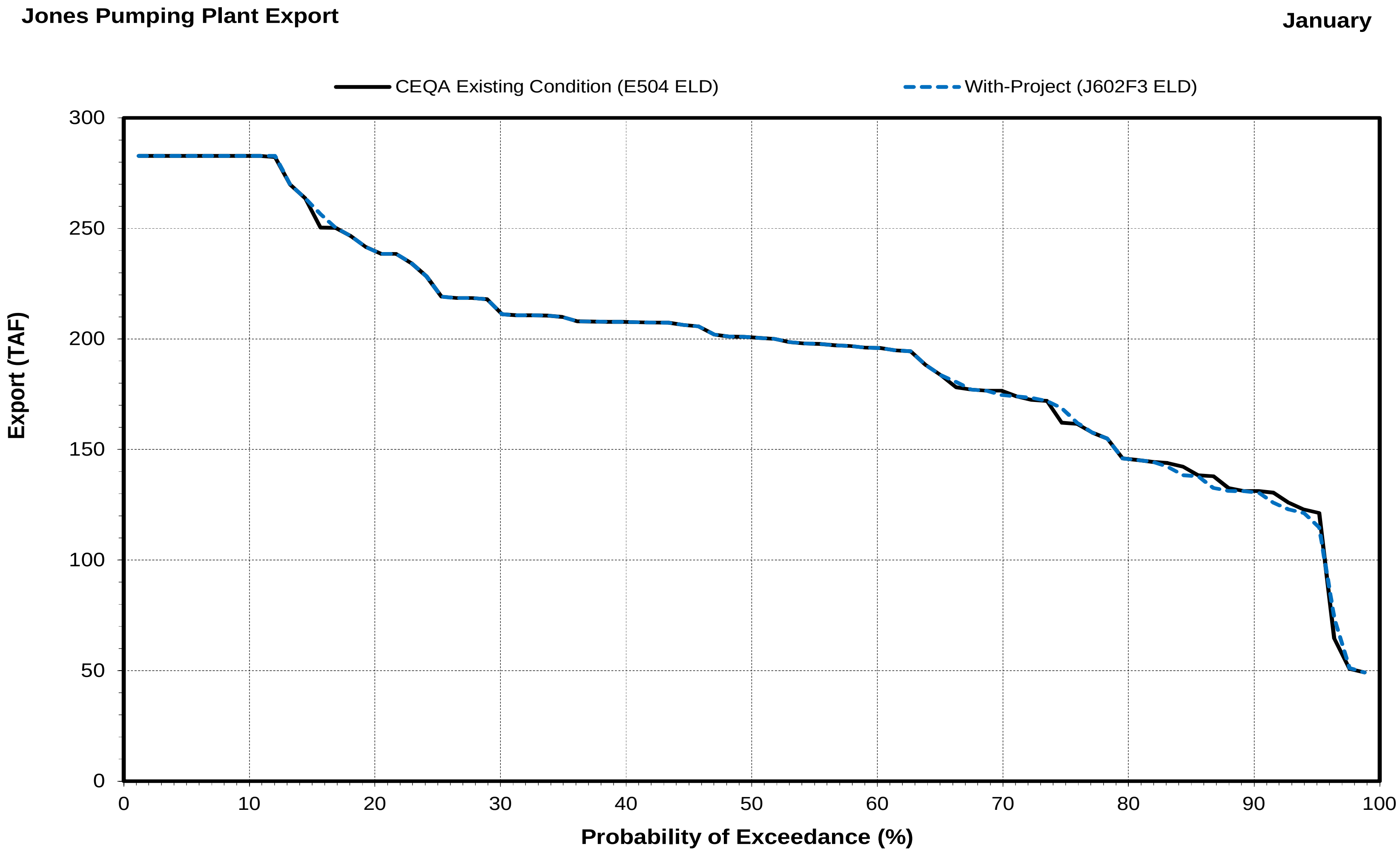


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



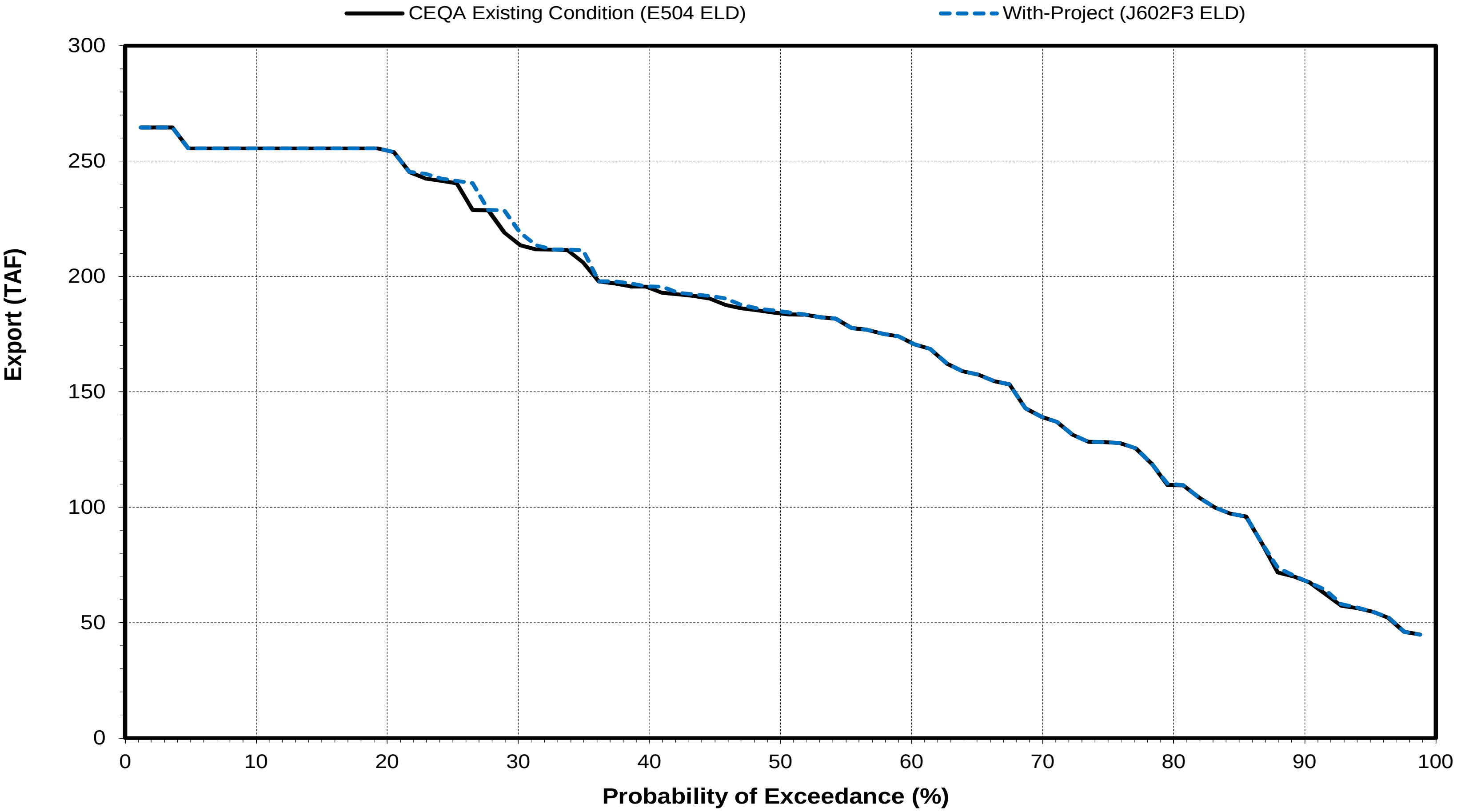
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

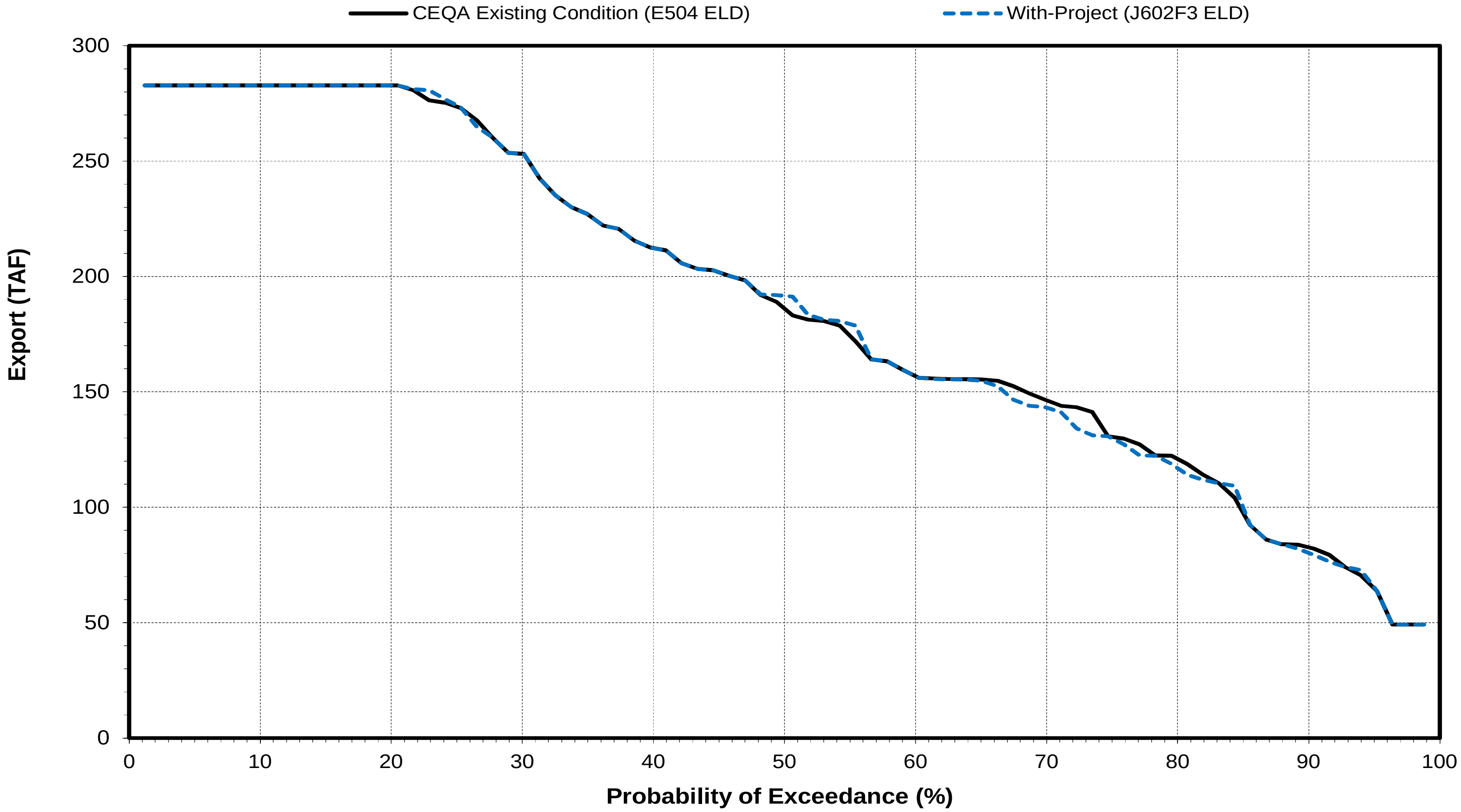
Jones Pumping Plant Export

February



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Jones Pumping Plant Export **March**

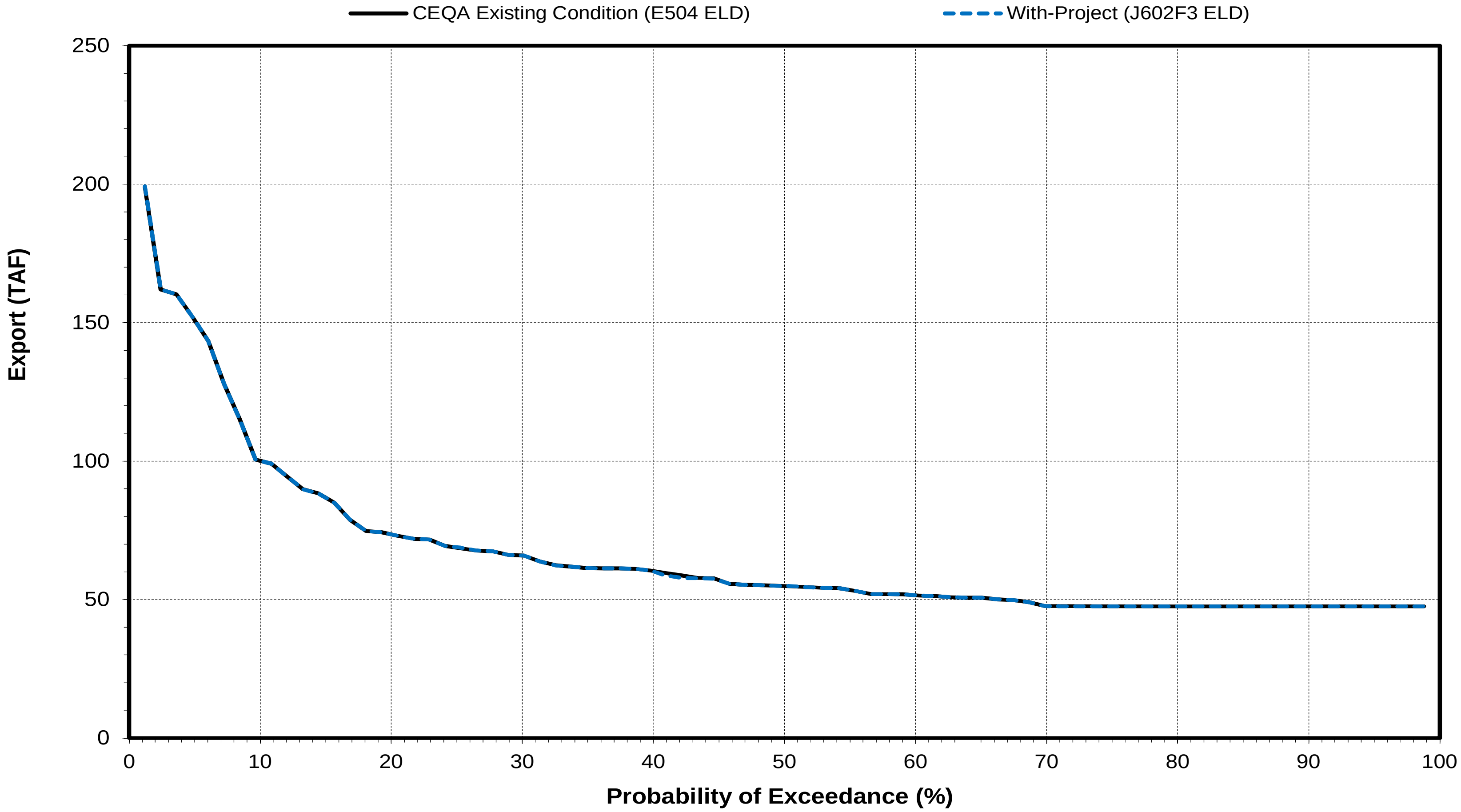


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

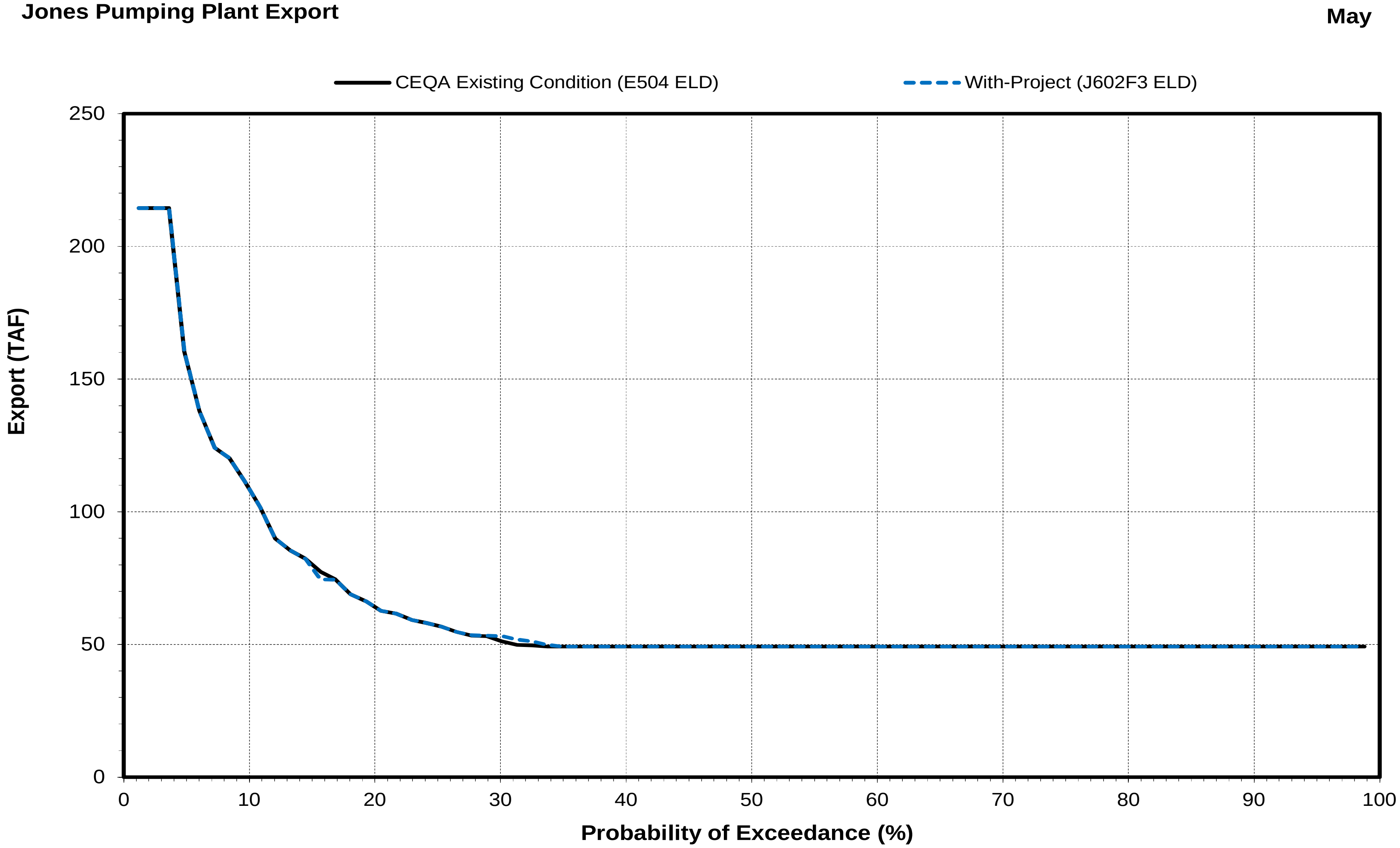
Jones Pumping Plant Export

April



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Jones Pumping Plant Export

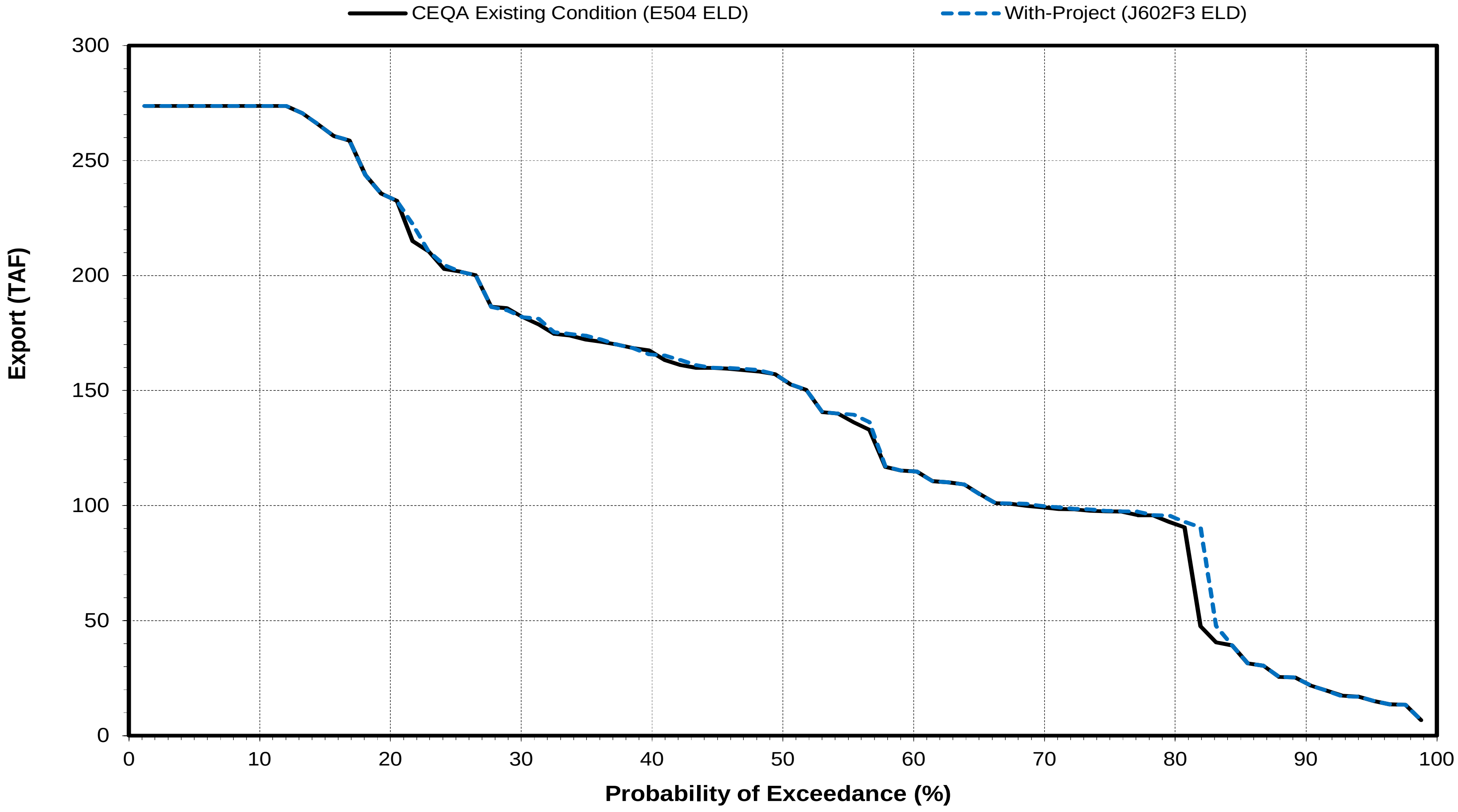


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

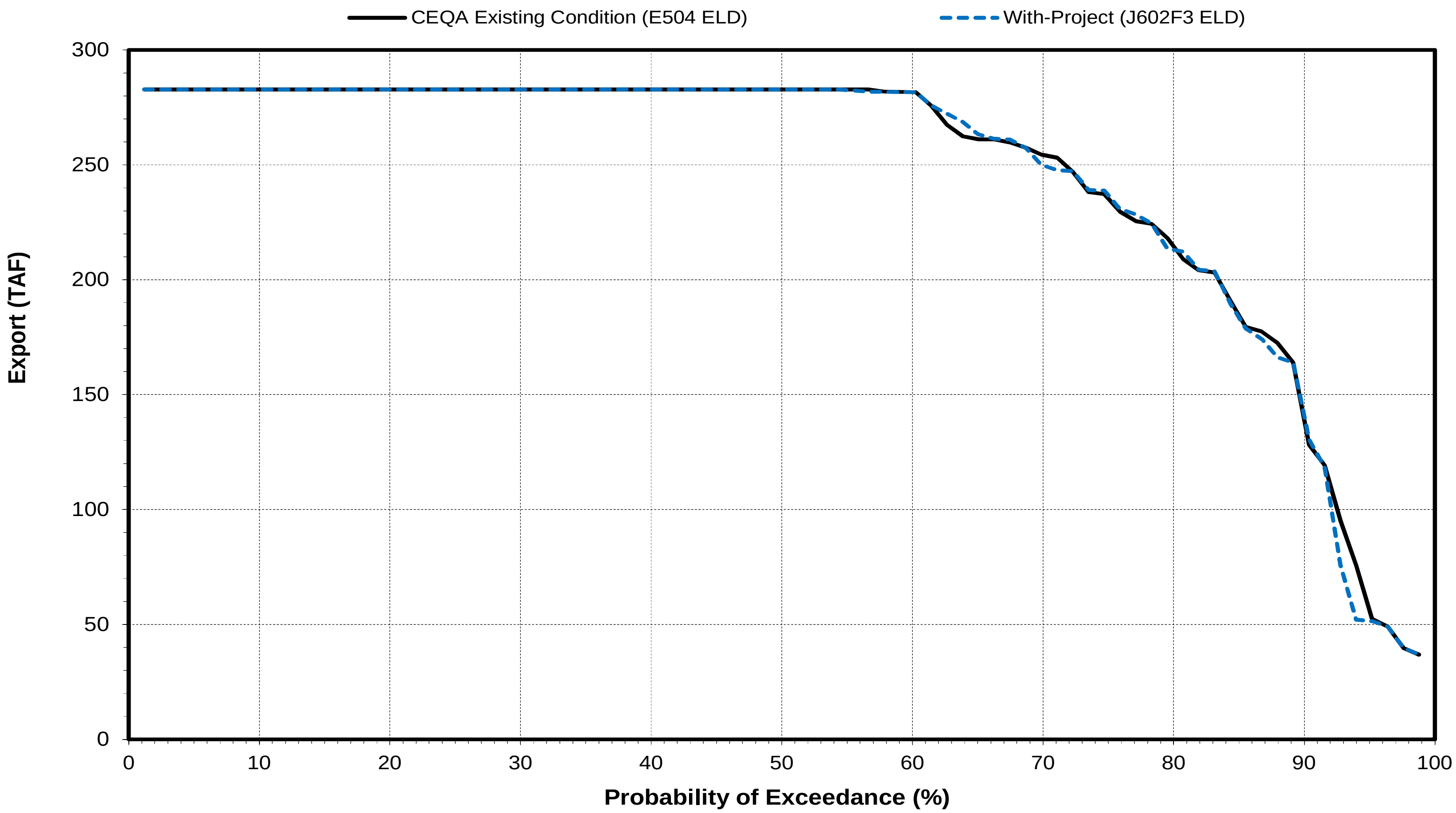
Jones Pumping Plant Export

June



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Jones Pumping Plant Export **July**

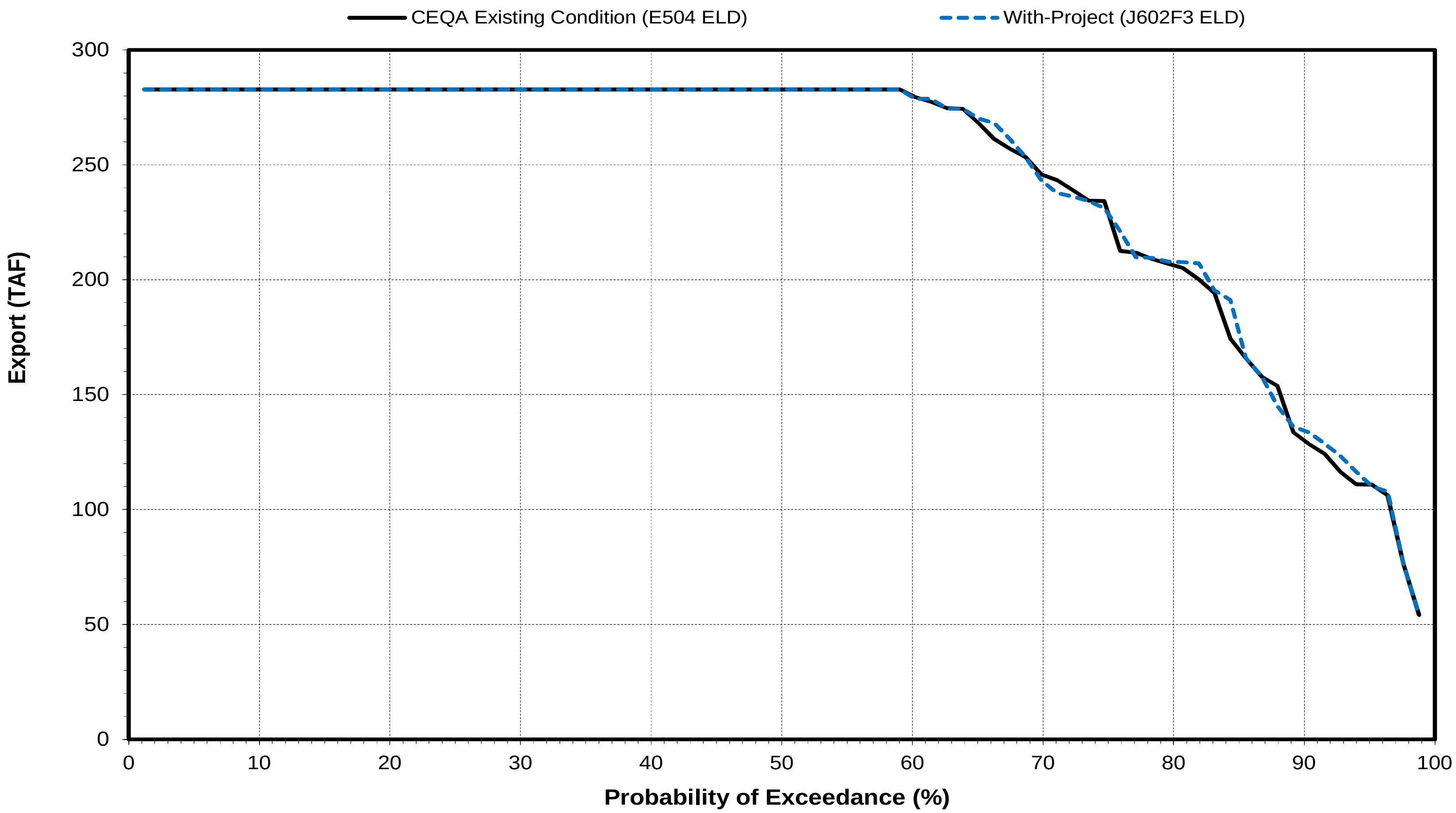


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

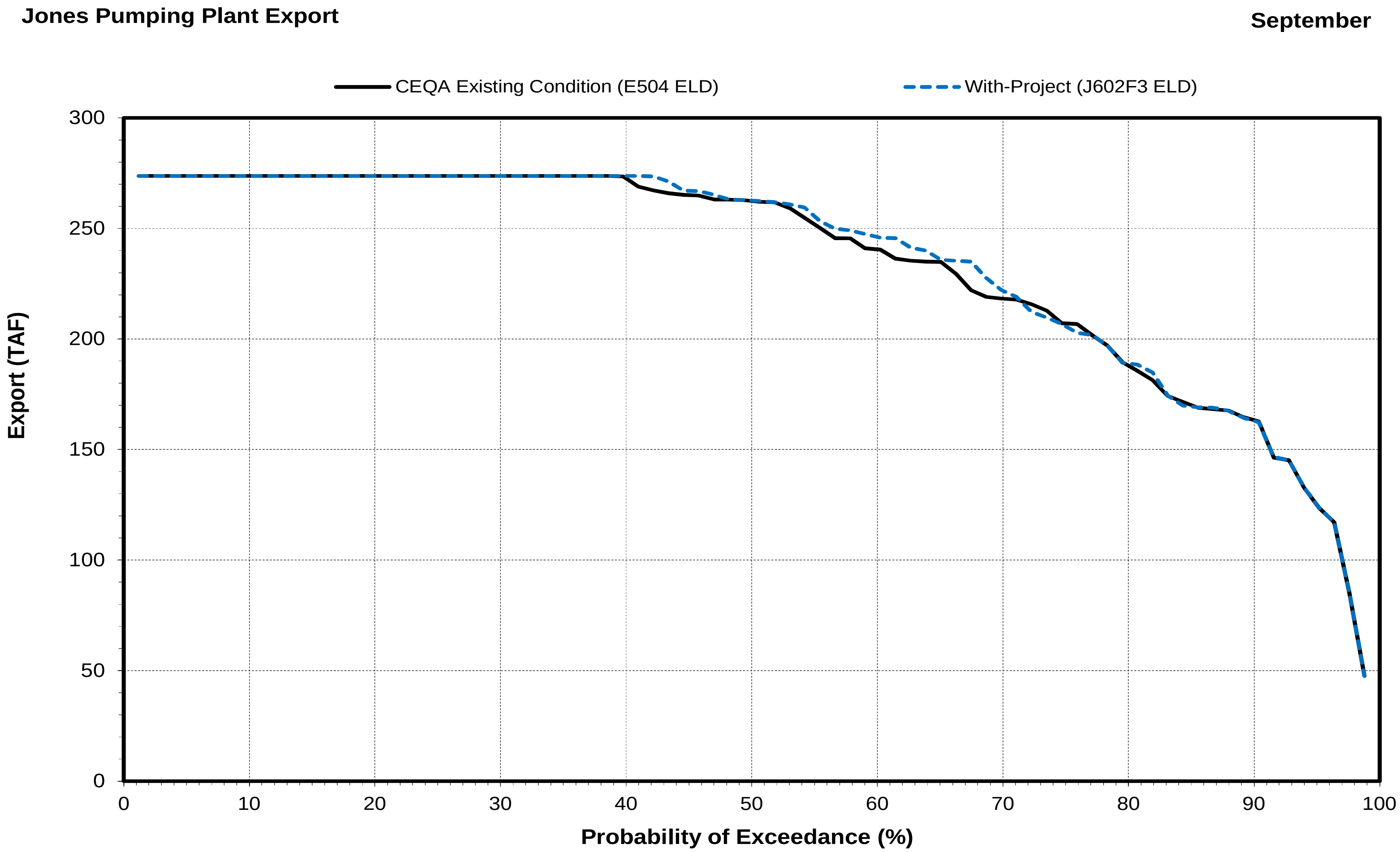
Jones Pumping Plant Export

August



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Banks Pumping Plant Export - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	411	411	0	0.0
2.4	411	411	0	0.0
3.6	411	411	0	0.0
4.8	411	411	0	0.0
6.0	395	395	0	0.0
7.2	391	390	-1	-0.3
8.4	385	387	2	0.5
9.6	383	386	3	0.8
10.8	383	385	2	0.5
12.0	361	361	0	0.0
13.3	347	347	0	0.0
14.5	344	344	0	0.0
15.7	337	337	0	0.0
16.9	328	328	0	0.0
18.1	295	295	0	0.0
19.3	294	294	0	0.0
20.5	294	293	-1	-0.3
21.7	287	287	0	0.0
22.9	284	277	-7	-2.5
24.1	273	273	0	0.0
25.3	272	272	0	0.0
26.5	272	270	-2	-0.7
27.7	267	266	-1	-0.4
28.9	265	265	0	0.0
30.1	261	261	0	0.0
31.3	257	257	0	0.0
32.5	257	256	-1	-0.4
33.7	256	251	-5	-2.0
34.9	251	251	0	0.0
36.1	250	250	0	0.0
37.3	248	246	-2	-0.8
38.6	246	242	-4	-1.6
39.8	242	242	0	0.0
41.0	242	237	-5	-2.1
42.2	232	232	0	0.0
43.4	231	231	0	0.0
44.6	228	229	1	0.4
45.8	224	224	0	0.0
47.0	217	218	1	0.5
48.2	213	217	4	1.9
49.4	213	213	0	0.0
50.6	211	211	0	0.0
51.8	211	211	0	0.0
53.0	208	208	0	0.0
54.2	206	206	0	0.0
55.4	202	202	0	0.0
56.6	199	199	0	0.0
57.8	197	197	0	0.0
59.0	194	194	0	0.0
60.2	187	187	0	0.0
61.4	184	184	0	0.0
62.7	182	182	0	0.0
63.9	178	177	-1	-0.6
65.1	167	167	0	0.0
66.3	166	166	0	0.0
67.5	162	162	0	0.0
68.7	153	153	0	0.0
69.9	148	148	0	0.0
71.1	147	147	0	0.0
72.3	144	144	0	0.0
73.5	144	143	-1	-0.7
74.7	142	142	0	0.0
75.9	141	142	1	0.7
77.1	137	136	-1	-0.7
78.3	122	121	-1	-0.8
79.5	117	117	0	0.0
80.7	111	113	2	1.8
81.9	102	102	0	0.0
83.1	91	93	2	2.2
84.3	88	91	3	3.4
85.5	72	79	7	9.7
86.7	69	71	2	2.9
88.0	68	66	-2	-2.9
89.2	66	59	-7	-10.6
90.4	59	57	-2	-3.4
91.6	44	44	0	0.0
92.8	34	34	0	0.0
94.0	27	27	0	0.0
95.2	24	24	0	0.0
96.4	22	22	0	0.0
97.6	18	18	0	0.0
98.8	18	18	0	0.0
Min	18	18	-7	-10.6
Max	411	411	7	9.7
Mean	211	211	0	-0.1
Median	212	212	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		7.3
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		7.3
X<=-5.0		1.2
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		25.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		5.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-5.0**

Banks Pumping Plant Export - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	397	397	0	0.0
2.4	397	397	0	0.0
3.6	397	397	0	0.0
4.8	397	397	0	0.0
6.0	397	397	0	0.0
7.2	397	397	0	0.0
8.4	397	397	0	0.0
9.6	397	397	0	0.0
10.8	397	397	0	0.0
12.0	397	397	0	0.0
13.3	397	397	0	0.0
14.5	397	397	0	0.0
15.7	397	397	0	0.0
16.9	397	397	0	0.0
18.1	397	397	0	0.0
19.3	375	375	0	0.0
20.5	364	365	1	0.3
21.7	362	362	0	0.0
22.9	339	339	0	0.0
24.1	319	319	0	0.0
25.3	313	313	0	0.0
26.5	294	296	2	0.7
27.7	283	283	0	0.0
28.9	274	274	0	0.0
30.1	265	265	0	0.0
31.3	264	264	0	0.0
32.5	253	253	0	0.0
33.7	252	252	0	0.0
34.9	247	244	-3	-1.2
36.1	244	240	-4	-1.6
37.3	240	235	-5	-2.1
38.6	235	233	-2	-0.9
39.8	234	227	-7	-3.0
41.0	227	225	-2	-0.9
42.2	225	225	0	0.0
43.4	223	222	-1	-0.4
44.6	223	221	-2	-0.9
45.8	221	214	-7	-3.2
47.0	214	210	-4	-1.9
48.2	210	208	-2	-1.0
49.4	208	206	-2	-1.0
50.6	206	205	-1	-0.5
51.8	205	202	-3	-1.5
53.0	205	199	-6	-2.9
54.2	198	196	-2	-1.0
55.4	195	194	-1	-0.5
56.6	194	194	0	0.0
57.8	191	191	0	0.0
59.0	191	191	0	0.0
60.2	188	188	0	0.0
61.4	185	185	0	0.0
62.7	182	184	2	1.1
63.9	180	180	0	0.0
65.1	177	177	0	0.0
66.3	168	168	0	0.0
67.5	166	168	2	1.2
68.7	166	166	0	0.0
69.9	164	165	1	0.6
71.1	158	161	3	1.9
72.3	157	157	0	0.0
73.5	154	154	0	0.0
74.7	150	150	0	0.0
75.9	149	149	0	0.0
77.1	147	148	1	0.7
78.3	142	142	0	0.0
79.5	135	135	0	0.0
80.7	134	134	0	0.0
81.9	131	131	0	0.0
83.1	123	120	-3	-2.4
84.3	120	118	-2	-1.7
85.5	118	110	-8	-6.8
86.7	110	108	-2	-1.8
88.0	108	107	-1	-0.9
89.2	105	105	0	0.0
90.4	95	96	1	1.1
91.6	92	92	0	0.0
92.8	82	80	-2	-2.4
94.0	80	77	-3	-3.8
95.2	77	72	-5	-6.5
96.4	67	69	2	3.0
97.6	54	54	0	0.0
98.8	31	31	0	0.0
Min	31	31	-8	-6.8
Max	397	397	3	3.0
Mean	229	228	-1	-0.5
Median	207	206	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	75.6
1.1<=X<10.0		6.1
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		18.3
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		35.0
X<=-5.0		10.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Banks Pumping Plant Export - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	472	472	0	0.0
2.4	472	472	0	0.0
3.6	472	472	0	0.0
4.8	472	472	0	0.0
6.0	453	453	0	0.0
7.2	442	442	0	0.0
8.4	441	441	0	0.0
9.6	438	438	0	0.0
10.8	437	437	0	0.0
12.0	437	437	0	0.0
13.3	437	437	0	0.0
14.5	436	436	0	0.0
15.7	436	436	0	0.0
16.9	435	435	0	0.0
18.1	435	435	0	0.0
19.3	434	434	0	0.0
20.5	433	433	0	0.0
21.7	433	433	0	0.0
22.9	433	433	0	0.0
24.1	433	433	0	0.0
25.3	433	433	0	0.0
26.5	433	433	0	0.0
27.7	432	432	0	0.0
28.9	432	432	0	0.0
30.1	432	432	0	0.0
31.3	431	431	0	0.0
32.5	430	429	-1	-0.2
33.7	429	422	-7	-1.6
34.9	415	418	3	0.7
36.1	405	404	-1	-0.2
37.3	377	377	0	0.0
38.6	365	365	0	0.0
39.8	319	318	-1	-0.3
41.0	318	318	0	0.0
42.2	317	317	0	0.0
43.4	289	289	0	0.0
44.6	266	266	0	0.0
45.8	263	263	0	0.0
47.0	261	261	0	0.0
48.2	256	256	0	0.0
49.4	254	254	0	0.0
50.6	254	254	0	0.0
51.8	254	254	0	0.0
53.0	252	252	0	0.0
54.2	245	247	2	0.8
55.4	243	245	2	0.8
56.6	242	242	0	0.0
57.8	242	242	0	0.0
59.0	241	241	0	0.0
60.2	240	240	0	0.0
61.4	239	239	0	0.0
62.7	237	237	0	0.0
63.9	235	235	0	0.0
65.1	235	235	0	0.0
66.3	235	235	0	0.0
67.5	232	232	0	0.0
68.7	229	229	0	0.0
69.9	228	228	0	0.0
71.1	224	224	0	0.0
72.3	223	223	0	0.0
73.5	221	221	0	0.0
74.7	219	219	0	0.0
75.9	216	216	0	0.0
77.1	215	215	0	0.0
78.3	213	213	0	0.0
79.5	210	210	0	0.0
80.7	205	204	-1	-0.5
81.9	204	204	0	0.0
83.1	204	204	0	0.0
84.3	202	204	2	1.0
85.5	191	191	0	0.0
86.7	190	190	0	0.0
88.0	181	181	0	0.0
89.2	173	173	0	0.0
90.4	167	166	-1	-0.6
91.6	158	158	0	0.0
92.8	149	149	0	0.0
94.0	146	146	0	0.0
95.2	129	129	0	0.0
96.4	107	115	8	7.5
97.6	88	88	0	0.0
98.8	86	86	0	0.0
Min	86	86	-7	-1.6
Max	472	472	8	7.5
Mean	303	303	0	0.1
Median	254	254	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	97.6
1.1<=X<10.0		1.2
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Banks Pumping Plant Export - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	523	523	0	0.0
2.4	523	523	0	0.0
3.6	523	523	0	0.0
4.8	512	507	-5	-1.0
6.0	451	451	0	0.0
7.2	395	395	0	0.0
8.4	377	377	0	0.0
9.6	373	373	0	0.0
10.8	369	363	-6	-1.6
12.0	359	359	0	0.0
13.3	327	317	-10	-3.1
14.5	309	309	0	0.0
15.7	283	283	0	0.0
16.9	283	270	-13	-4.6
18.1	270	264	-6	-2.2
19.3	264	264	0	0.0
20.5	250	250	0	0.0
21.7	247	247	0	0.0
22.9	243	246	3	1.2
24.1	242	242	0	0.0
25.3	239	239	0	0.0
26.5	238	238	0	0.0
27.7	234	234	0	0.0
28.9	228	231	3	1.3
30.1	222	228	6	2.7
31.3	219	219	0	0.0
32.5	219	219	0	0.0
33.7	218	218	0	0.0
34.9	211	211	0	0.0
36.1	211	211	0	0.0
37.3	211	211	0	0.0
38.6	210	210	0	0.0
39.8	208	208	0	0.0
41.0	208	208	0	0.0
42.2	208	208	0	0.0
43.4	208	208	0	0.0
44.6	207	207	0	0.0
45.8	207	207	0	0.0
47.0	206	206	0	0.0
48.2	206	206	0	0.0
49.4	205	205	0	0.0
50.6	202	202	0	0.0
51.8	201	201	0	0.0
53.0	201	201	0	0.0
54.2	200	200	0	0.0
55.4	200	200	0	0.0
56.6	199	199	0	0.0
57.8	198	198	0	0.0
59.0	198	198	0	0.0
60.2	197	197	0	0.0
61.4	197	197	0	0.0
62.7	196	196	0	0.0
63.9	196	196	0	0.0
65.1	195	195	0	0.0
66.3	194	195	1	0.5
67.5	194	194	0	0.0
68.7	188	188	0	0.0
69.9	186	186	0	0.0
71.1	184	184	0	0.0
72.3	177	177	0	0.0
73.5	177	177	0	0.0
74.7	174	174	0	0.0
75.9	172	172	0	0.0
77.1	168	168	0	0.0
78.3	162	162	0	0.0
79.5	158	158	0	0.0
80.7	155	155	0	0.0
81.9	146	146	0	0.0
83.1	145	145	0	0.0
84.3	144	144	0	0.0
85.5	142	142	0	0.0
86.7	140	138	-2	-1.4
88.0	138	138	0	0.0
89.2	138	133	-5	-3.6
90.4	133	131	-2	-1.5
91.6	131	131	0	0.0
92.8	131	130	-1	-0.8
94.0	130	126	-4	-3.1
95.2	126	123	-3	-2.4
96.4	123	115	-8	-6.5
97.6	32	32	0	0.0
98.8	18	18	0	0.0
Min	18	18	-13	-6.5
Max	523	523	6	2.7
Mean	224	223	-1	-0.3
Median	204	204	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		12.2
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Banks Pumping Plant Export - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	472	472	0	0.0
2.4	472	472	0	0.0
3.6	472	472	0	0.0
4.8	472	472	0	0.0
6.0	472	472	0	0.0
7.2	472	472	0	0.0
8.4	471	456	-15	-3.2
9.6	455	455	0	0.0
10.8	424	424	0	0.0
12.0	390	390	0	0.0
13.3	360	366	6	1.7
14.5	359	359	0	0.0
15.7	358	358	0	0.0
16.9	355	355	0	0.0
18.1	348	348	0	0.0
19.3	325	325	0	0.0
20.5	321	316	-5	-1.6
21.7	305	304	-1	-0.3
22.9	298	289	-9	-3.0
24.1	289	283	-6	-2.1
25.3	283	280	-3	-1.1
26.5	270	270	0	0.0
27.7	260	260	0	0.0
28.9	260	260	0	0.0
30.1	254	254	0	0.0
31.3	242	242	0	0.0
32.5	241	241	0	0.0
33.7	240	240	0	0.0
34.9	240	240	0	0.0
36.1	229	229	0	0.0
37.3	229	229	0	0.0
38.6	219	219	0	0.0
39.8	214	214	0	0.0
41.0	212	212	0	0.0
42.2	212	212	0	0.0
43.4	211	211	0	0.0
44.6	206	206	0	0.0
45.8	198	198	0	0.0
47.0	198	198	0	0.0
48.2	196	196	0	0.0
49.4	196	196	0	0.0
50.6	193	193	0	0.0
51.8	192	192	0	0.0
53.0	192	192	0	0.0
54.2	190	190	0	0.0
55.4	188	188	0	0.0
56.6	186	186	0	0.0
57.8	185	185	0	0.0
59.0	185	185	0	0.0
60.2	184	184	0	0.0
61.4	184	184	0	0.0
62.7	184	184	0	0.0
63.9	182	182	0	0.0
65.1	179	179	0	0.0
66.3	178	178	0	0.0
67.5	177	177	0	0.0
68.7	177	177	0	0.0
69.9	175	175	0	0.0
71.1	174	174	0	0.0
72.3	171	171	0	0.0
73.5	169	169	0	0.0
74.7	158	158	0	0.0
75.9	155	155	0	0.0
77.1	153	153	0	0.0
78.3	143	143	0	0.0
79.5	139	139	0	0.0
80.7	137	137	0	0.0
81.9	131	131	0	0.0
83.1	128	128	0	0.0
84.3	128	128	0	0.0
85.5	126	126	0	0.0
86.7	119	119	0	0.0
88.0	110	110	0	0.0
89.2	104	104	0	0.0
90.4	100	100	0	0.0
91.6	98	98	0	0.0
92.8	97	97	0	0.0
94.0	96	96	0	0.0
95.2	84	84	0	0.0
96.4	74	74	0	0.0
97.6	38	38	0	0.0
98.8	18	18	0	0.0
Min	18	18	-15	-3.2
Max	472	472	6	1.7
Mean	228	227	0	-0.1
Median	195	195	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	92.7
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Banks Pumping Plant Export - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	465	465	0	0.0
2.4	465	465	0	0.0
3.6	465	465	0	0.0
4.8	465	465	0	0.0
6.0	465	465	0	0.0
7.2	465	465	0	0.0
8.4	465	465	0	0.0
9.6	465	465	0	0.0
10.8	465	465	0	0.0
12.0	422	421	-1	-0.2
13.3	421	418	-3	-0.7
14.5	387	387	0	0.0
15.7	387	387	0	0.0
16.9	384	384	0	0.0
18.1	383	383	0	0.0
19.3	367	367	0	0.0
20.5	367	367	0	0.0
21.7	365	365	0	0.0
22.9	358	358	0	0.0
24.1	354	353	-1	-0.3
25.3	350	350	0	0.0
26.5	332	335	3	0.9
27.7	331	331	0	0.0
28.9	318	318	0	0.0
30.1	315	315	0	0.0
31.3	313	313	0	0.0
32.5	307	307	0	0.0
33.7	307	307	0	0.0
34.9	296	296	0	0.0
36.1	292	292	0	0.0
37.3	260	260	0	0.0
38.6	254	254	0	0.0
39.8	253	253	0	0.0
41.0	252	243	-9	-3.6
42.2	243	236	-7	-2.9
43.4	236	235	-1	-0.4
44.6	235	232	-3	-1.3
45.8	230	230	0	0.0
47.0	227	227	0	0.0
48.2	223	223	0	0.0
49.4	222	222	0	0.0
50.6	218	218	0	0.0
51.8	217	217	0	0.0
53.0	215	215	0	0.0
54.2	213	213	0	0.0
55.4	211	211	0	0.0
56.6	206	206	0	0.0
57.8	203	203	0	0.0
59.0	203	203	0	0.0
60.2	197	202	5	2.5
61.4	195	197	2	1.0
62.7	192	195	3	1.6
63.9	191	192	1	0.5
65.1	181	191	10	5.5
66.3	181	181	0	0.0
67.5	179	181	2	1.1
68.7	163	179	16	9.8
69.9	161	164	3	1.9
71.1	159	163	4	2.5
72.3	156	161	5	3.2
73.5	156	159	3	1.9
74.7	155	156	1	0.6
75.9	152	155	3	2.0
77.1	149	152	3	2.0
78.3	149	149	0	0.0
79.5	147	147	0	0.0
80.7	144	144	0	0.0
81.9	143	143	0	0.0
83.1	141	141	0	0.0
84.3	131	131	0	0.0
85.5	119	119	0	0.0
86.7	110	110	0	0.0
88.0	107	109	2	1.9
89.2	103	103	0	0.0
90.4	101	101	0	0.0
91.6	82	82	0	0.0
92.8	79	79	0	0.0
94.0	74	74	0	0.0
95.2	64	64	0	0.0
96.4	49	49	0	0.0
97.6	18	18	0	0.0
98.8	18	18	0	0.0
Min	18	18	-9	-3.6
Max	465	465	16	9.8
Mean	246	247	1	0.4
Median	220	220	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	81.7
1.1<=X<10.0		14.6
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Banks Pumping Plant Export - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	364	364	0	0.0
2.4	200	200	0	0.0
3.6	160	160	0	0.0
4.8	152	152	0	0.0
6.0	144	144	0	0.0
7.2	128	128	0	0.0
8.4	115	115	0	0.0
9.6	101	101	0	0.0
10.8	99	99	0	0.0
12.0	94	94	0	0.0
13.3	90	90	0	0.0
14.5	85	85	0	0.0
15.7	75	75	0	0.0
16.9	74	74	0	0.0
18.1	73	73	0	0.0
19.3	72	72	0	0.0
20.5	72	72	0	0.0
21.7	69	69	0	0.0
22.9	69	69	0	0.0
24.1	68	68	0	0.0
25.3	67	67	0	0.0
26.5	66	66	0	0.0
27.7	66	66	0	0.0
28.9	64	65	1	1.6
30.1	64	64	0	0.0
31.3	62	62	0	0.0
32.5	61	61	0	0.0
33.7	61	61	0	0.0
34.9	61	61	0	0.0
36.1	61	61	0	0.0
37.3	59	59	0	0.0
38.6	58	58	0	0.0
39.8	58	58	0	0.0
41.0	56	58	2	3.6
42.2	56	56	0	0.0
43.4	55	55	0	0.0
44.6	55	55	0	0.0
45.8	55	55	0	0.0
47.0	55	55	0	0.0
48.2	54	54	0	0.0
49.4	54	54	0	0.0
50.6	54	54	0	0.0
51.8	53	53	0	0.0
53.0	52	52	0	0.0
54.2	52	52	0	0.0
55.4	52	52	0	0.0
56.6	51	51	0	0.0
57.8	51	51	0	0.0
59.0	51	51	0	0.0
60.2	51	51	0	0.0
61.4	50	50	0	0.0
62.7	50	50	0	0.0
63.9	49	49	0	0.0
65.1	48	48	0	0.0
66.3	47	47	0	0.0
67.5	47	47	0	0.0
68.7	46	46	0	0.0
69.9	45	45	0	0.0
71.1	43	43	0	0.0
72.3	42	42	0	0.0
73.5	42	42	0	0.0
74.7	42	42	0	0.0
75.9	42	42	0	0.0
77.1	42	42	0	0.0
78.3	42	42	0	0.0
79.5	42	42	0	0.0
80.7	42	42	0	0.0
81.9	42	42	0	0.0
83.1	42	42	0	0.0
84.3	42	42	0	0.0
85.5	42	42	0	0.0
86.7	42	42	0	0.0
88.0	39	39	0	0.0
89.2	33	34	1	3.0
90.4	27	27	0	0.0
91.6	21	21	0	0.0
92.8	18	18	0	0.0
94.0	18	18	0	0.0
95.2	18	18	0	0.0
96.4	18	18	0	0.0
97.6	18	18	0	0.0
98.8	18	18	0	0.0
Min	18	18	0	0.0
Max	364	364	2	3.6
Mean	64	64	0	0.1
Median	54	54	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	96.3
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Banks Pumping Plant Export - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	380	380	0	0.0
2.4	380	380	0	0.0
3.6	248	248	0	0.0
4.8	160	160	0	0.0
6.0	138	138	0	0.0
7.2	124	124	0	0.0
8.4	120	120	0	0.0
9.6	111	111	0	0.0
10.8	106	106	0	0.0
12.0	102	102	0	0.0
13.3	90	90	0	0.0
14.5	85	85	0	0.0
15.7	82	82	0	0.0
16.9	77	75	-2	-2.6
18.1	74	74	0	0.0
19.3	63	63	0	0.0
20.5	62	62	0	0.0
21.7	59	59	0	0.0
22.9	58	58	0	0.0
24.1	57	57	0	0.0
25.3	55	55	0	0.0
26.5	55	55	0	0.0
27.7	53	53	0	0.0
28.9	53	53	0	0.0
30.1	51	51	0	0.0
31.3	50	50	0	0.0
32.5	49	49	0	0.0
33.7	49	49	0	0.0
34.9	49	49	0	0.0
36.1	44	44	0	0.0
37.3	43	43	0	0.0
38.6	43	43	0	0.0
39.8	43	43	0	0.0
41.0	43	43	0	0.0
42.2	43	43	0	0.0
43.4	43	43	0	0.0
44.6	43	43	0	0.0
45.8	43	43	0	0.0
47.0	43	43	0	0.0
48.2	43	43	0	0.0
49.4	43	43	0	0.0
50.6	43	43	0	0.0
51.8	43	43	0	0.0
53.0	43	43	0	0.0
54.2	43	43	0	0.0
55.4	43	43	0	0.0
56.6	43	43	0	0.0
57.8	43	43	0	0.0
59.0	43	43	0	0.0
60.2	43	43	0	0.0
61.4	43	43	0	0.0
62.7	43	43	0	0.0
63.9	43	43	0	0.0
65.1	43	43	0	0.0
66.3	43	43	0	0.0
67.5	43	43	0	0.0
68.7	43	43	0	0.0
69.9	43	43	0	0.0
71.1	43	43	0	0.0
72.3	43	43	0	0.0
73.5	43	43	0	0.0
74.7	43	43	0	0.0
75.9	43	43	0	0.0
77.1	43	43	0	0.0
78.3	43	43	0	0.0
79.5	43	43	0	0.0
80.7	43	43	0	0.0
81.9	43	43	0	0.0
83.1	43	43	0	0.0
84.3	43	43	0	0.0
85.5	43	43	0	0.0
86.7	43	43	0	0.0
88.0	43	43	0	0.0
89.2	39	42	3	7.7
90.4	28	28	0	0.0
91.6	18	18	0	0.0
92.8	18	18	0	0.0
94.0	18	18	0	0.0
95.2	18	18	0	0.0
96.4	18	18	0	0.0
97.6	18	18	0	0.0
98.8	18	18	0	0.0
Min	18	18	-2	-2.6
Max	380	380	3	7.7
Mean	63	63	0	0.1
Median	43	43	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	97.6
1.1<=X<10.0		1.2
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Banks Pumping Plant Export - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	397	397	0	0.0
2.4	397	397	0	0.0
3.6	397	397	0	0.0
4.8	397	397	0	0.0
6.0	397	397	0	0.0
7.2	397	397	0	0.0
8.4	364	364	0	0.0
9.6	348	348	0	0.0
10.8	317	317	0	0.0
12.0	313	313	0	0.0
13.3	266	266	0	0.0
14.5	261	261	0	0.0
15.7	259	259	0	0.0
16.9	258	258	0	0.0
18.1	247	251	4	1.6
19.3	244	244	0	0.0
20.5	236	236	0	0.0
21.7	232	232	0	0.0
22.9	202	202	0	0.0
24.1	200	200	0	0.0
25.3	186	186	0	0.0
26.5	176	177	1	0.6
27.7	174	174	0	0.0
28.9	172	172	0	0.0
30.1	171	169	-2	-1.2
31.3	169	163	-6	-3.6
32.5	161	161	0	0.0
33.7	161	161	0	0.0
34.9	160	160	0	0.0
36.1	160	160	0	0.0
37.3	159	159	0	0.0
38.6	159	159	0	0.0
39.8	157	157	0	0.0
41.0	153	153	0	0.0
42.2	153	151	-2	-1.3
43.4	151	150	-1	-0.7
44.6	150	146	-4	-2.7
45.8	146	146	0	0.0
47.0	144	144	0	0.0
48.2	141	141	0	0.0
49.4	140	140	0	0.0
50.6	121	119	-2	-1.7
51.8	115	115	0	0.0
53.0	115	115	0	0.0
54.2	112	113	1	0.9
55.4	111	111	0	0.0
56.6	110	110	0	0.0
57.8	109	109	0	0.0
59.0	101	105	4	4.0
60.2	101	101	0	0.0
61.4	100	101	1	1.0
62.7	99	100	1	1.0
63.9	99	99	0	0.0
65.1	98	99	1	1.0
66.3	98	98	0	0.0
67.5	98	98	0	0.0
68.7	97	98	1	1.0
69.9	96	97	1	1.0
71.1	96	96	0	0.0
72.3	95	96	1	1.1
73.5	93	95	2	2.2
74.7	91	93	2	2.2
75.9	89	91	2	2.2
77.1	72	88	16	22.2
78.3	55	68	13	23.6
79.5	37	55	18	48.6
80.7	23	39	16	69.6
81.9	18	21	3	16.7
83.1	18	18	0	0.0
84.3	18	18	0	0.0
85.5	18	18	0	0.0
86.7	18	18	0	0.0
88.0	18	18	0	0.0
89.2	18	18	0	0.0
90.4	18	18	0	0.0
91.6	17	17	0	0.0
92.8	15	15	0	0.0
94.0	14	14	0	0.0
95.2	13	13	0	0.0
96.4	12	12	0	0.0
97.6	9	9	0	0.0
98.8	1	1	0	0.0
Min	1	1	-6	-3.6
Max	397	397	18	69.6
Mean	148	149	1	2.3
Median	131	130	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	80.5
1.1<=X<10.0		7.3
X>=5.0		6.1
X>=10.0		6.1
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**6.1**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		5.0
X>=5.0		25.0
X>=10.0		25.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**25.0**

Banks Pumping Plant Export - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	441	441	0	0.0
2.4	437	437	0	0.0
3.6	437	437	0	0.0
4.8	433	431	-2	-0.5
6.0	431	431	0	0.0
7.2	431	431	0	0.0
8.4	431	431	0	0.0
9.6	431	431	0	0.0
10.8	431	431	0	0.0
12.0	431	431	0	0.0
13.3	431	431	0	0.0
14.5	431	431	0	0.0
15.7	431	431	0	0.0
16.9	431	431	0	0.0
18.1	431	431	0	0.0
19.3	431	431	0	0.0
20.5	431	431	0	0.0
21.7	431	431	0	0.0
22.9	431	431	0	0.0
24.1	431	431	0	0.0
25.3	431	431	0	0.0
26.5	431	431	0	0.0
27.7	431	431	0	0.0
28.9	431	431	0	0.0
30.1	431	431	0	0.0
31.3	431	431	0	0.0
32.5	431	431	0	0.0
33.7	431	431	0	0.0
34.9	431	431	0	0.0
36.1	431	431	0	0.0
37.3	431	431	0	0.0
38.6	431	429	-2	-0.5
39.8	429	429	0	0.0
41.0	429	429	0	0.0
42.2	429	426	-3	-0.7
43.4	426	426	0	0.0
44.6	426	426	0	0.0
45.8	426	426	0	0.0
47.0	426	425	-1	-0.2
48.2	425	425	0	0.0
49.4	425	425	0	0.0
50.6	425	425	0	0.0
51.8	425	425	0	0.0
53.0	425	425	0	0.0
54.2	425	425	0	0.0
55.4	425	424	-1	-0.2
56.6	424	424	0	0.0
57.8	424	421	-3	-0.7
59.0	421	420	-1	-0.2
60.2	420	420	0	0.0
61.4	420	420	0	0.0
62.7	420	420	0	0.0
63.9	420	417	-3	-0.7
65.1	417	414	-3	-0.7
66.3	411	412	1	0.2
67.5	411	411	0	0.0
68.7	411	411	0	0.0
69.9	411	411	0	0.0
71.1	409	409	0	0.0
72.3	404	403	-1	-0.2
73.5	403	401	-2	-0.5
74.7	401	401	0	0.0
75.9	399	399	0	0.0
77.1	396	386	-10	-2.5
78.3	386	384	-2	-0.5
79.5	385	370	-15	-3.9
80.7	366	366	0	0.0
81.9	355	353	-2	-0.6
83.1	338	341	3	0.9
84.3	270	270	0	0.0
85.5	241	267	26	10.8
86.7	240	241	1	0.4
88.0	151	151	0	0.0
89.2	129	128	-1	-0.8
90.4	112	112	0	0.0
91.6	53	54	1	1.9
92.8	51	51	0	0.0
94.0	42	42	0	0.0
95.2	34	34	0	0.0
96.4	34	34	0	0.0
97.6	34	33	-1	-2.9
98.8	28	28	0	0.0
Min	28	28	-15	-3.9
Max	441	441	26	10.8
Mean	371	371	0	0.0
Median	425	425	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		1.2
X>=5.0		1.2
X>=10.0		1.2
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		5.0
X>=5.0		5.0
X>=10.0		5.0
-10.0<X<=-1.1		15.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**5.0**

Banks Pumping Plant Export - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	441	441	0	0.0
2.4	441	441	0	0.0
3.6	441	441	0	0.0
4.8	441	441	0	0.0
6.0	441	441	0	0.0
7.2	441	441	0	0.0
8.4	441	441	0	0.0
9.6	441	441	0	0.0
10.8	441	441	0	0.0
12.0	441	441	0	0.0
13.3	441	441	0	0.0
14.5	441	441	0	0.0
15.7	441	441	0	0.0
16.9	441	441	0	0.0
18.1	441	441	0	0.0
19.3	441	441	0	0.0
20.5	441	441	0	0.0
21.7	441	441	0	0.0
22.9	441	441	0	0.0
24.1	441	441	0	0.0
25.3	441	441	0	0.0
26.5	441	441	0	0.0
27.7	441	441	0	0.0
28.9	441	441	0	0.0
30.1	441	441	0	0.0
31.3	441	441	0	0.0
32.5	441	441	0	0.0
33.7	441	441	0	0.0
34.9	441	441	0	0.0
36.1	441	441	0	0.0
37.3	441	441	0	0.0
38.6	441	441	0	0.0
39.8	441	441	0	0.0
41.0	441	441	0	0.0
42.2	441	441	0	0.0
43.4	441	441	0	0.0
44.6	434	434	0	0.0
45.8	432	432	0	0.0
47.0	432	432	0	0.0
48.2	432	432	0	0.0
49.4	432	432	0	0.0
50.6	426	426	0	0.0
51.8	426	426	0	0.0
53.0	426	426	0	0.0
54.2	426	426	0	0.0
55.4	425	425	0	0.0
56.6	424	424	0	0.0
57.8	415	415	0	0.0
59.0	411	411	0	0.0
60.2	411	411	0	0.0
61.4	411	411	0	0.0
62.7	411	411	0	0.0
63.9	331	310	-21	-6.3
65.1	286	309	23	8.0
66.3	267	260	-7	-2.6
67.5	264	247	-17	-6.4
68.7	246	239	-7	-2.8
69.9	235	234	-1	-0.4
71.1	234	203	-31	-13.2
72.3	198	198	0	0.0
73.5	192	194	2	1.0
74.7	175	180	5	2.9
75.9	171	173	2	1.2
77.1	169	171	2	1.2
78.3	142	163	21	14.8
79.5	134	142	8	6.0
80.7	96	115	19	19.8
81.9	91	88	-3	-3.3
83.1	79	80	1	1.3
84.3	61	61	0	0.0
85.5	54	54	0	0.0
86.7	47	47	0	0.0
88.0	46	46	0	0.0
89.2	35	35	0	0.0
90.4	34	34	0	0.0
91.6	28	28	0	0.0
92.8	23	23	0	0.0
94.0	22	22	0	0.0
95.2	22	22	0	0.0
96.4	18	18	0	0.0
97.6	18	18	0	0.0
98.8	18	18	0	0.0
Min	18	18	-31	-13.2
Max	441	441	23	19.8
Mean	322	322	0	0.3
Median	429	429	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	82.9
1.1<=X<10.0		7.3
X>=5.0		4.9
X>=10.0		2.4
-10.0<X<=-1.1		6.1
X<=-5.0		3.7
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	65.0
1.1<=X<10.0		20.0
X>=5.0		15.0
X>=10.0		10.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**10.0**

Banks Pumping Plant Export - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	416	416	0	0.0
2.4	411	411	0	0.0
3.6	407	407	0	0.0
4.8	407	407	0	0.0
6.0	397	397	0	0.0
7.2	397	397	0	0.0
8.4	397	397	0	0.0
9.6	397	397	0	0.0
10.8	397	397	0	0.0
12.0	397	397	0	0.0
13.3	397	397	0	0.0
14.5	397	397	0	0.0
15.7	397	397	0	0.0
16.9	397	397	0	0.0
18.1	397	397	0	0.0
19.3	397	397	0	0.0
20.5	397	397	0	0.0
21.7	397	397	0	0.0
22.9	397	397	0	0.0
24.1	397	397	0	0.0
25.3	397	397	0	0.0
26.5	397	397	0	0.0
27.7	397	397	0	0.0
28.9	397	397	0	0.0
30.1	397	397	0	0.0
31.3	397	397	0	0.0
32.5	397	397	0	0.0
33.7	397	397	0	0.0
34.9	397	397	0	0.0
36.1	397	397	0	0.0
37.3	397	397	0	0.0
38.6	397	397	0	0.0
39.8	397	397	0	0.0
41.0	397	397	0	0.0
42.2	397	397	0	0.0
43.4	397	397	0	0.0
44.6	397	397	0	0.0
45.8	397	397	0	0.0
47.0	397	397	0	0.0
48.2	397	397	0	0.0
49.4	397	395	-2	-0.5
50.6	397	389	-8	-2.0
51.8	391	388	-3	-0.8
53.0	388	388	0	0.0
54.2	388	382	-6	-1.5
55.4	382	382	0	0.0
56.6	382	381	-1	-0.3
57.8	381	375	-6	-1.6
59.0	378	374	-4	-1.1
60.2	377	373	-4	-1.1
61.4	364	364	0	0.0
62.7	364	364	0	0.0
63.9	360	360	0	0.0
65.1	344	351	7	2.0
66.3	328	341	13	4.0
67.5	328	324	-4	-1.2
68.7	325	320	-5	-1.5
69.9	313	307	-6	-1.9
71.1	284	297	13	4.6
72.3	236	250	14	5.9
73.5	229	229	0	0.0
74.7	218	216	-2	-0.9
75.9	189	189	0	0.0
77.1	184	183	-1	-0.5
78.3	176	176	0	0.0
79.5	172	166	-6	-3.5
80.7	166	164	-2	-1.2
81.9	151	151	0	0.0
83.1	147	146	-1	-0.7
84.3	140	140	0	0.0
85.5	135	135	0	0.0
86.7	127	127	0	0.0
88.0	126	126	0	0.0
89.2	119	119	0	0.0
90.4	91	91	0	0.0
91.6	88	88	0	0.0
92.8	57	57	0	0.0
94.0	53	55	2	3.8
95.2	45	45	0	0.0
96.4	39	39	0	0.0
97.6	32	31	-1	-3.1
98.8	28	28	0	0.0
Min	28	28	-8	-3.5
Max	416	416	14	5.9
Mean	314	314	0	0.0
Median	397	392	0	0.0

Entire 82-Year Simulation Period

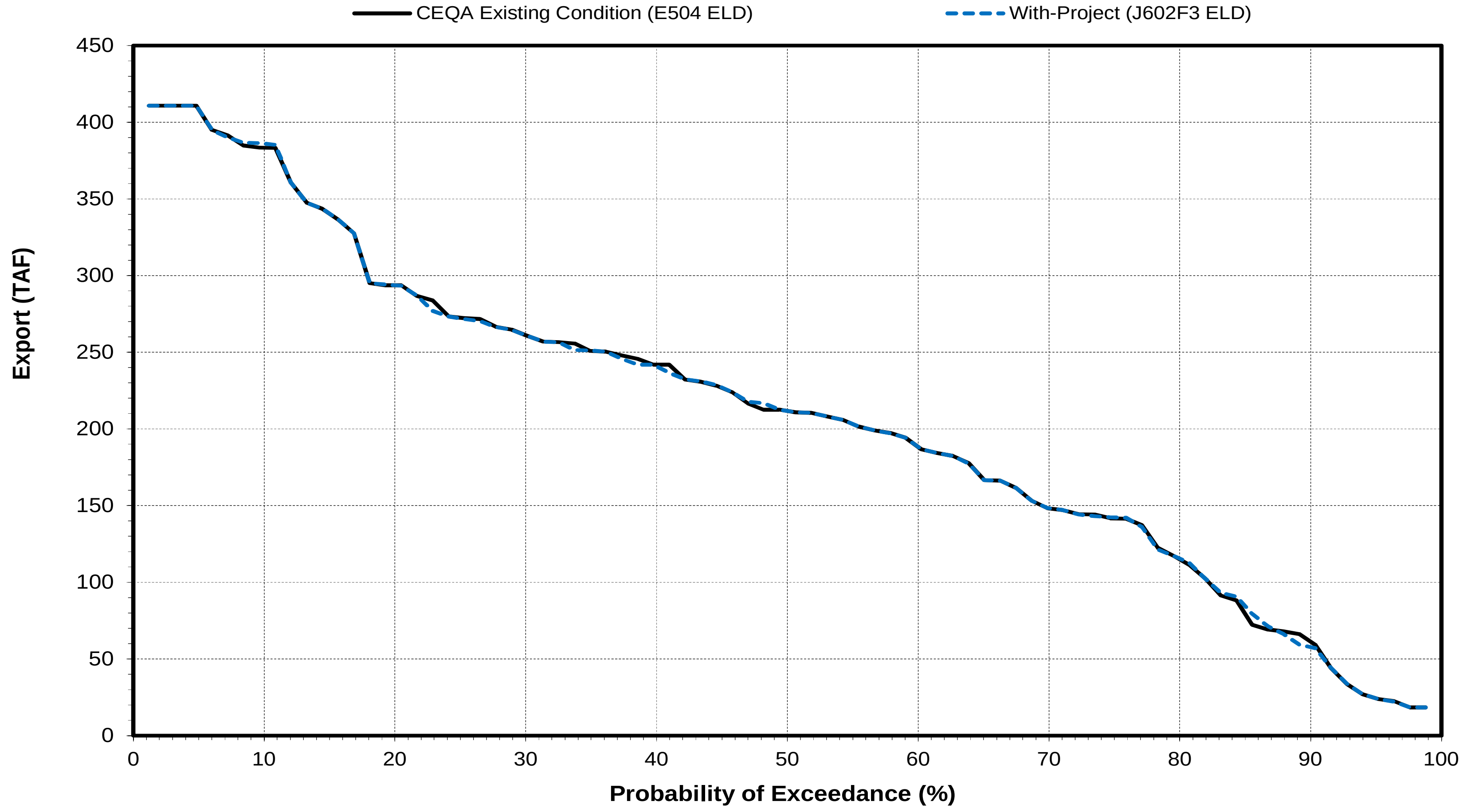
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	80.5
1.1<=X<10.0		6.1
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		13.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

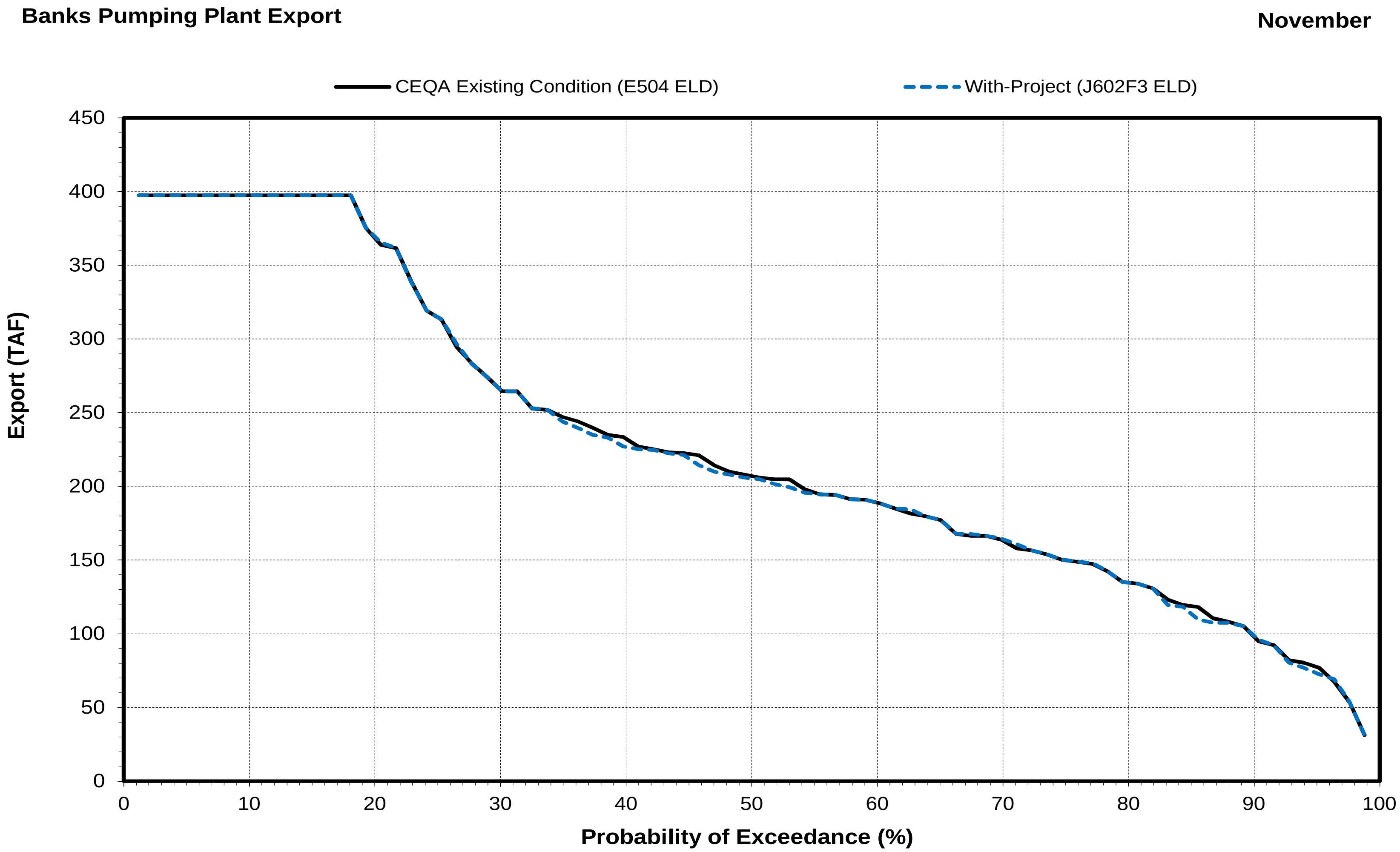
(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Banks Pumping Plant Export

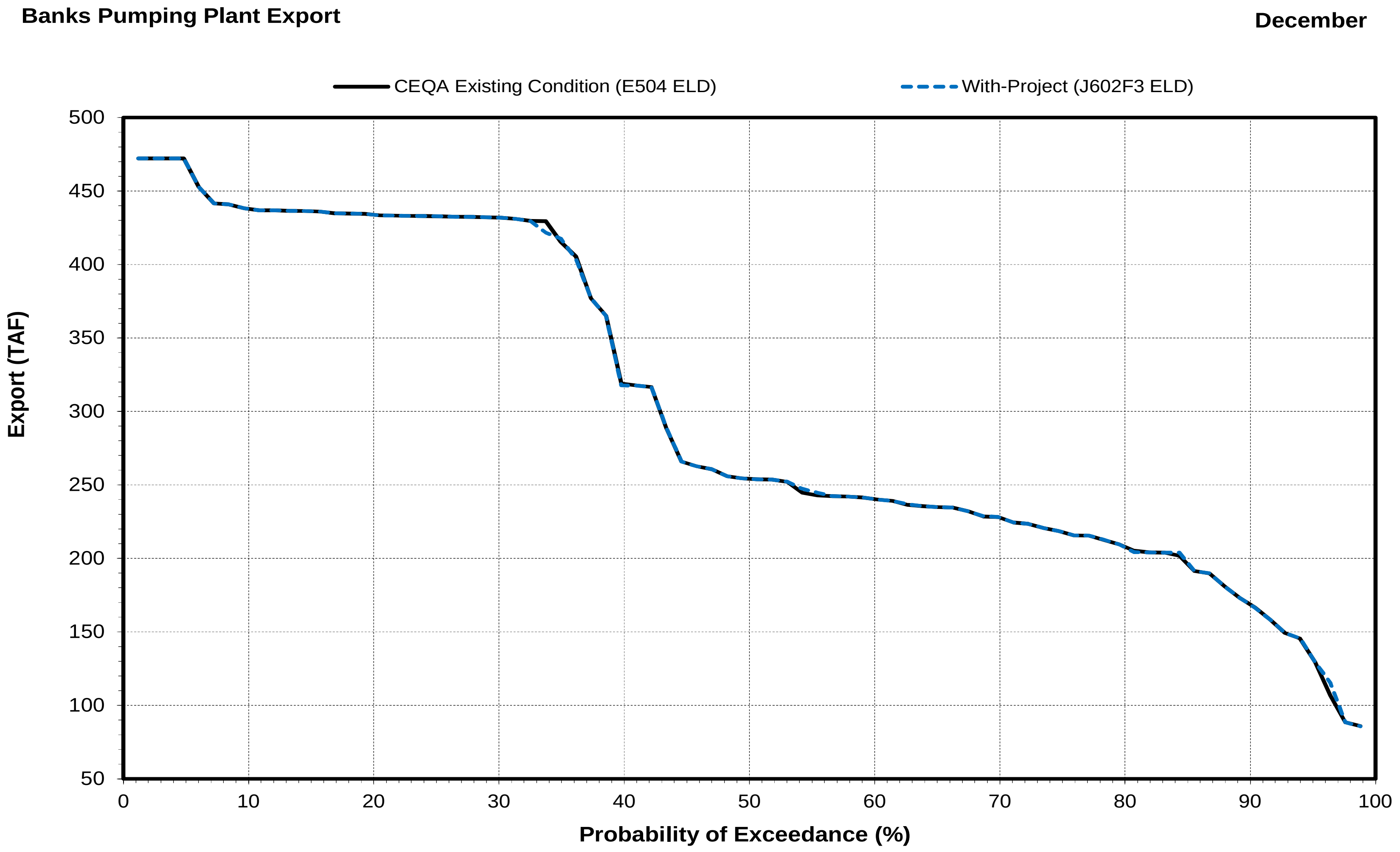
October



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

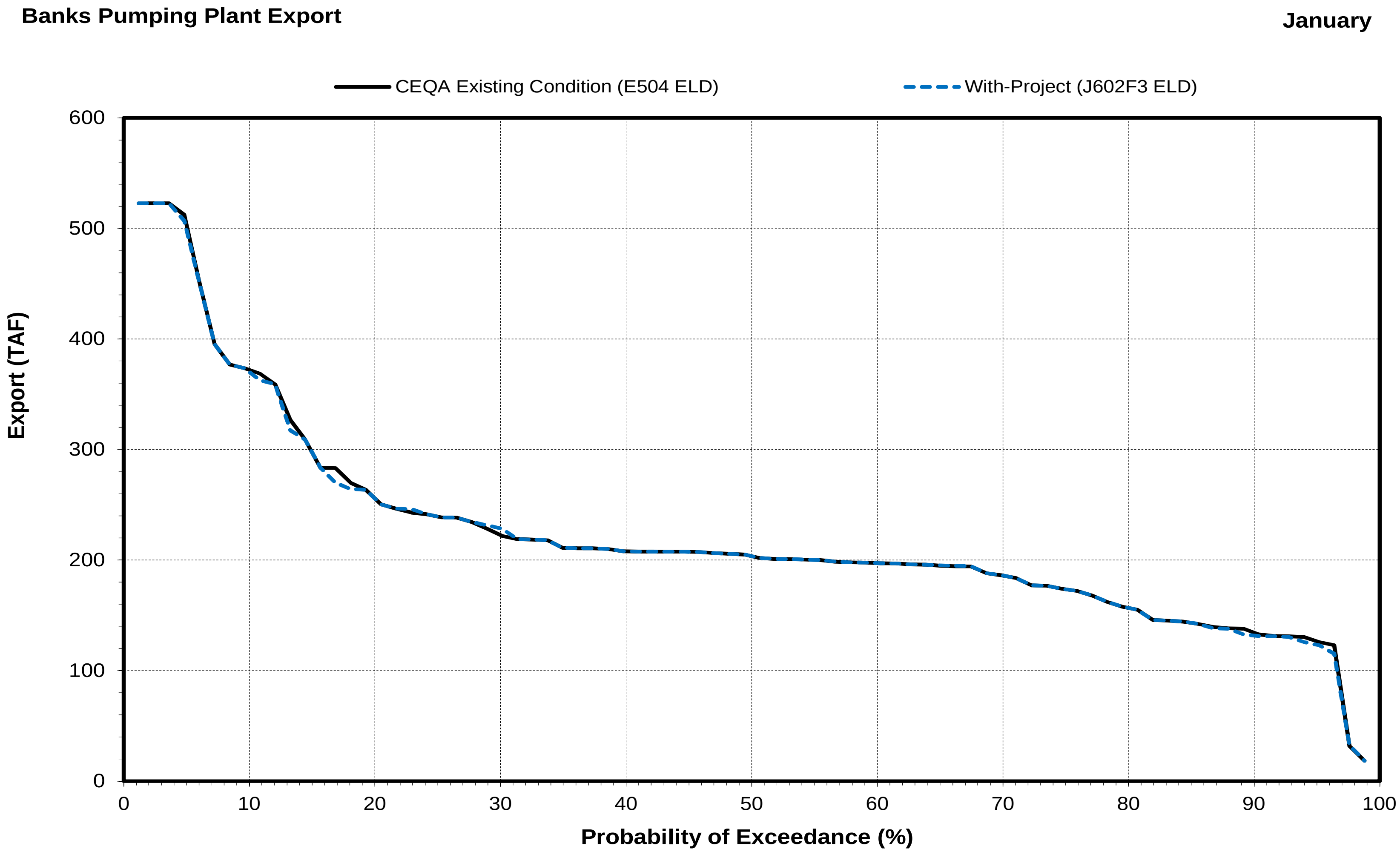


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

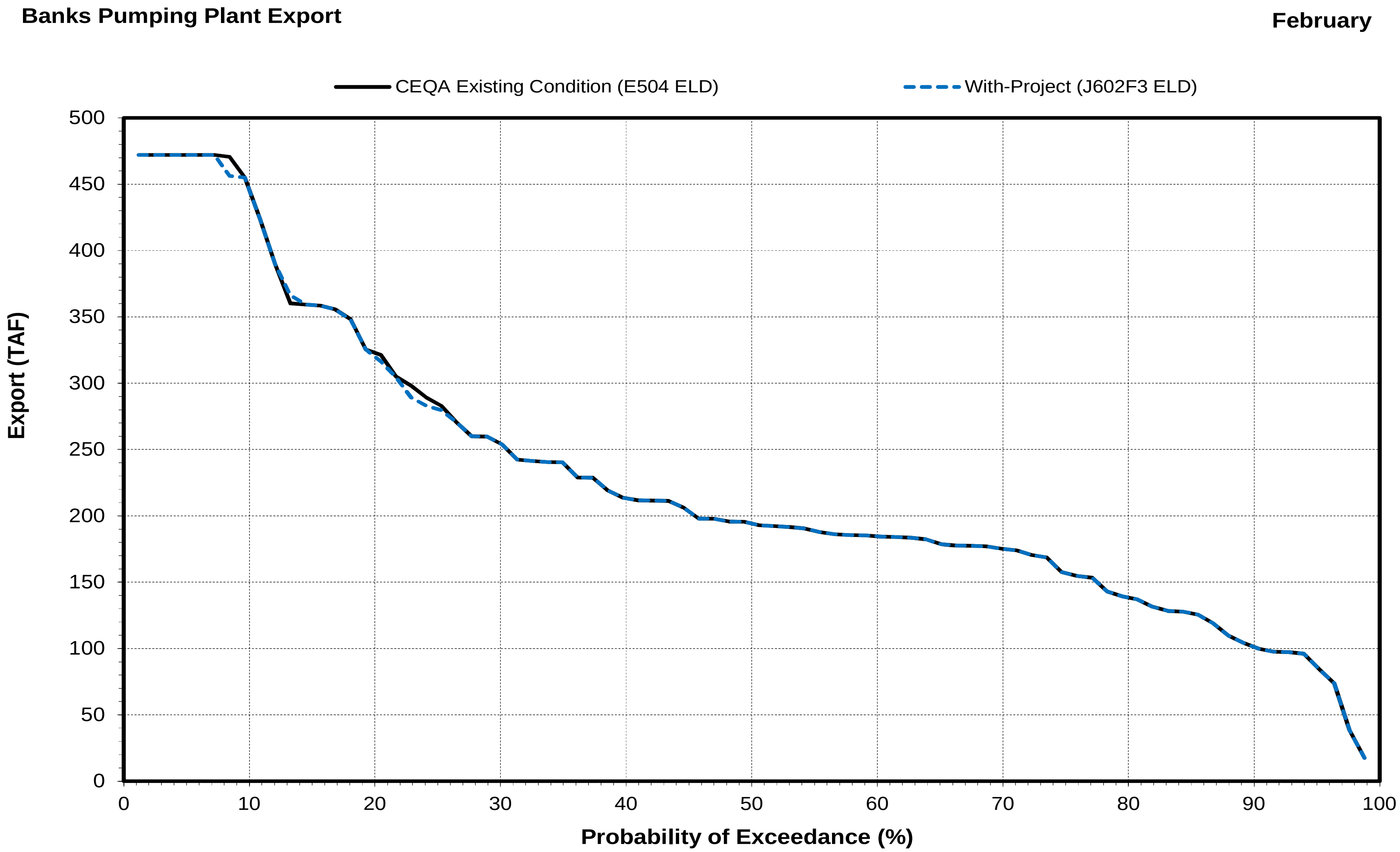


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



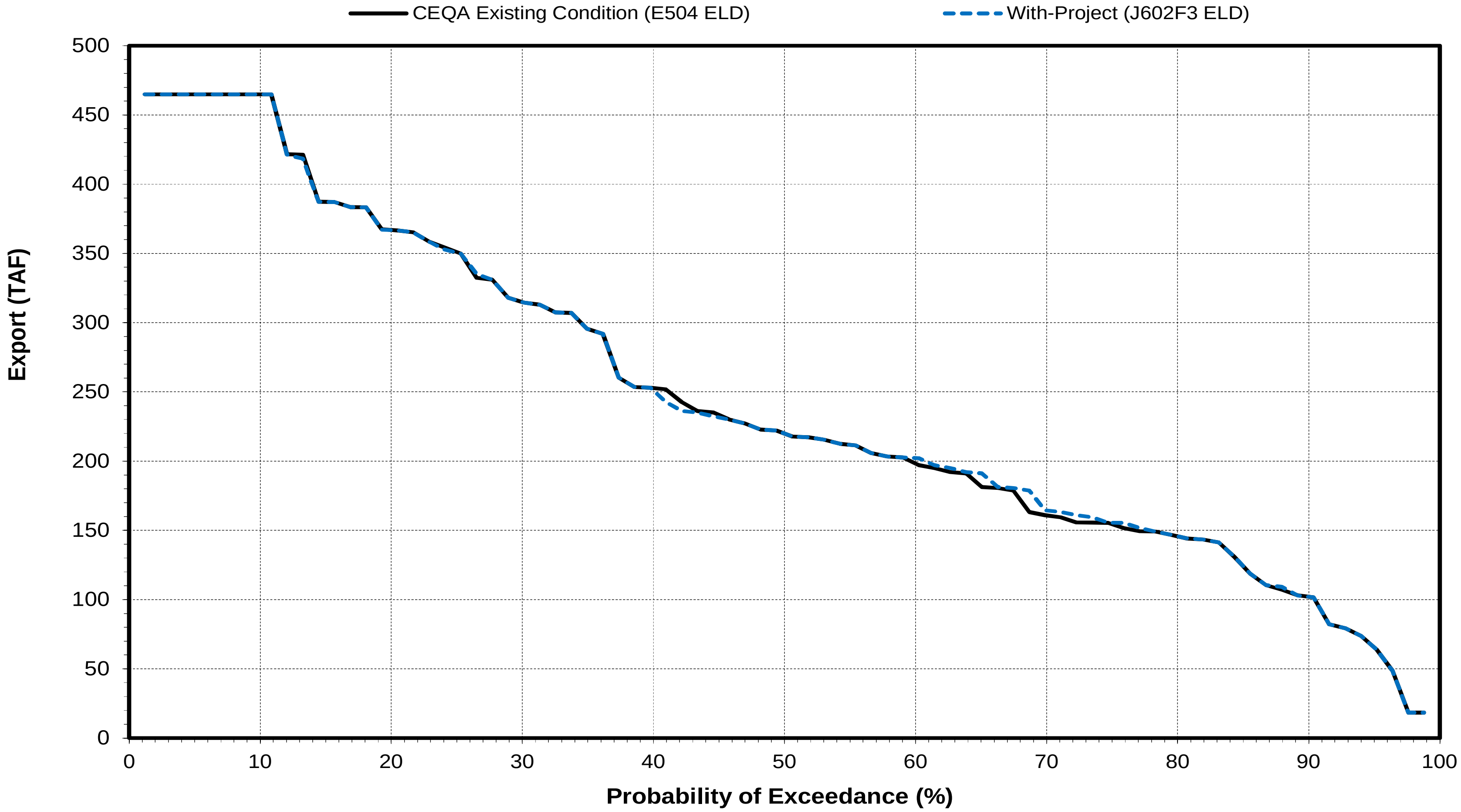
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

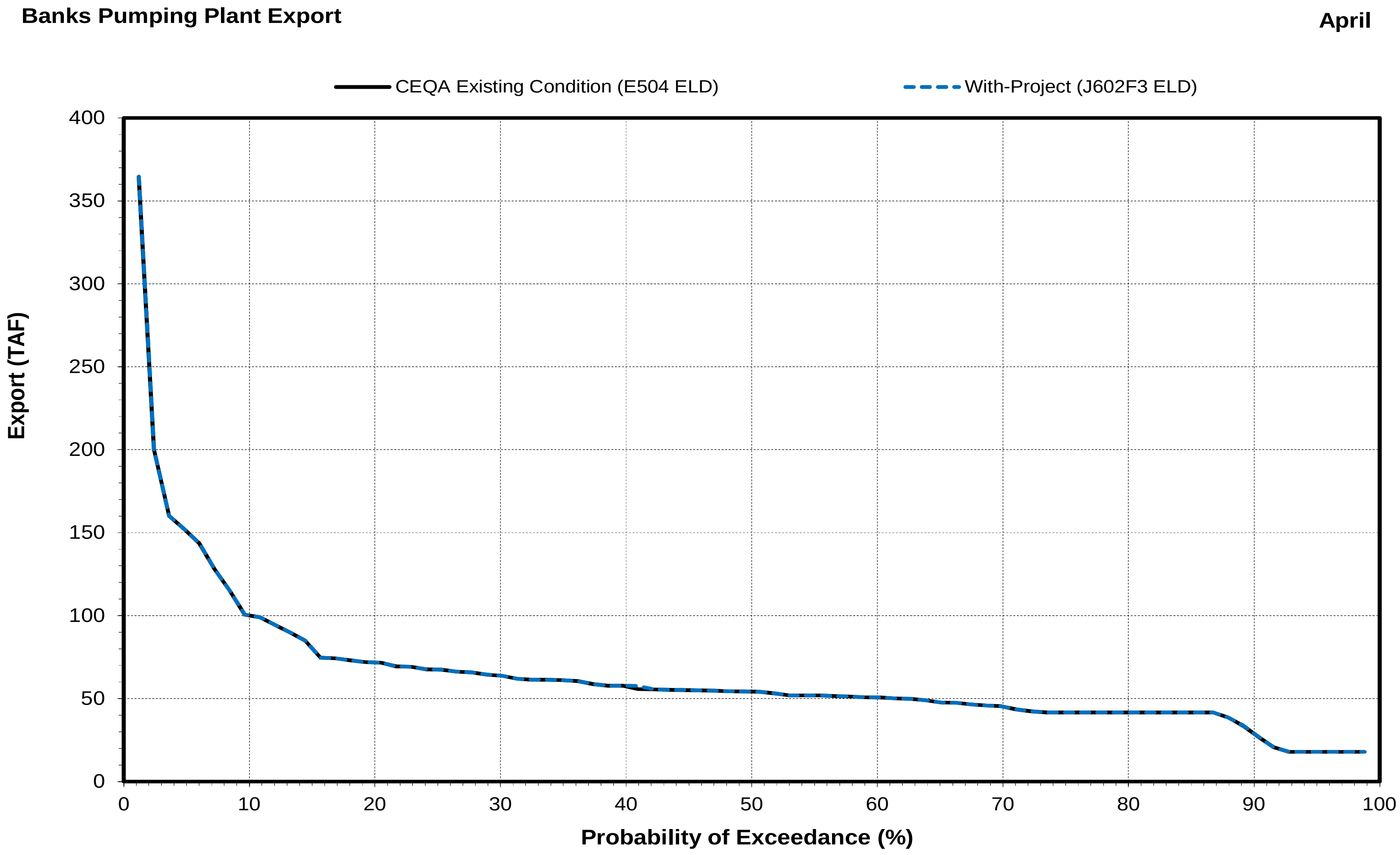
Banks Pumping Plant Export

March



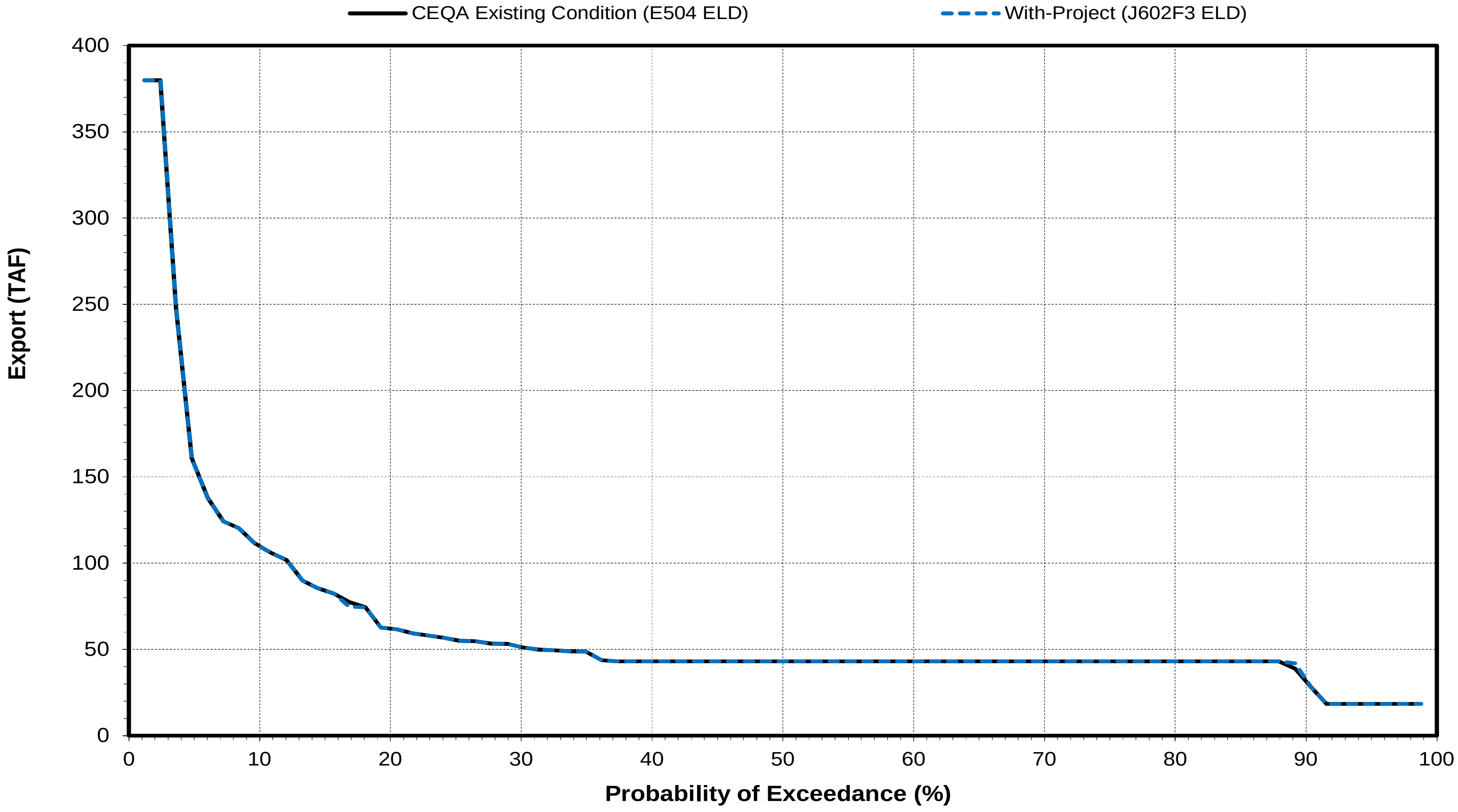
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

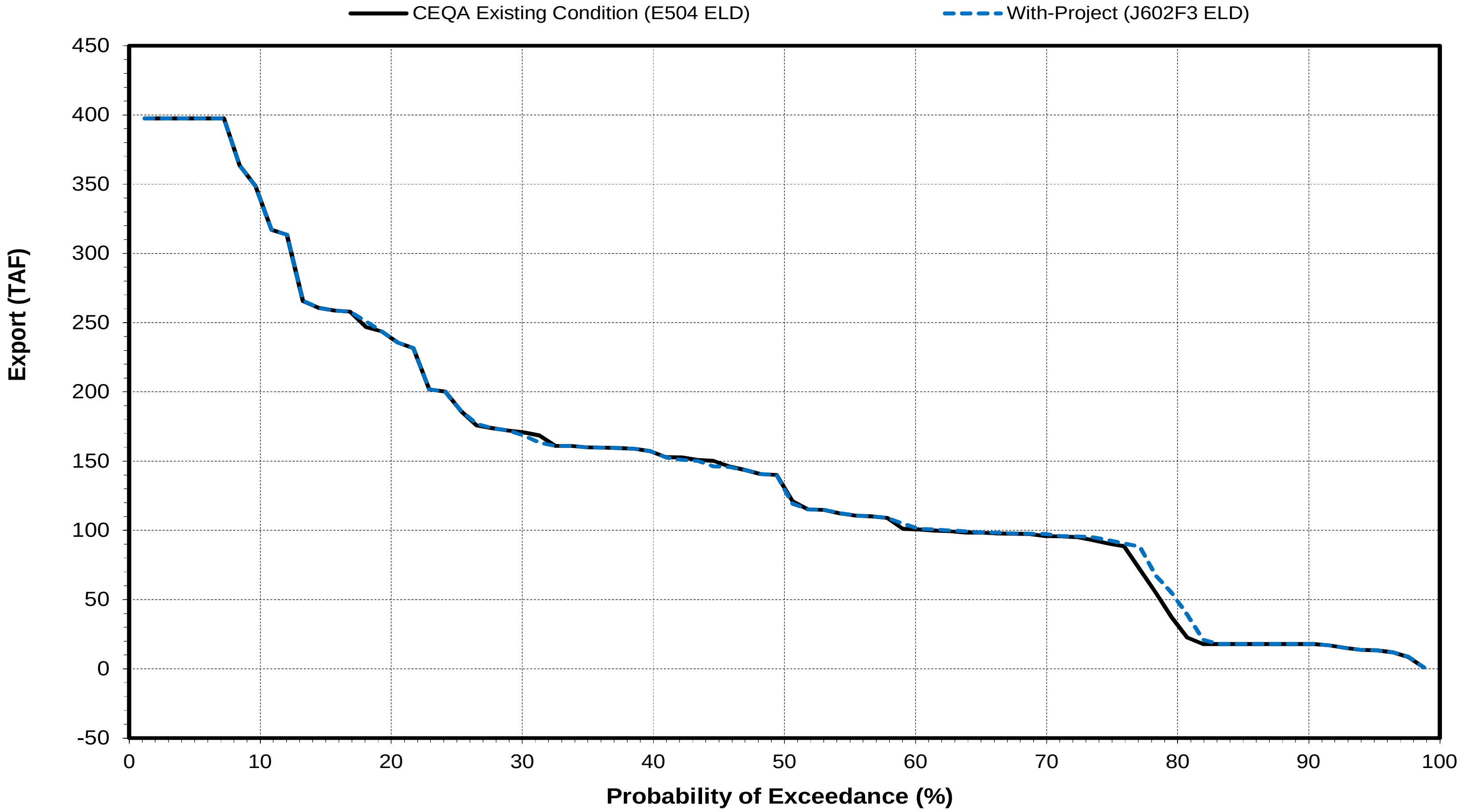
Banks Pumping Plant Export **May**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Banks Pumping Plant Export

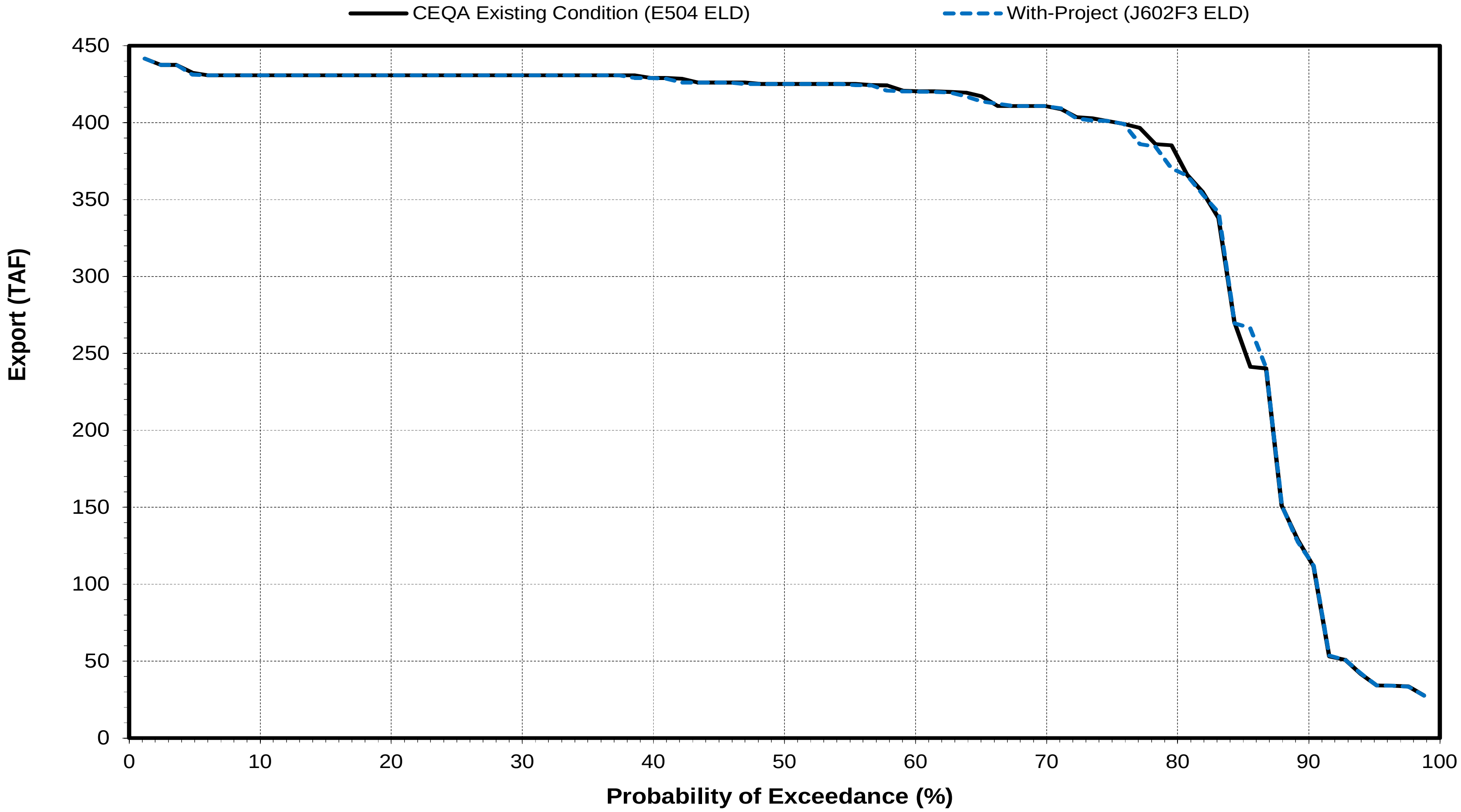
June



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

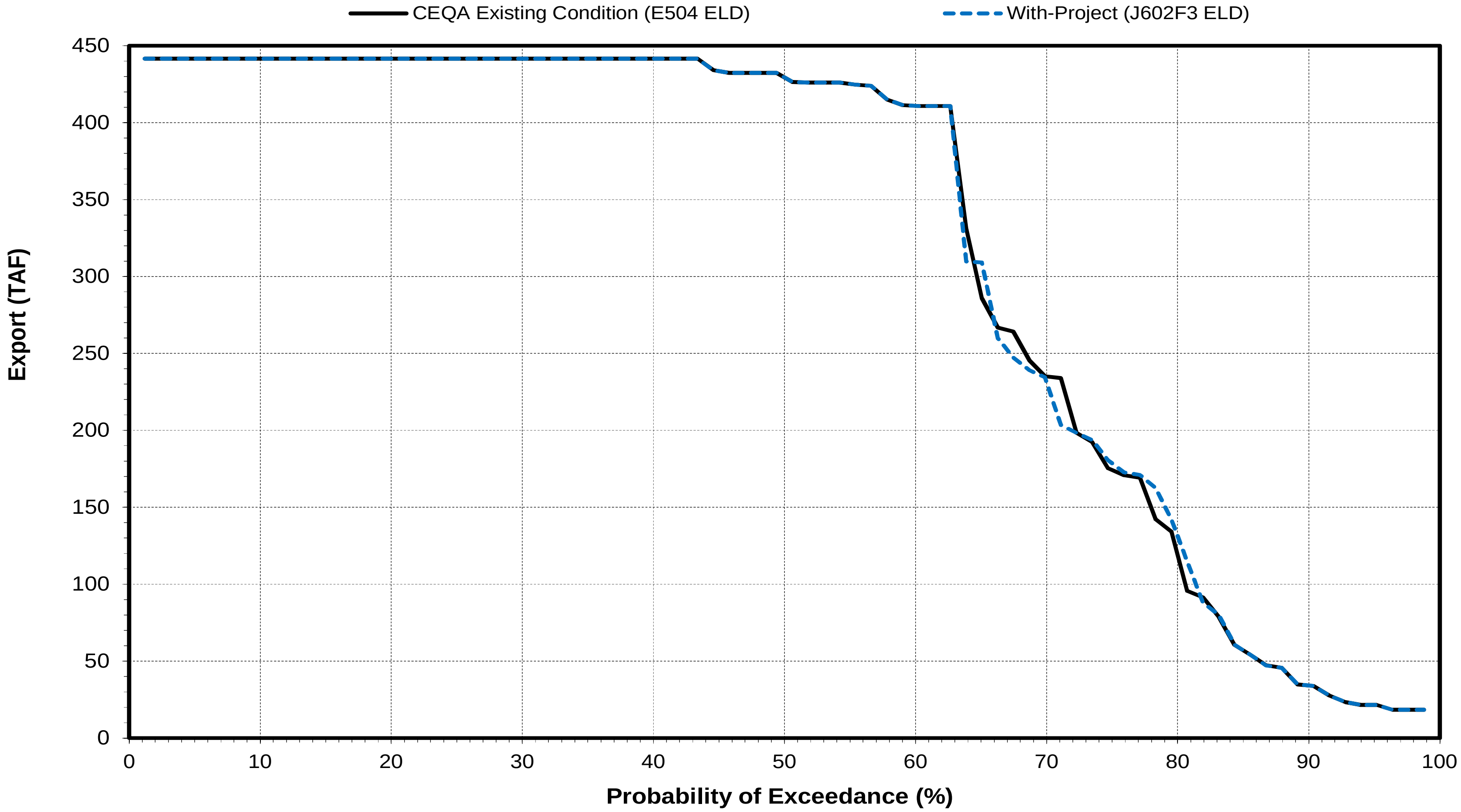
Banks Pumping Plant Export

July



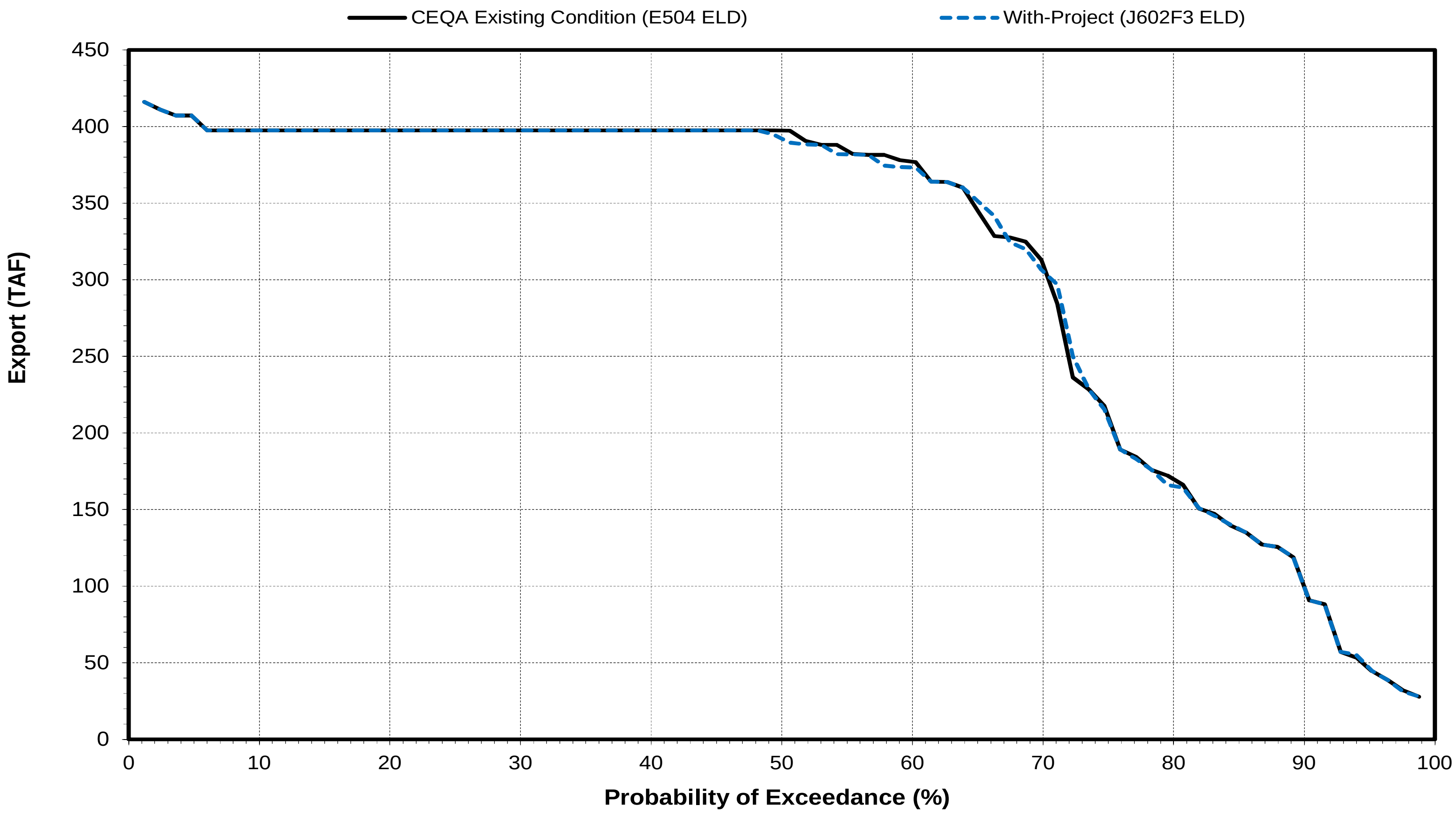
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Banks Pumping Plant Export **August**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Banks Pumping Plant Export **September**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Long-term Average Total Delta Export (Banks + Jones) and Average Total Delta Export (Banks + Jones) by Water Year Type Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD) Conditions

	Monthly Mean Exports (TAF)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	439	447	541	421	403	435	130	127	294	618	569	549
With-Project (J602F3 ELD)	439	447	541	420	404	436	130	127	296	617	570	550
Difference	0	0	0	-1	1	1	0	0	2	-1	1	1
Percent Difference[3]	0.0	0.0	0.0	-0.2	0.2	0.2	0.0	0.0	0.7	-0.2	0.2	0.2
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	481	512	552	503	527	600	183	192	472	704	720	653
With-Project (J602F3 ELD)	479	513	552	503	529	601	183	192	472	704	720	652
Difference	-2	1	0	0	2	1	0	0	0	0	0	-1
Percent Difference	-0.4	0.2	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	-0.2
Above Normal												
CEQA Existing Condition (E504 ELD)	406	429	590	398	396	519	115	102	370	651	710	641
With-Project (J602F3 ELD)	406	429	590	398	396	520	115	102	370	650	711	647
Difference	0	0	0	0	0	1	0	0	0	-1	1	6
Percent Difference	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	-0.2	0.1	0.9
Below Normal												
CEQA Existing Condition (E504 ELD)	465	481	566	384	384	433	106	99	262	695	680	638
With-Project (J602F3 ELD)	465	477	566	384	383	433	106	99	262	696	679	636
Difference	0	-4	0	0	-1	0	0	0	0	1	-1	-2
Percent Difference	0.0	-0.8	0.0	0.0	-0.3	0.0	0.0	0.0	0.0	0.1	-0.1	-0.3
Dry												
CEQA Existing Condition (E504 ELD)	421	427	563	397	334	295	106	99	170	635	396	474
With-Project (J602F3 ELD)	425	431	563	397	334	295	106	99	179	634	400	478
Difference	4	4	0	0	0	0	0	0	9	-1	4	4
Percent Difference	1.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	5.3	-0.2	1.0	0.8
Critical												
CEQA Existing Condition (E504 ELD)	374	312	406	342	270	209	94	86	58	283	231	239
With-Project (J602F3 ELD)	376	313	409	338	270	208	94	86	58	279	230	239
Difference	2	1	3	-4	0	-1	0	0	0	-4	-1	0
Percent Difference	0.5	0.3	0.7	-1.2	0.0	-0.5	0.0	0.0	0.0	-1.4	-0.4	0.0

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

Total Delta Export (Banks + Jones) - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	694	694	0	0.0
2.4	694	694	0	0.0
3.6	694	694	0	0.0
4.8	694	694	0	0.0
6.0	674	673	-1	-0.1
7.2	668	670	2	0.3
8.4	666	669	3	0.5
9.6	640	640	0	0.0
10.8	625	625	0	0.0
12.0	619	619	0	0.0
13.3	610	610	0	0.0
14.5	603	603	0	0.0
15.7	595	600	5	0.8
16.9	578	578	0	0.0
18.1	577	577	0	0.0
19.3	574	576	2	0.3
20.5	555	555	0	0.0
21.7	533	533	0	0.0
22.9	532	532	0	0.0
24.1	530	530	0	0.0
25.3	529	529	0	0.0
26.5	517	521	4	0.8
27.7	514	514	0	0.0
28.9	508	512	4	0.8
30.1	507	507	0	0.0
31.3	506	507	1	0.2
32.5	494	500	6	1.2
33.7	493	498	5	1.0
34.9	493	494	1	0.2
36.1	493	494	1	0.2
37.3	491	493	2	0.4
38.6	485	493	8	1.6
39.8	480	491	11	2.3
41.0	480	486	6	1.3
42.2	479	480	1	0.2
43.4	475	476	1	0.2
44.6	472	475	3	0.6
45.8	470	472	2	0.4
47.0	463	470	7	1.5
48.2	458	468	10	2.2
49.4	458	458	0	0.0
50.6	455	455	0	0.0
51.8	453	453	0	0.0
53.0	449	449	0	0.0
54.2	433	435	2	0.5
55.4	432	433	1	0.2
56.6	432	432	0	0.0
57.8	430	430	0	0.0
59.0	427	427	0	0.0
60.2	424	412	-12	-2.8
61.4	407	407	0	0.0
62.7	401	401	0	0.0
63.9	382	387	5	1.3
65.1	381	381	0	0.0
66.3	363	359	-4	-1.1
67.5	361	356	-5	-1.4
68.7	355	340	-15	-4.2
69.9	336	336	0	0.0
71.1	336	328	-8	-2.4
72.3	328	328	0	0.0
73.5	328	327	-1	-0.3
74.7	327	327	0	0.0
75.9	326	319	-7	-2.1
77.1	319	313	-6	-1.9
78.3	310	310	0	0.0
79.5	307	307	0	0.0
80.7	306	305	-1	-0.3
81.9	303	303	0	0.0
83.1	301	301	0	0.0
84.3	289	288	-1	-0.3
85.5	284	280	-4	-1.4
86.7	274	271	-3	-1.1
88.0	271	270	-1	-0.4
89.2	270	268	-2	-0.7
90.4	261	261	0	0.0
91.6	248	248	0	0.0
92.8	225	228	3	1.3
94.0	218	225	7	3.2
95.2	188	189	1	0.5
96.4	146	146	0	0.0
97.6	134	134	0	0.0
98.8	127	127	0	0.0
Min	127	127	-15	-4.2
Max	694	694	11	3.2
Mean	439	439	0	0.0
Median	457	457	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	78.0
1.1<=X<10.0		11.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		11.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	671	671	0	0.0
2.4	671	671	0	0.0
3.6	671	671	0	0.0
4.8	671	671	0	0.0
6.0	671	671	0	0.0
7.2	671	671	0	0.0
8.4	671	671	0	0.0
9.6	671	671	0	0.0
10.8	671	671	0	0.0
12.0	671	671	0	0.0
13.3	671	671	0	0.0
14.5	671	671	0	0.0
15.7	671	671	0	0.0
16.9	643	640	-3	-0.5
18.1	613	614	1	0.2
19.3	612	612	0	0.0
20.5	595	595	0	0.0
21.7	593	593	0	0.0
22.9	587	587	0	0.0
24.1	575	575	0	0.0
25.3	568	555	-13	-2.3
26.5	551	551	0	0.0
27.7	538	538	0	0.0
28.9	518	518	0	0.0
30.1	507	507	0	0.0
31.3	497	497	0	0.0
32.5	493	495	2	0.4
33.7	490	492	2	0.4
34.9	482	489	7	1.5
36.1	480	482	2	0.4
37.3	479	479	0	0.0
38.6	478	475	-3	-0.6
39.8	471	470	-1	-0.2
41.0	470	468	-2	-0.4
42.2	468	463	-5	-1.1
43.4	460	459	-1	-0.2
44.6	459	453	-6	-1.3
45.8	453	451	-2	-0.4
47.0	451	450	-1	-0.2
48.2	450	442	-8	-1.8
49.4	442	441	-1	-0.2
50.6	440	440	0	0.0
51.8	437	431	-6	-1.4
53.0	421	422	1	0.2
54.2	419	419	0	0.0
55.4	418	416	-2	-0.5
56.6	416	415	-1	-0.2
57.8	414	414	0	0.0
59.0	413	413	0	0.0
60.2	401	401	0	0.0
61.4	400	400	0	0.0
62.7	396	392	-4	-1.0
63.9	392	391	-1	-0.3
65.1	391	391	0	0.0
66.3	385	387	2	0.5
67.5	379	385	6	1.6
68.7	378	379	1	0.3
69.9	377	378	1	0.3
71.1	369	377	8	2.2
72.3	366	370	4	1.1
73.5	355	366	11	3.1
74.7	353	355	2	0.6
75.9	339	354	15	4.4
77.1	333	329	-4	-1.2
78.3	316	329	13	4.1
79.5	305	315	10	3.3
80.7	290	293	3	1.0
81.9	283	290	7	2.5
83.1	279	284	5	1.8
84.3	279	279	0	0.0
85.5	271	279	8	3.0
86.7	255	255	0	0.0
88.0	250	249	-1	-0.4
89.2	249	249	0	0.0
90.4	246	246	0	0.0
91.6	227	227	0	0.0
92.8	223	218	-5	-2.2
94.0	218	215	-3	-1.4
95.2	215	211	-4	-1.9
96.4	210	210	0	0.0
97.6	202	207	5	2.5
98.8	178	178	0	0.0
Min	178	178	-13	-2.3
Max	671	671	15	4.4
Mean	447	447	0	0.2
Median	441	441	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	74.4
1.1<=X<10.0		14.6
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		11.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	45.0
1.1<=X<10.0		35.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		20.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	755	755	0	0.0
2.4	755	755	0	0.0
3.6	755	755	0	0.0
4.8	736	736	0	0.0
6.0	724	724	0	0.0
7.2	724	724	0	0.0
8.4	721	721	0	0.0
9.6	720	720	0	0.0
10.8	719	719	0	0.0
12.0	719	719	0	0.0
13.3	718	718	0	0.0
14.5	717	717	0	0.0
15.7	716	716	0	0.0
16.9	716	716	0	0.0
18.1	716	716	0	0.0
19.3	716	716	0	0.0
20.5	716	716	0	0.0
21.7	715	715	0	0.0
22.9	715	715	0	0.0
24.1	715	715	0	0.0
25.3	710	710	0	0.0
26.5	698	700	2	0.3
27.7	696	697	1	0.1
28.9	696	696	0	0.0
30.1	687	687	0	0.0
31.3	684	684	0	0.0
32.5	667	667	0	0.0
33.7	660	660	0	0.0
34.9	657	656	-1	-0.2
36.1	614	613	-1	-0.2
37.3	601	601	0	0.0
38.6	597	597	0	0.0
39.8	594	594	0	0.0
41.0	575	579	4	0.7
42.2	571	571	0	0.0
43.4	562	562	0	0.0
44.6	532	532	0	0.0
45.8	525	525	0	0.0
47.0	521	521	0	0.0
48.2	512	512	0	0.0
49.4	508	508	0	0.0
50.6	507	507	0	0.0
51.8	504	504	0	0.0
53.0	502	498	-4	-0.8
54.2	489	489	0	0.0
55.4	485	485	0	0.0
56.6	484	484	0	0.0
57.8	483	483	0	0.0
59.0	480	480	0	0.0
60.2	478	478	0	0.0
61.4	471	471	0	0.0
62.7	470	470	0	0.0
63.9	469	469	0	0.0
65.1	464	464	0	0.0
66.3	463	464	1	0.2
67.5	457	458	1	0.2
68.7	456	456	0	0.0
69.9	449	449	0	0.0
71.1	447	447	0	0.0
72.3	441	441	0	0.0
73.5	437	437	0	0.0
74.7	431	431	0	0.0
75.9	431	431	0	0.0
77.1	425	425	0	0.0
78.3	408	408	0	0.0
79.5	408	408	0	0.0
80.7	403	398	-5	-1.2
81.9	398	396	-2	-0.5
83.1	390	390	0	0.0
84.3	383	383	0	0.0
85.5	383	383	0	0.0
86.7	380	380	0	0.0
88.0	375	375	0	0.0
89.2	370	370	0	0.0
90.4	365	368	3	0.8
91.6	361	359	-2	-0.6
92.8	355	354	-1	-0.3
94.0	346	346	0	0.0
95.2	275	289	14	5.1
96.4	256	267	11	4.3
97.6	232	231	-1	-0.4
98.8	177	196	19	10.7
Min	177	196	-5	-1.2
Max	755	755	19	10.7
Mean	541	541	0	0.2
Median	508	508	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	95.1
1.1<=X<10.0		2.4
X>=5.0		2.4
X>=10.0		1.2
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		10.0
X>=5.0		10.0
X>=10.0		5.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**5.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	805	805	0	0.0
2.4	805	805	0	0.0
3.6	805	805	0	0.0
4.8	795	790	-5	-0.6
6.0	678	678	0	0.0
7.2	656	656	0	0.0
8.4	642	642	0	0.0
9.6	619	619	0	0.0
10.8	592	592	0	0.0
12.0	566	566	0	0.0
13.3	540	540	0	0.0
14.5	527	527	0	0.0
15.7	502	502	0	0.0
16.9	501	501	0	0.0
18.1	498	498	0	0.0
19.3	493	493	0	0.0
20.5	483	483	0	0.0
21.7	477	477	0	0.0
22.9	477	477	0	0.0
24.1	469	469	0	0.0
25.3	457	457	0	0.0
26.5	445	445	0	0.0
27.7	438	438	0	0.0
28.9	437	437	0	0.0
30.1	436	436	0	0.0
31.3	424	424	0	0.0
32.5	422	422	0	0.0
33.7	421	421	0	0.0
34.9	421	421	0	0.0
36.1	420	420	0	0.0
37.3	420	420	0	0.0
38.6	416	416	0	0.0
39.8	416	416	0	0.0
41.0	416	416	0	0.0
42.2	415	415	0	0.0
43.4	415	415	0	0.0
44.6	415	415	0	0.0
45.8	413	413	0	0.0
47.0	411	411	0	0.0
48.2	404	404	0	0.0
49.4	402	402	0	0.0
50.6	402	402	0	0.0
51.8	401	401	0	0.0
53.0	400	400	0	0.0
54.2	400	400	0	0.0
55.4	397	397	0	0.0
56.6	397	397	0	0.0
57.8	396	396	0	0.0
59.0	396	396	0	0.0
60.2	394	394	0	0.0
61.4	394	394	0	0.0
62.7	392	392	0	0.0
63.9	392	392	0	0.0
65.1	391	391	0	0.0
66.3	390	390	0	0.0
67.5	389	389	0	0.0
68.7	376	376	0	0.0
69.9	376	376	0	0.0
71.1	367	370	3	0.8
72.3	367	367	0	0.0
73.5	354	354	0	0.0
74.7	353	353	0	0.0
75.9	348	348	0	0.0
77.1	344	344	0	0.0
78.3	324	324	0	0.0
79.5	315	315	0	0.0
80.7	314	315	1	0.3
81.9	310	310	0	0.0
83.1	292	292	0	0.0
84.3	290	290	0	0.0
85.5	289	289	0	0.0
86.7	285	285	0	0.0
88.0	284	277	-7	-2.5
89.2	277	276	-1	-0.4
90.4	276	265	-11	-4.0
91.6	265	263	-2	-0.8
92.8	263	262	-1	-0.4
94.0	262	261	-1	-0.4
95.2	261	252	-9	-3.4
96.4	252	246	-6	-2.4
97.6	246	230	-16	-6.5
98.8	68	68	0	0.0
Min	68	68	-16	-6.5
Max	805	805	3	0.8
Mean	421	420	-1	-0.2
Median	402	402	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	728	728	0	0.0
2.4	728	728	0	0.0
3.6	728	728	0	0.0
4.8	728	728	0	0.0
6.0	720	720	0	0.0
7.2	679	679	0	0.0
8.4	654	654	0	0.0
9.6	645	645	0	0.0
10.8	624	624	0	0.0
12.0	581	603	22	3.8
13.3	577	581	4	0.7
14.5	565	572	7	1.2
15.7	548	548	0	0.0
16.9	545	545	0	0.0
18.1	535	536	1	0.2
19.3	526	526	0	0.0
20.5	524	524	0	0.0
21.7	515	515	0	0.0
22.9	515	515	0	0.0
24.1	515	515	0	0.0
25.3	508	508	0	0.0
26.5	485	485	0	0.0
27.7	483	483	0	0.0
28.9	481	481	0	0.0
30.1	462	462	0	0.0
31.3	458	458	0	0.0
32.5	457	457	0	0.0
33.7	438	438	0	0.0
34.9	431	437	6	1.4
36.1	430	431	1	0.2
37.3	427	427	0	0.0
38.6	423	423	0	0.0
39.8	423	423	0	0.0
41.0	423	423	0	0.0
42.2	415	415	0	0.0
43.4	396	396	0	0.0
44.6	391	391	0	0.0
45.8	391	391	0	0.0
47.0	386	386	0	0.0
48.2	385	385	0	0.0
49.4	383	383	0	0.0
50.6	381	381	0	0.0
51.8	381	381	0	0.0
53.0	375	375	0	0.0
54.2	372	372	0	0.0
55.4	371	371	0	0.0
56.6	369	369	0	0.0
57.8	367	367	0	0.0
59.0	365	365	0	0.0
60.2	363	363	0	0.0
61.4	360	360	0	0.0
62.7	360	360	0	0.0
63.9	355	355	0	0.0
65.1	354	354	0	0.0
66.3	354	350	-4	-1.1
67.5	350	348	-2	-0.6
68.7	348	341	-7	-2.0
69.9	341	337	-4	-1.2
71.1	337	336	-1	-0.3
72.3	315	315	0	0.0
73.5	310	310	0	0.0
74.7	307	307	0	0.0
75.9	306	306	0	0.0
77.1	286	286	0	0.0
78.3	285	285	0	0.0
79.5	279	279	0	0.0
80.7	274	274	0	0.0
81.9	263	263	0	0.0
83.1	257	257	0	0.0
84.3	256	256	0	0.0
85.5	251	251	0	0.0
86.7	238	238	0	0.0
88.0	219	219	0	0.0
89.2	208	208	0	0.0
90.4	200	200	0	0.0
91.6	194	194	0	0.0
92.8	192	192	0	0.0
94.0	183	184	1	0.5
95.2	169	169	0	0.0
96.4	152	152	0	0.0
97.6	110	112	2	1.8
98.8	64	64	0	0.0
Min	64	64	-7	-2.0
Max	728	728	22	3.8
Mean	403	404	0	0.1
Median	382	382	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	91.5
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	748	748	0	0.0
2.4	748	748	0	0.0
3.6	748	748	0	0.0
4.8	748	748	0	0.0
6.0	748	748	0	0.0
7.2	741	746	5	0.7
8.4	740	742	2	0.3
9.6	738	738	0	0.0
10.8	704	704	0	0.0
12.0	650	650	0	0.0
13.3	648	648	0	0.0
14.5	648	648	0	0.0
15.7	641	641	0	0.0
16.9	633	633	0	0.0
18.1	614	614	0	0.0
19.3	611	611	0	0.0
20.5	601	601	0	0.0
21.7	600	600	0	0.0
22.9	596	596	0	0.0
24.1	595	595	0	0.0
25.3	590	590	0	0.0
26.5	590	590	0	0.0
27.7	578	578	0	0.0
28.9	575	575	0	0.0
30.1	539	539	0	0.0
31.3	539	539	0	0.0
32.5	521	521	0	0.0
33.7	515	515	0	0.0
34.9	507	507	0	0.0
36.1	506	506	0	0.0
37.3	501	501	0	0.0
38.6	485	485	0	0.0
39.8	484	484	0	0.0
41.0	470	470	0	0.0
42.2	460	460	0	0.0
43.4	454	454	0	0.0
44.6	444	444	0	0.0
45.8	438	440	2	0.5
47.0	438	438	0	0.0
48.2	431	431	0	0.0
49.4	425	425	0	0.0
50.6	424	424	0	0.0
51.8	423	423	0	0.0
53.0	411	411	0	0.0
54.2	407	407	0	0.0
55.4	405	405	0	0.0
56.6	397	397	0	0.0
57.8	393	393	0	0.0
59.0	384	384	0	0.0
60.2	363	363	0	0.0
61.4	361	361	0	0.0
62.7	357	357	0	0.0
63.9	345	348	3	0.9
65.1	340	345	5	1.5
66.3	327	327	0	0.0
67.5	325	325	0	0.0
68.7	319	319	0	0.0
69.9	314	314	0	0.0
71.1	311	311	0	0.0
72.3	311	311	0	0.0
73.5	311	311	0	0.0
74.7	309	309	0	0.0
75.9	306	306	0	0.0
77.1	302	302	0	0.0
78.3	299	299	0	0.0
79.5	293	293	0	0.0
80.7	288	288	0	0.0
81.9	287	287	0	0.0
83.1	283	283	0	0.0
84.3	261	261	0	0.0
85.5	238	238	0	0.0
86.7	221	221	0	0.0
88.0	191	186	-5	-2.6
89.2	186	186	0	0.0
90.4	164	164	0	0.0
91.6	159	159	0	0.0
92.8	152	152	0	0.0
94.0	148	148	0	0.0
95.2	128	128	0	0.0
96.4	105	105	0	0.0
97.6	98	98	0	0.0
98.8	68	68	0	0.0
Min	68	68	-5	-2.6
Max	748	748	5	1.5
Mean	435	436	0	0.0
Median	425	425	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	97.6
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	563	564	1	0.2
2.4	362	362	0	0.0
3.6	320	320	0	0.0
4.8	304	304	0	0.0
6.0	287	287	0	0.0
7.2	256	256	0	0.0
8.4	230	230	0	0.0
9.6	201	201	0	0.0
10.8	198	198	0	0.0
12.0	189	189	0	0.0
13.3	180	180	0	0.0
14.5	170	170	0	0.0
15.7	150	150	0	0.0
16.9	149	149	0	0.0
18.1	146	146	0	0.0
19.3	144	144	0	0.0
20.5	143	143	0	0.0
21.7	139	139	0	0.0
22.9	135	135	0	0.0
24.1	135	135	0	0.0
25.3	132	132	0	0.0
26.5	132	132	0	0.0
27.7	128	128	0	0.0
28.9	124	124	0	0.0
30.1	123	123	0	0.0
31.3	123	123	0	0.0
32.5	122	122	0	0.0
33.7	122	122	0	0.0
34.9	121	121	0	0.0
36.1	117	117	0	0.0
37.3	117	117	0	0.0
38.6	116	116	0	0.0
39.8	115	115	0	0.0
41.0	115	115	0	0.0
42.2	112	112	0	0.0
43.4	111	111	0	0.0
44.6	111	111	0	0.0
45.8	110	110	0	0.0
47.0	110	110	0	0.0
48.2	110	110	0	0.0
49.4	109	109	0	0.0
50.6	108	108	0	0.0
51.8	108	108	0	0.0
53.0	106	106	0	0.0
54.2	106	106	0	0.0
55.4	104	104	0	0.0
56.6	104	104	0	0.0
57.8	104	104	0	0.0
59.0	103	103	0	0.0
60.2	103	103	0	0.0
61.4	102	102	0	0.0
62.7	101	101	0	0.0
63.9	100	100	0	0.0
65.1	100	100	0	0.0
66.3	98	98	0	0.0
67.5	95	95	0	0.0
68.7	95	95	0	0.0
69.9	94	94	0	0.0
71.1	93	93	0	0.0
72.3	93	93	0	0.0
73.5	90	90	0	0.0
74.7	89	89	0	0.0
75.9	89	89	0	0.0
77.1	89	89	0	0.0
78.3	89	89	0	0.0
79.5	89	89	0	0.0
80.7	89	89	0	0.0
81.9	89	89	0	0.0
83.1	89	89	0	0.0
84.3	89	89	0	0.0
85.5	89	89	0	0.0
86.7	89	89	0	0.0
88.0	89	89	0	0.0
89.2	89	89	0	0.0
90.4	89	89	0	0.0
91.6	89	89	0	0.0
92.8	81	81	0	0.0
94.0	79	79	0	0.0
95.2	65	65	0	0.0
96.4	65	65	0	0.0
97.6	65	65	0	0.0
98.8	65	65	0	0.0
Min	65	65	0	0.0
Max	563	564	1	0.2
Mean	130	130	0	0.0
Median	109	109	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	594	594	0	0.0
2.4	594	594	0	0.0
3.6	463	463	0	0.0
4.8	321	321	0	0.0
6.0	276	276	0	0.0
7.2	248	248	0	0.0
8.4	240	240	0	0.0
9.6	223	223	0	0.0
10.8	204	204	0	0.0
12.0	180	180	0	0.0
13.3	171	171	0	0.0
14.5	165	165	0	0.0
15.7	155	155	0	0.0
16.9	149	149	0	0.0
18.1	127	127	0	0.0
19.3	125	125	0	0.0
20.5	123	123	0	0.0
21.7	119	119	0	0.0
22.9	116	116	0	0.0
24.1	116	116	0	0.0
25.3	113	113	0	0.0
26.5	109	109	0	0.0
27.7	107	107	0	0.0
28.9	106	106	0	0.0
30.1	104	104	0	0.0
31.3	102	102	0	0.0
32.5	100	100	0	0.0
33.7	99	99	0	0.0
34.9	98	98	0	0.0
36.1	98	98	0	0.0
37.3	93	93	0	0.0
38.6	92	92	0	0.0
39.8	92	92	0	0.0
41.0	92	92	0	0.0
42.2	92	92	0	0.0
43.4	92	92	0	0.0
44.6	92	92	0	0.0
45.8	92	92	0	0.0
47.0	92	92	0	0.0
48.2	92	92	0	0.0
49.4	92	92	0	0.0
50.6	92	92	0	0.0
51.8	92	92	0	0.0
53.0	92	92	0	0.0
54.2	92	92	0	0.0
55.4	92	92	0	0.0
56.6	92	92	0	0.0
57.8	92	92	0	0.0
59.0	92	92	0	0.0
60.2	92	92	0	0.0
61.4	92	92	0	0.0
62.7	92	92	0	0.0
63.9	92	92	0	0.0
65.1	92	92	0	0.0
66.3	92	92	0	0.0
67.5	92	92	0	0.0
68.7	92	92	0	0.0
69.9	92	92	0	0.0
71.1	92	92	0	0.0
72.3	92	92	0	0.0
73.5	92	92	0	0.0
74.7	92	92	0	0.0
75.9	92	92	0	0.0
77.1	92	92	0	0.0
78.3	92	92	0	0.0
79.5	92	92	0	0.0
80.7	92	92	0	0.0
81.9	92	92	0	0.0
83.1	92	92	0	0.0
84.3	92	92	0	0.0
85.5	92	92	0	0.0
86.7	92	92	0	0.0
88.0	92	92	0	0.0
89.2	92	92	0	0.0
90.4	87	87	0	0.0
91.6	85	85	0	0.0
92.8	77	77	0	0.0
94.0	68	72	4	5.9
95.2	68	68	0	0.0
96.4	68	68	0	0.0
97.6	68	68	0	0.0
98.8	68	68	0	0.0
Min	68	68	0	0.0
Max	594	594	4	5.9
Mean	127	127	0	0.1
Median	92	92	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		1.2
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	671	671	0	0.0
2.4	671	671	0	0.0
3.6	671	671	0	0.0
4.8	671	671	0	0.0
6.0	671	671	0	0.0
7.2	671	671	0	0.0
8.4	637	637	0	0.0
9.6	622	622	0	0.0
10.8	591	591	0	0.0
12.0	587	587	0	0.0
13.3	532	532	0	0.0
14.5	528	528	0	0.0
15.7	521	521	0	0.0
16.9	517	517	0	0.0
18.1	487	487	0	0.0
19.3	471	471	0	0.0
20.5	464	464	0	0.0
21.7	403	403	0	0.0
22.9	400	400	0	0.0
24.1	386	386	0	0.0
25.3	373	373	0	0.0
26.5	362	362	0	0.0
27.7	354	354	0	0.0
28.9	352	352	0	0.0
30.1	348	348	0	0.0
31.3	344	344	0	0.0
32.5	337	337	0	0.0
33.7	325	325	0	0.0
34.9	324	324	0	0.0
36.1	324	324	0	0.0
37.3	322	322	0	0.0
38.6	320	320	0	0.0
39.8	320	320	0	0.0
41.0	319	319	0	0.0
42.2	318	318	0	0.0
43.4	316	316	0	0.0
44.6	314	314	0	0.0
45.8	311	311	0	0.0
47.0	305	305	0	0.0
48.2	301	301	0	0.0
49.4	291	294	3	1.0
50.6	281	281	0	0.0
51.8	280	280	0	0.0
53.0	277	277	0	0.0
54.2	243	243	0	0.0
55.4	230	230	0	0.0
56.6	230	230	0	0.0
57.8	221	221	0	0.0
59.0	220	220	0	0.0
60.2	218	218	0	0.0
61.4	205	210	5	2.4
62.7	205	205	0	0.0
63.9	202	205	3	1.5
65.1	201	202	1	0.5
66.3	200	201	1	0.5
67.5	199	200	1	0.5
68.7	197	199	2	1.0
69.9	197	197	0	0.0
71.1	195	197	2	1.0
72.3	195	195	0	0.0
73.5	195	195	0	0.0
74.7	192	195	3	1.6
75.9	191	192	1	0.5
77.1	191	191	0	0.0
78.3	186	191	5	2.7
79.5	181	186	5	2.8
80.7	155	181	26	16.8
81.9	60	161	101	168.3
83.1	58	60	2	3.4
84.3	57	57	0	0.0
85.5	49	49	0	0.0
86.7	48	48	0	0.0
88.0	43	43	0	0.0
89.2	43	43	0	0.0
90.4	40	40	0	0.0
91.6	37	37	0	0.0
92.8	34	34	0	0.0
94.0	30	30	0	0.0
95.2	27	27	0	0.0
96.4	27	27	0	0.0
97.6	26	26	0	0.0
98.8	8	8	0	0.0
Min	8	8	0	0.0
Max	671	671	101	168.3
Mean	294	296	2	2.5
Median	286	288	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	90.2
1.1<=X<10.0		7.3
X>=5.0		2.4
X>=10.0		2.4
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		15.0
X>=5.0		10.0
X>=10.0		10.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**10.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Exports (TAF)	With-Project (J602F3 ELD) Monthly Mean Exports (TAF)	Absolute Difference (TAF)	Relative Difference (%)
1.2	724	724	0	0.0
2.4	720	720	0	0.0
3.6	715	714	-1	-0.1
4.8	714	714	0	0.0
6.0	714	714	0	0.0
7.2	714	714	0	0.0
8.4	714	714	0	0.0
9.6	714	714	0	0.0
10.8	714	714	0	0.0
12.0	714	714	0	0.0
13.3	714	714	0	0.0
14.5	714	714	0	0.0
15.7	714	714	0	0.0
16.9	714	714	0	0.0
18.1	714	714	0	0.0
19.3	714	714	0	0.0
20.5	714	714	0	0.0
21.7	714	714	0	0.0
22.9	714	714	0	0.0
24.1	714	714	0	0.0
25.3	714	714	0	0.0
26.5	714	714	0	0.0
27.7	714	714	0	0.0
28.9	714	714	0	0.0
30.1	714	714	0	0.0
31.3	712	712	0	0.0
32.5	712	712	0	0.0
33.7	711	711	0	0.0
34.9	709	709	0	0.0
36.1	709	709	0	0.0
37.3	709	709	0	0.0
38.6	708	708	0	0.0
39.8	708	708	0	0.0
41.0	708	708	0	0.0
42.2	708	708	0	0.0
43.4	708	707	-1	-0.1
44.6	707	707	0	0.0
45.8	707	707	0	0.0
47.0	707	707	0	0.0
48.2	704	704	0	0.0
49.4	703	703	0	0.0
50.6	703	703	0	0.0
51.8	702	702	0	0.0
53.0	702	702	0	0.0
54.2	702	702	0	0.0
55.4	700	700	0	0.0
56.6	694	699	5	0.7
57.8	694	694	0	0.0
59.0	694	694	0	0.0
60.2	693	694	1	0.1
61.4	682	682	0	0.0
62.7	669	670	1	0.1
63.9	667	666	-1	-0.1
65.1	658	662	4	0.6
66.3	656	657	1	0.2
67.5	647	653	6	0.9
68.7	643	653	10	1.6
69.9	641	647	6	0.9
71.1	640	643	3	0.5
72.3	636	639	3	0.5
73.5	634	635	1	0.2
74.7	633	633	0	0.0
75.9	625	632	7	1.1
77.1	621	626	5	0.8
78.3	614	614	0	0.0
79.5	567	567	0	0.0
80.7	563	558	-5	-0.9
81.9	557	555	-2	-0.4
83.1	509	539	30	5.9
84.3	483	436	-47	-9.7
85.5	442	408	-34	-7.7
86.7	408	394	-14	-3.4
88.0	383	375	-8	-2.1
89.2	369	371	2	0.5
90.4	306	317	11	3.6
91.6	291	291	0	0.0
92.8	147	146	-1	-0.7
94.0	129	110	-19	-14.7
95.2	110	100	-10	-9.1
96.4	100	85	-15	-15.0
97.6	79	79	0	0.0
98.8	74	74	0	0.0
Min	74	74	-47	-15.0
Max	724	724	30	5.9
Mean	618	617	-1	-0.6
Median	703	703	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		4.9
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		6.1
X<=-10.0		2.4
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-2.4**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	50.0
1.1<=X<10.0		15.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		25.0
X<=-10.0		10.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-10.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	724	724	0	0.0
2.4	724	724	0	0.0
3.6	724	724	0	0.0
4.8	724	724	0	0.0
6.0	724	724	0	0.0
7.2	724	724	0	0.0
8.4	724	724	0	0.0
9.6	724	724	0	0.0
10.8	724	724	0	0.0
12.0	724	724	0	0.0
13.3	724	724	0	0.0
14.5	724	724	0	0.0
15.7	724	724	0	0.0
16.9	724	724	0	0.0
18.1	724	724	0	0.0
19.3	724	724	0	0.0
20.5	724	724	0	0.0
21.7	724	724	0	0.0
22.9	724	724	0	0.0
24.1	724	724	0	0.0
25.3	724	724	0	0.0
26.5	724	724	0	0.0
27.7	724	724	0	0.0
28.9	724	724	0	0.0
30.1	724	724	0	0.0
31.3	724	724	0	0.0
32.5	724	724	0	0.0
33.7	724	724	0	0.0
34.9	719	720	1	0.1
36.1	716	716	0	0.0
37.3	716	716	0	0.0
38.6	715	715	0	0.0
39.8	715	715	0	0.0
41.0	715	715	0	0.0
42.2	715	715	0	0.0
43.4	710	710	0	0.0
44.6	709	709	0	0.0
45.8	709	709	0	0.0
47.0	709	709	0	0.0
48.2	709	709	0	0.0
49.4	707	707	0	0.0
50.6	707	707	0	0.0
51.8	698	698	0	0.0
53.0	694	694	0	0.0
54.2	694	694	0	0.0
55.4	694	694	0	0.0
56.6	685	685	0	0.0
57.8	676	676	0	0.0
59.0	664	664	0	0.0
60.2	649	649	0	0.0
61.4	639	641	2	0.3
62.7	570	570	0	0.0
63.9	532	531	-1	-0.2
65.1	489	477	-12	-2.5
66.3	478	471	-7	-1.5
67.5	474	469	-5	-1.1
68.7	458	467	9	2.0
69.9	457	463	6	1.3
71.1	441	457	16	3.6
72.3	417	456	39	9.4
73.5	401	401	0	0.0
74.7	388	400	12	3.1
75.9	374	384	10	2.7
77.1	369	371	2	0.5
78.3	362	363	1	0.3
79.5	353	346	-7	-2.0
80.7	340	340	0	0.0
81.9	330	330	0	0.0
83.1	328	328	0	0.0
84.3	318	318	0	0.0
85.5	295	295	0	0.0
86.7	287	289	2	0.7
88.0	253	287	34	13.4
89.2	236	220	-16	-6.8
90.4	220	217	-3	-1.4
91.6	216	215	-1	-0.5
92.8	196	196	0	0.0
94.0	172	171	-1	-0.6
95.2	171	152	-19	-11.1
96.4	152	142	-10	-6.6
97.6	132	129	-3	-2.3
98.8	104	104	0	0.0
Min	104	104	-19	-11.1
Max	724	724	39	13.4
Mean	569	569	1	0.0
Median	707	707	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	80.5
1.1<=X<10.0		7.3
X>=5.0		2.4
X>=10.0		1.2
-10.0<X<=-1.1		9.8
X<=-5.0		3.7
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		5.0
X>=5.0		5.0
X>=10.0		5.0
-10.0<X<=-1.1		25.0
X<=-5.0		15.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Total Delta Export (Banks + Jones) - Probability of Exceedance

September

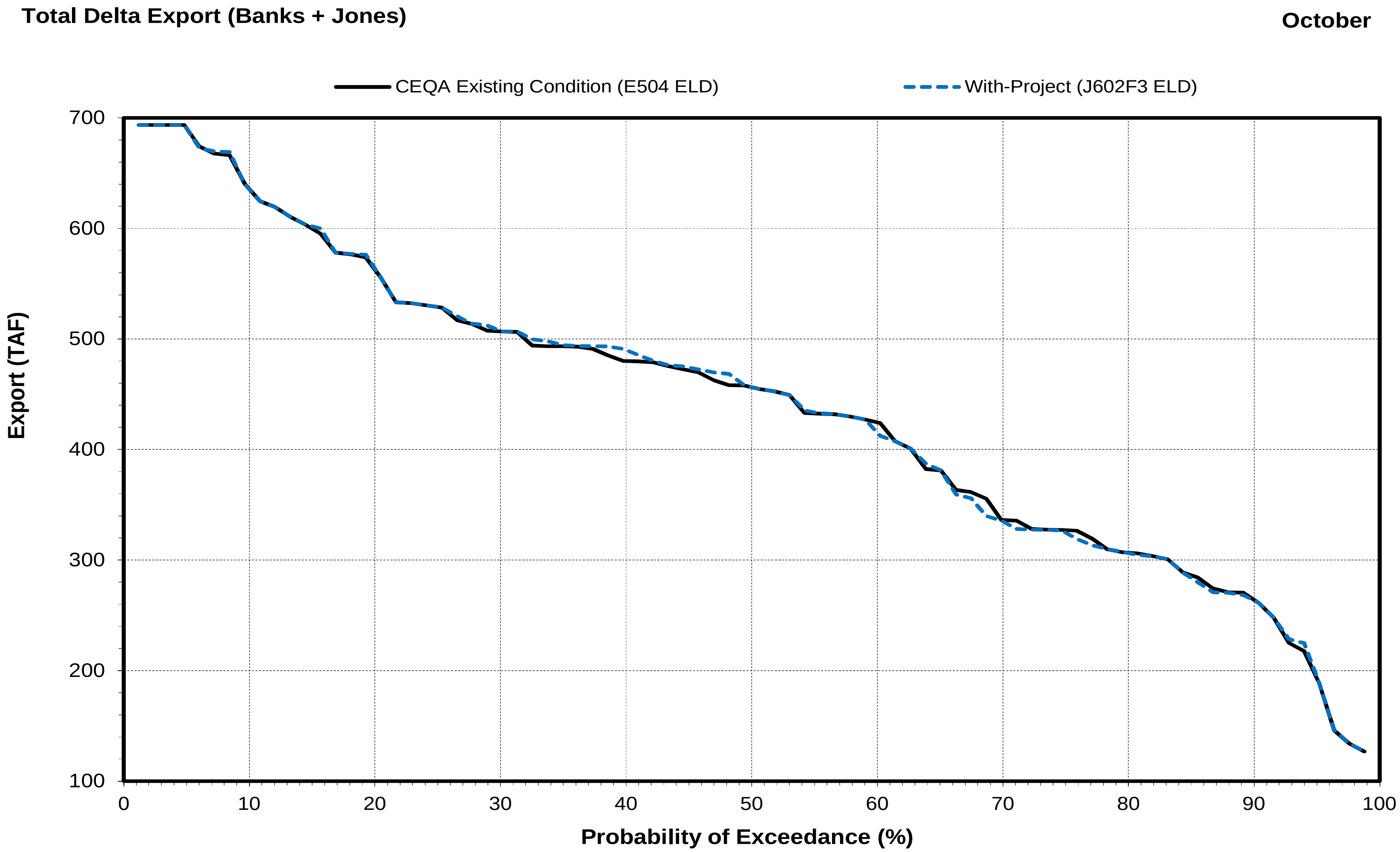
Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (TAF)	Relative Difference (%)
	Monthly Mean Exports (TAF)	Monthly Mean Exports (TAF)		
1.2	671	671	0	0.0
2.4	671	671	0	0.0
3.6	671	671	0	0.0
4.8	671	671	0	0.0
6.0	671	671	0	0.0
7.2	671	671	0	0.0
8.4	671	671	0	0.0
9.6	671	671	0	0.0
10.8	671	671	0	0.0
12.0	671	671	0	0.0
13.3	671	671	0	0.0
14.5	671	671	0	0.0
15.7	671	671	0	0.0
16.9	671	671	0	0.0
18.1	671	671	0	0.0
19.3	671	671	0	0.0
20.5	671	671	0	0.0
21.7	671	671	0	0.0
22.9	671	671	0	0.0
24.1	671	671	0	0.0
25.3	671	671	0	0.0
26.5	671	671	0	0.0
27.7	671	671	0	0.0
28.9	671	671	0	0.0
30.1	670	670	0	0.0
31.3	664	669	5	0.8
32.5	663	668	5	0.8
33.7	662	663	1	0.2
34.9	661	663	2	0.3
36.1	660	661	1	0.2
37.3	659	660	1	0.2
38.6	657	659	2	0.3
39.8	657	657	0	0.0
41.0	656	657	1	0.2
42.2	655	656	1	0.2
43.4	655	655	0	0.0
44.6	651	655	4	0.6
45.8	646	648	2	0.3
47.0	643	646	3	0.5
48.2	638	643	5	0.8
49.4	637	638	1	0.2
50.6	636	637	1	0.2
51.8	634	635	1	0.2
53.0	634	634	0	0.0
54.2	634	634	0	0.0
55.4	628	625	-3	-0.5
56.6	627	623	-4	-0.6
57.8	616	616	0	0.0
59.0	610	604	-6	-1.0
60.2	604	601	-3	-0.5
61.4	594	594	0	0.0
62.7	590	586	-4	-0.7
63.9	572	572	0	0.0
65.1	560	571	11	2.0
66.3	553	560	7	1.3
67.5	544	552	8	1.5
68.7	515	544	29	5.6
69.9	509	522	13	2.6
71.1	484	482	-2	-0.4
72.3	454	451	-3	-0.7
73.5	451	445	-6	-1.3
74.7	446	440	-6	-1.3
75.9	445	439	-6	-1.3
77.1	440	438	-2	-0.5
78.3	439	437	-2	-0.5
79.5	403	430	27	6.7
80.7	375	375	0	0.0
81.9	354	356	2	0.6
83.1	336	336	0	0.0
84.3	334	334	0	0.0
85.5	329	329	0	0.0
86.7	272	272	0	0.0
88.0	252	252	0	0.0
89.2	244	244	0	0.0
90.4	226	226	0	0.0
91.6	225	225	0	0.0
92.8	212	212	0	0.0
94.0	207	207	0	0.0
95.2	206	206	0	0.0
96.4	200	200	0	0.0
97.6	192	192	0	0.0
98.8	176	176	0	0.0
Min	176	176	-6	-1.3
Max	671	671	29	6.7
Mean	549	550	1	0.2
Median	637	638	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		7.3
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		5.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

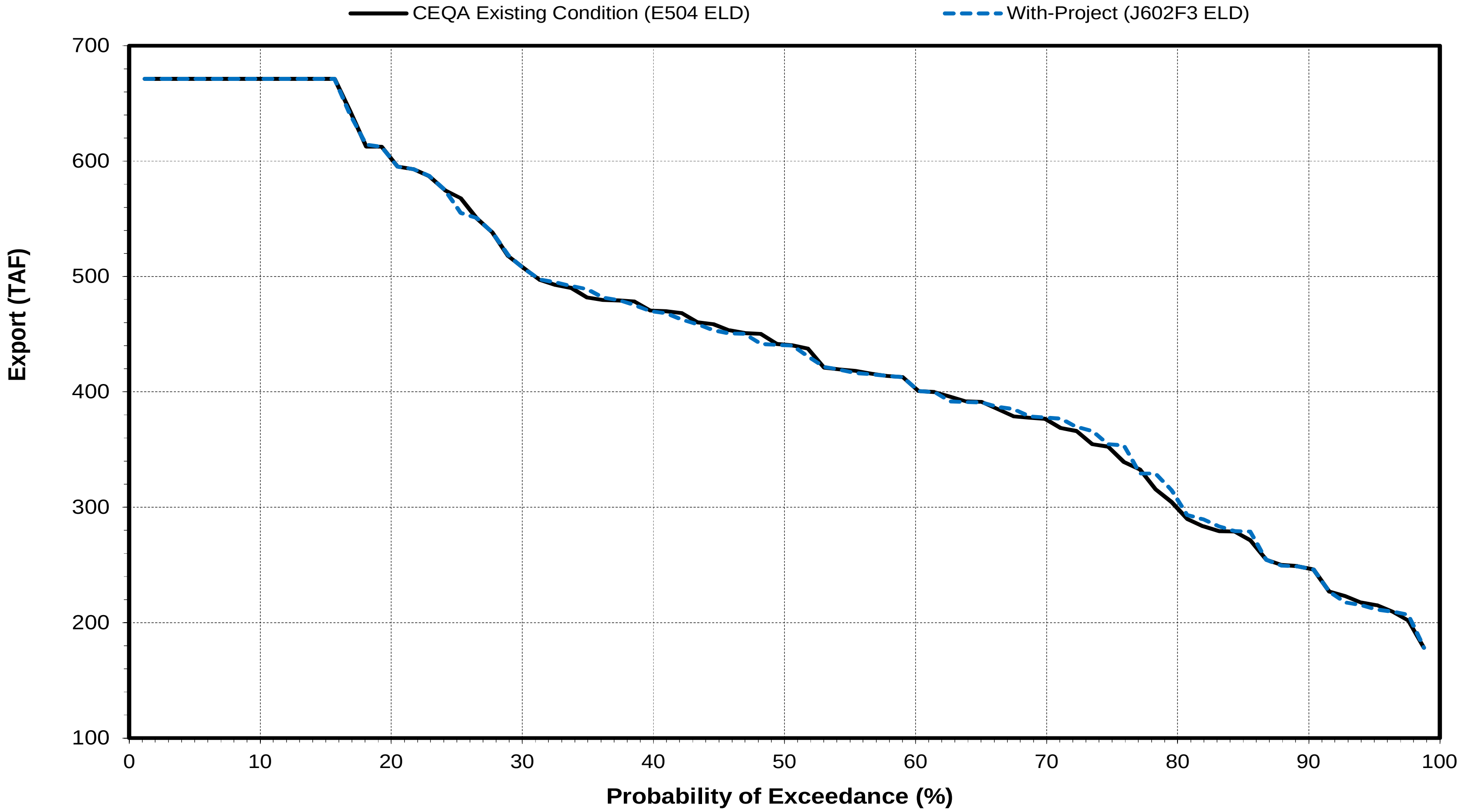


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Total Delta Export (Banks + Jones)

November

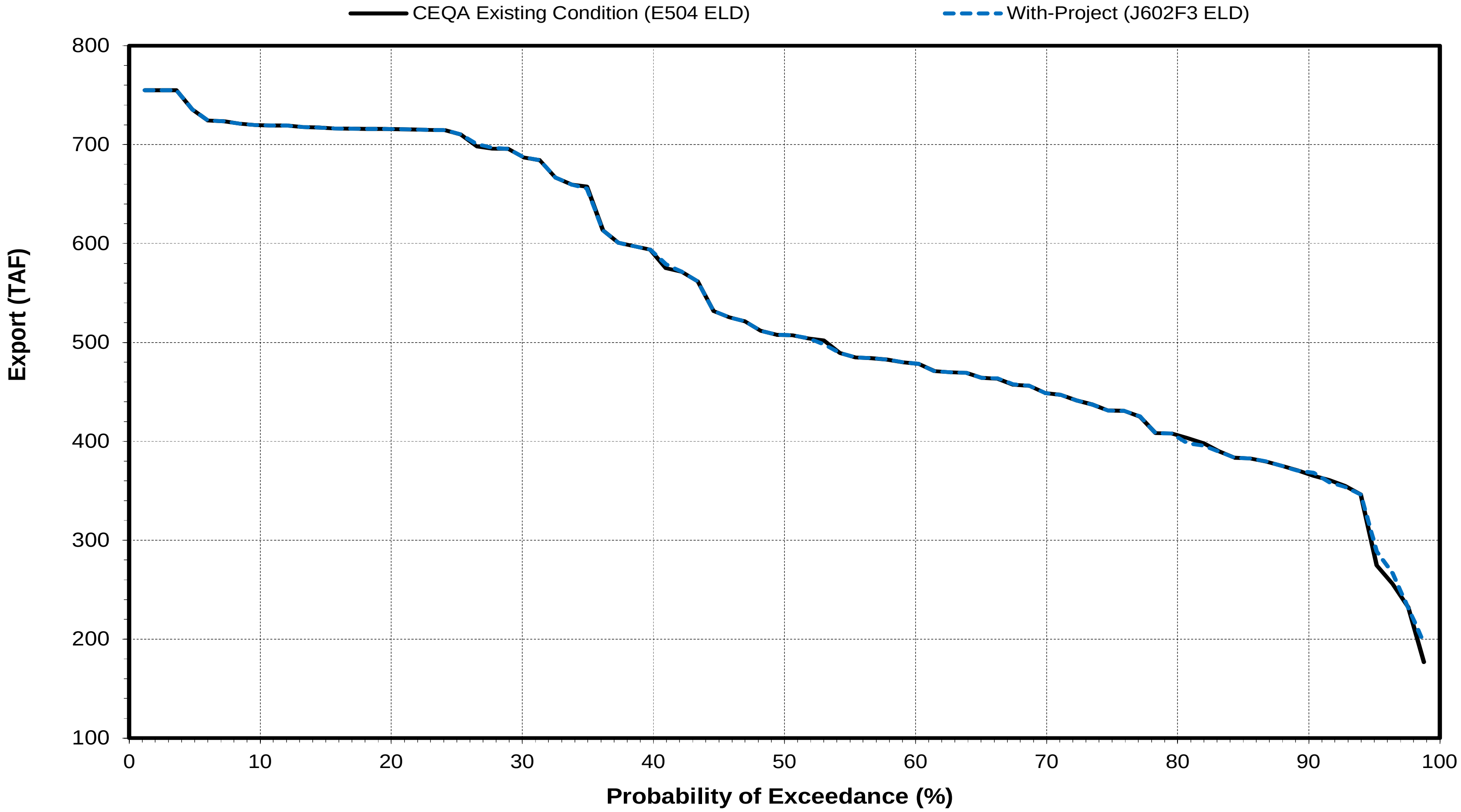


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

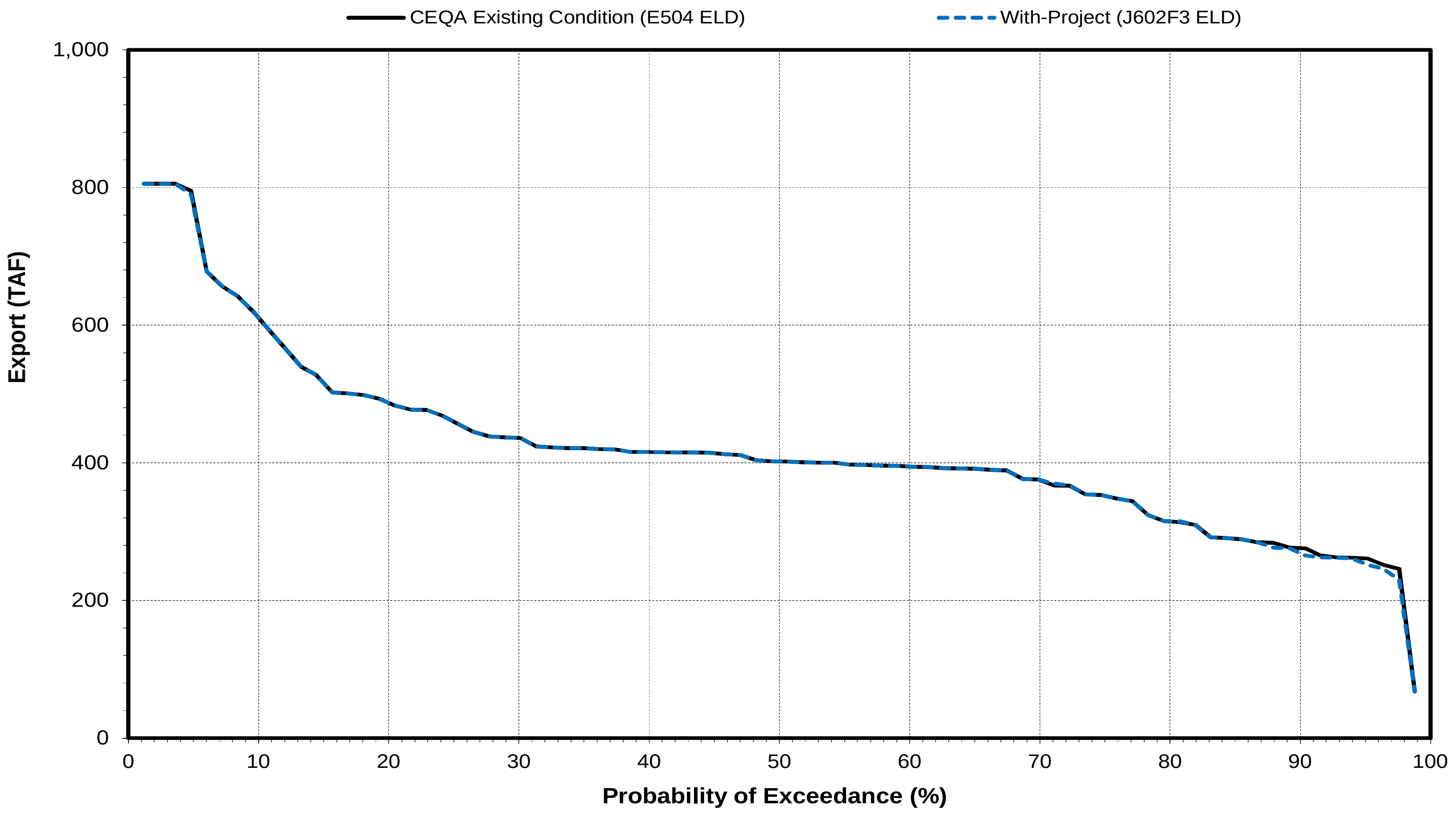
Total Delta Export (Banks + Jones)

December



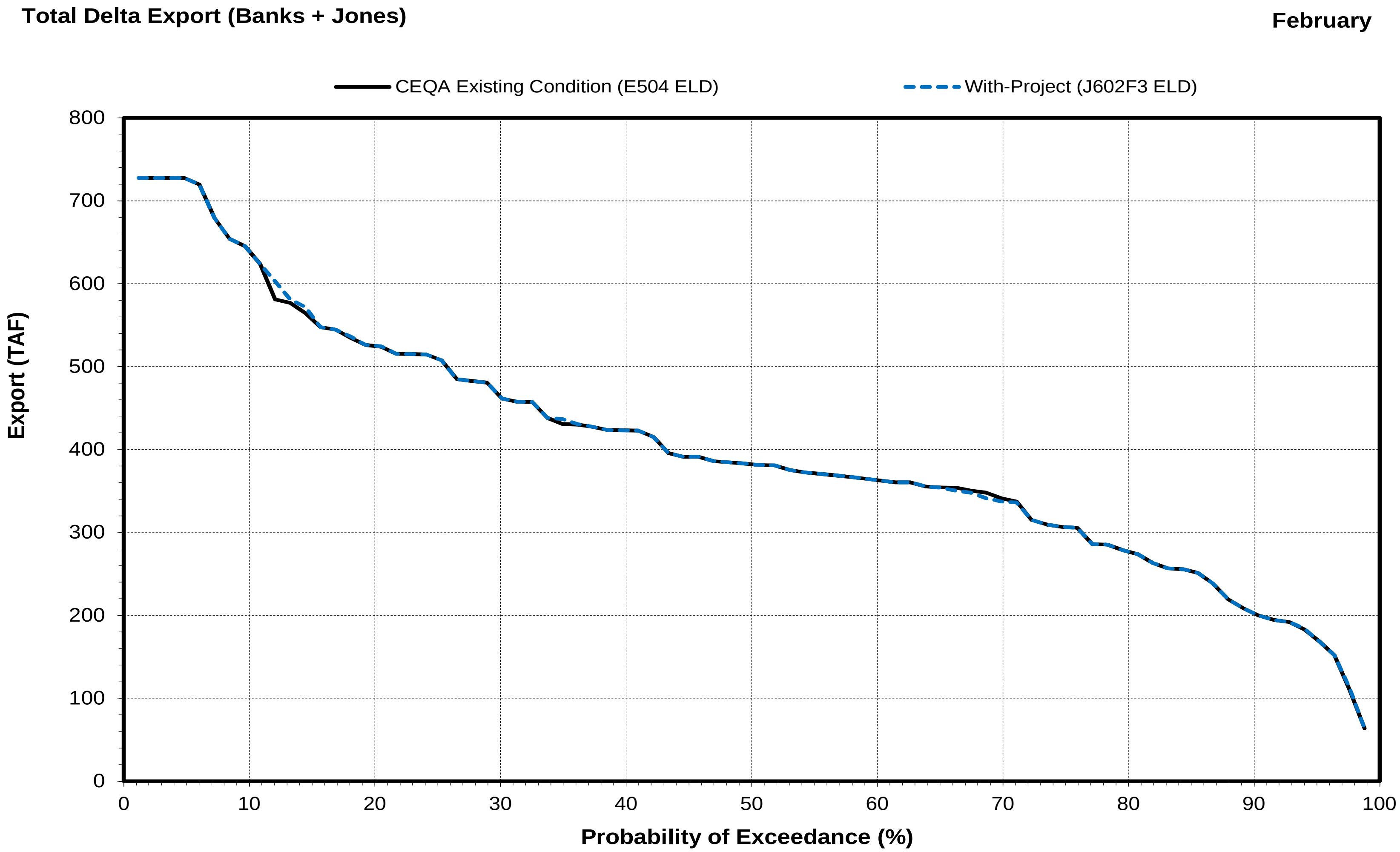
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Total Delta Export (Banks + Jones) **January**

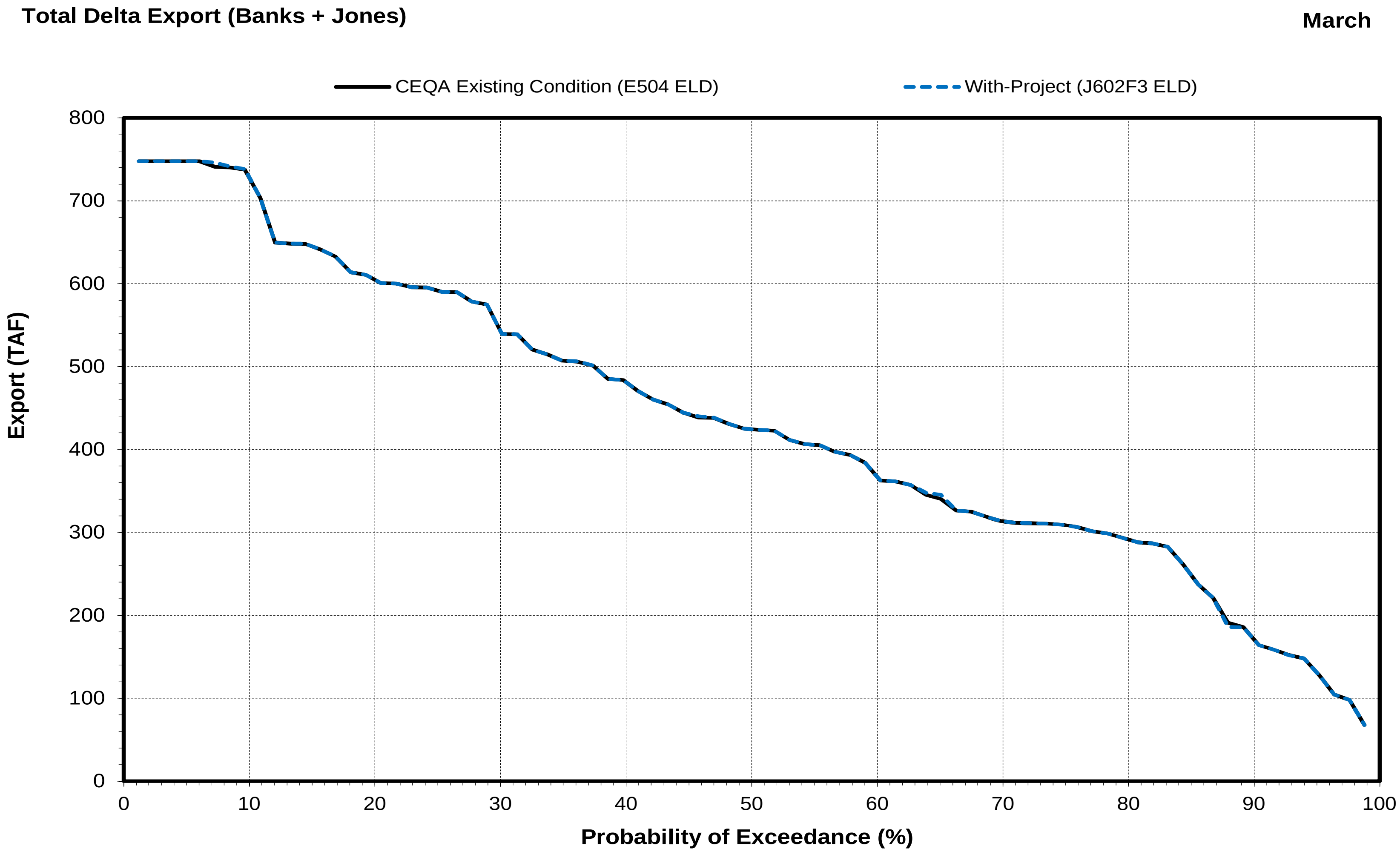


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



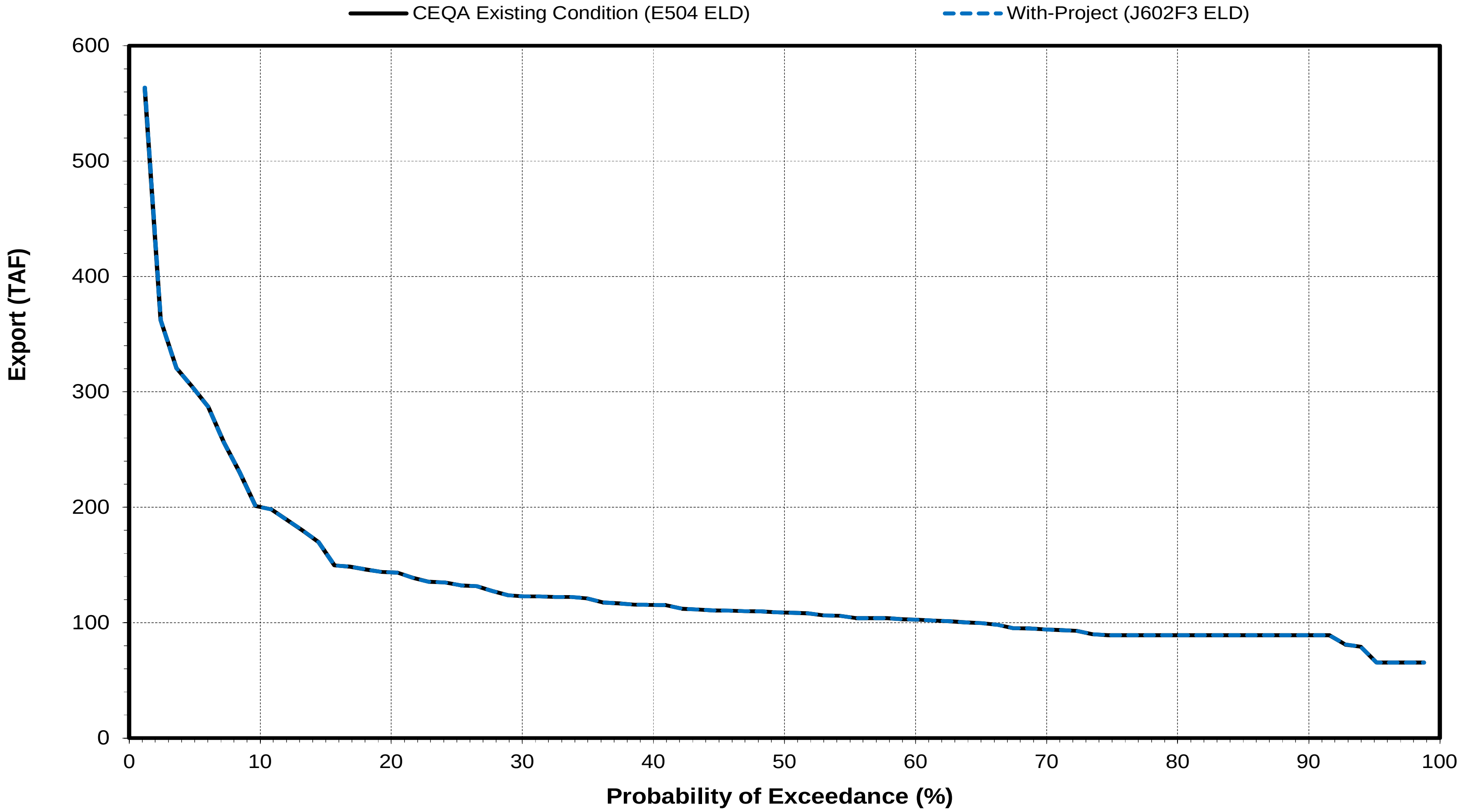
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

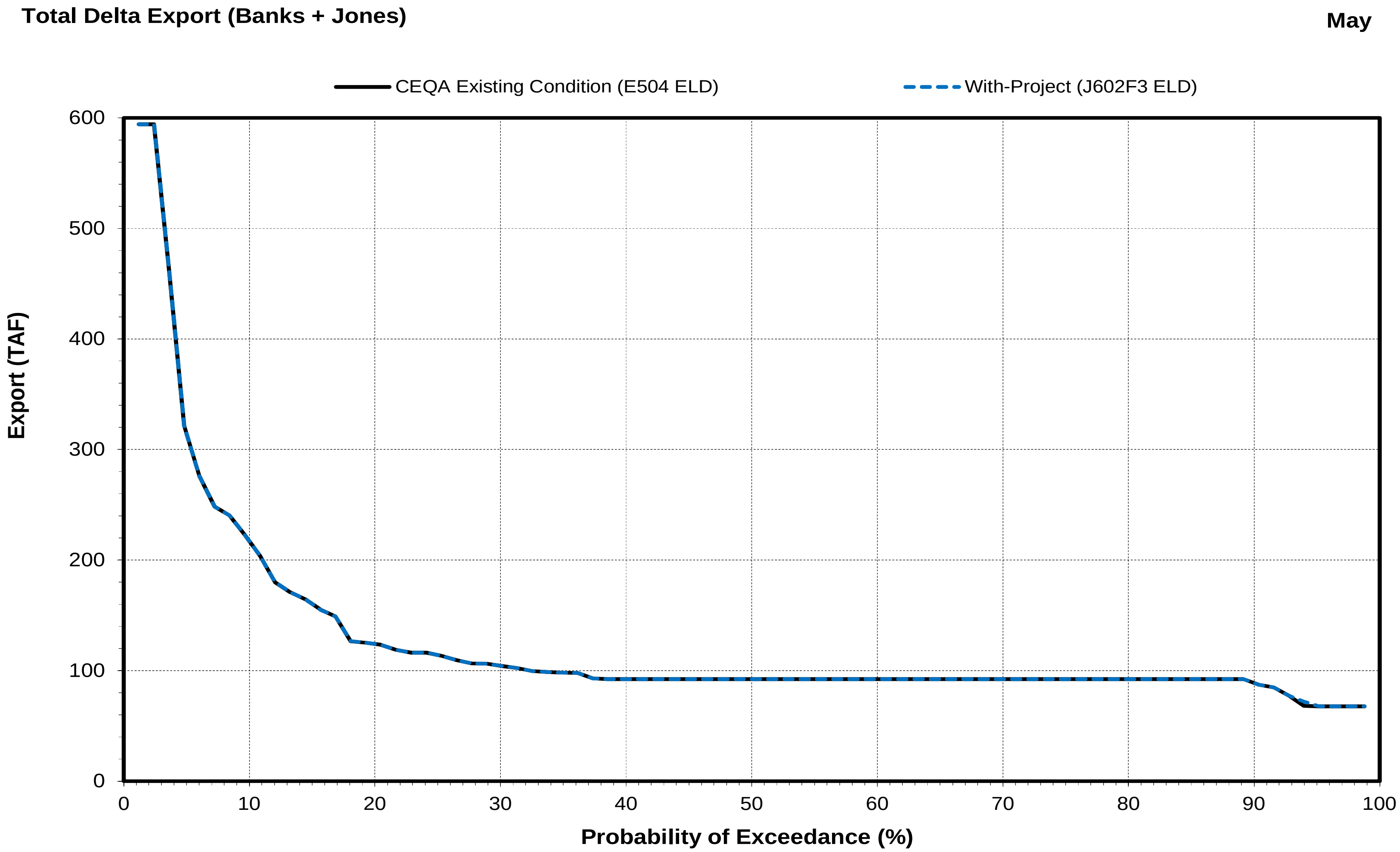
Created: 7/26/2016

Total Delta Export (Banks + Jones) **April**



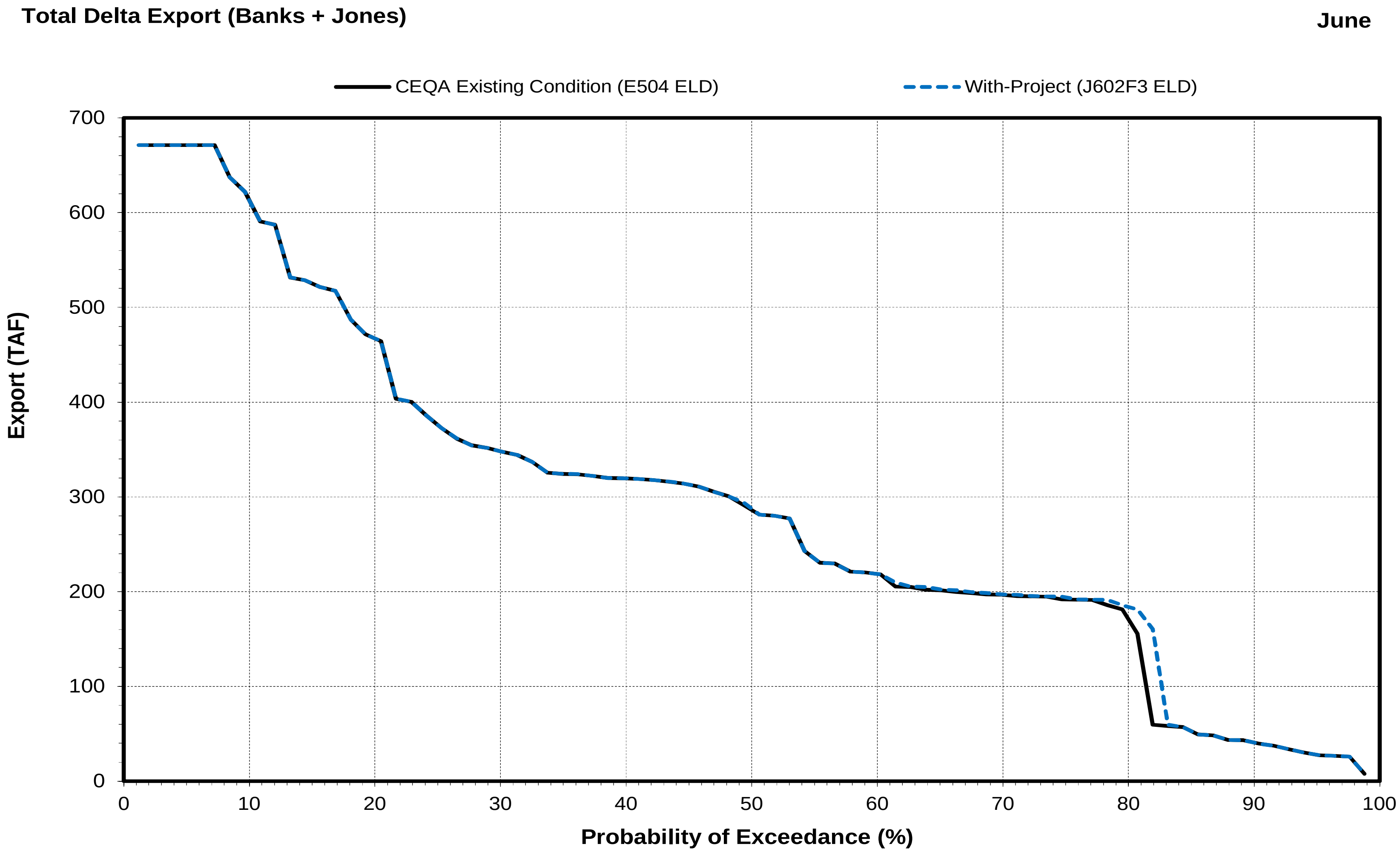
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



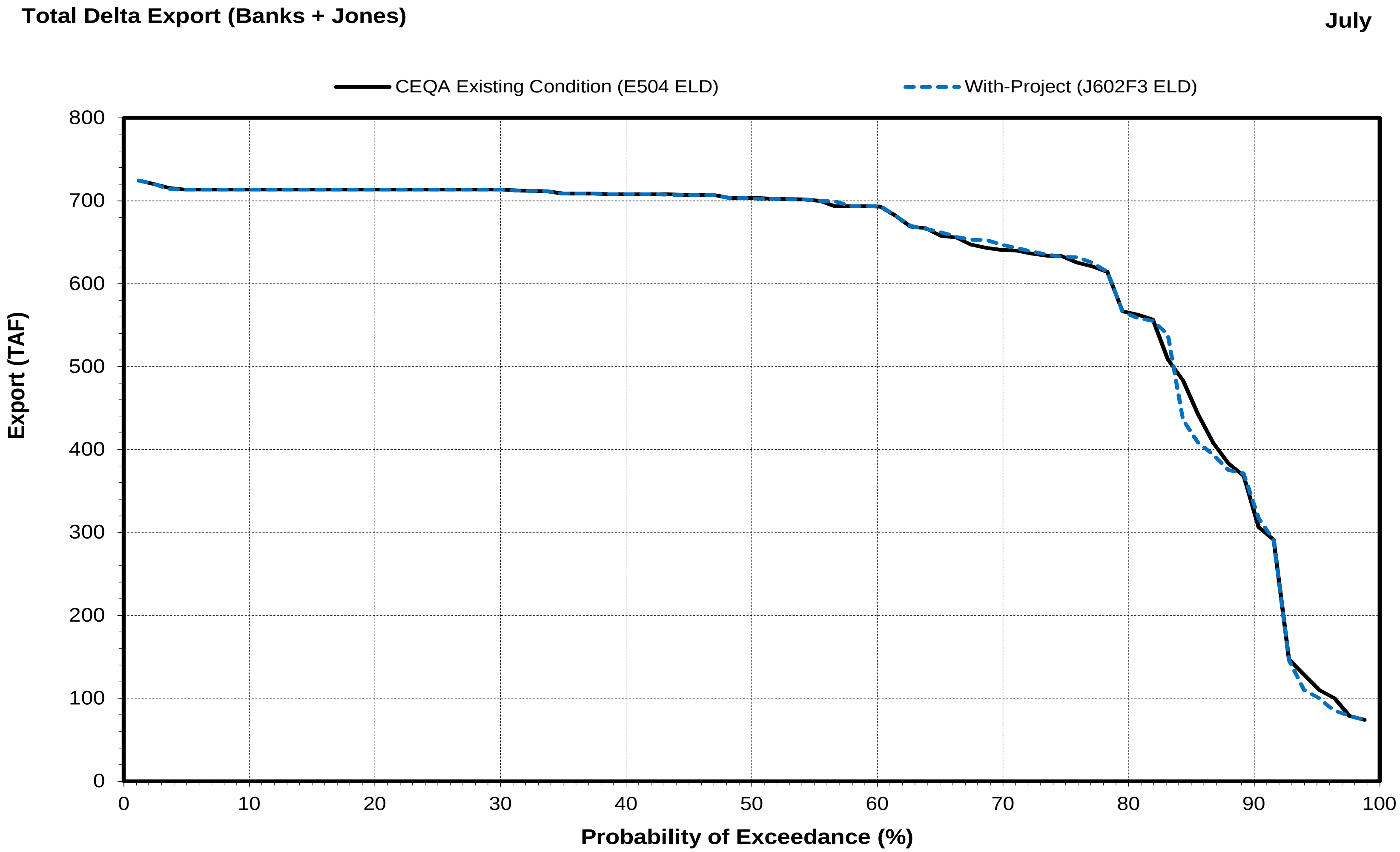
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

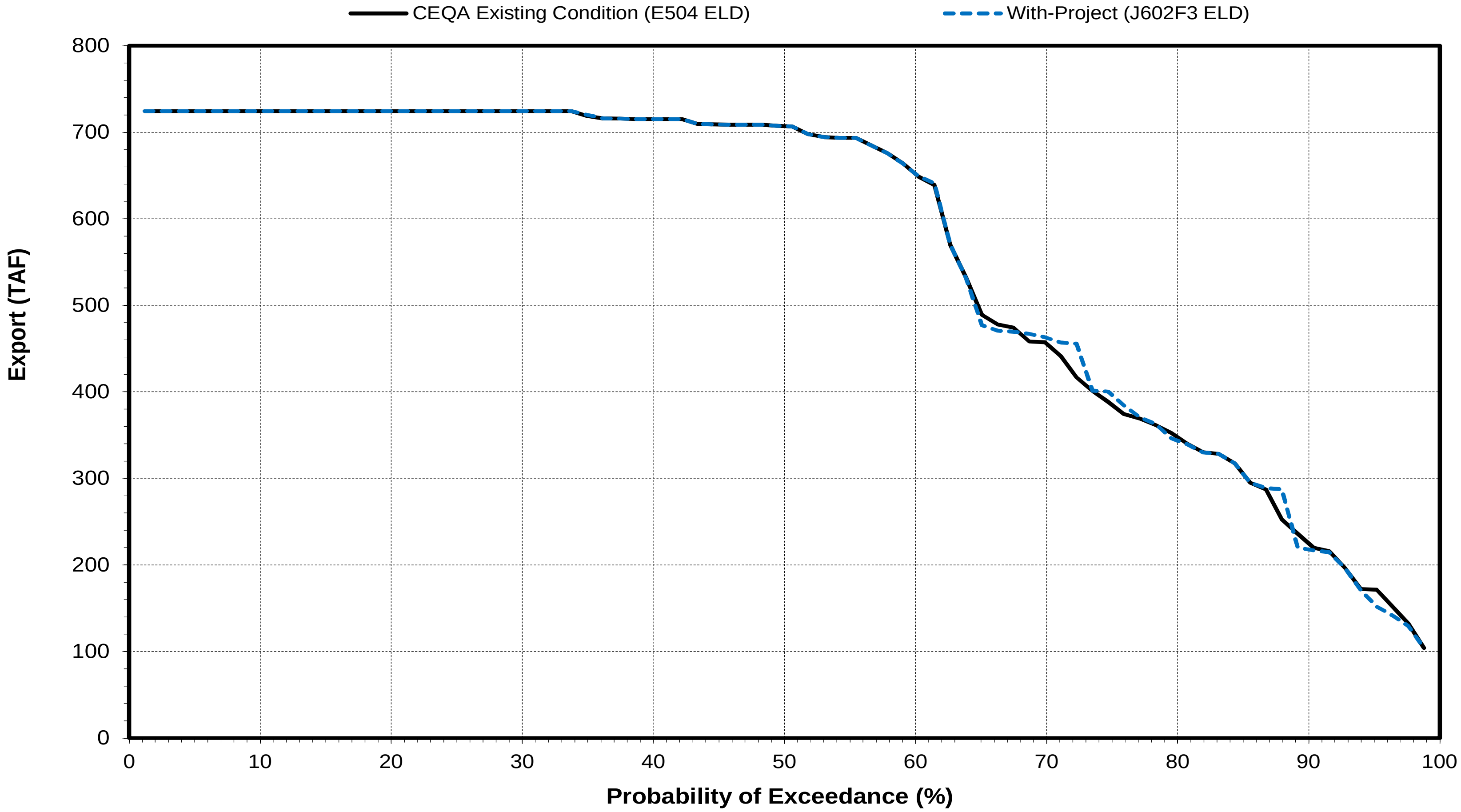
Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Total Delta Export (Banks + Jones)

August

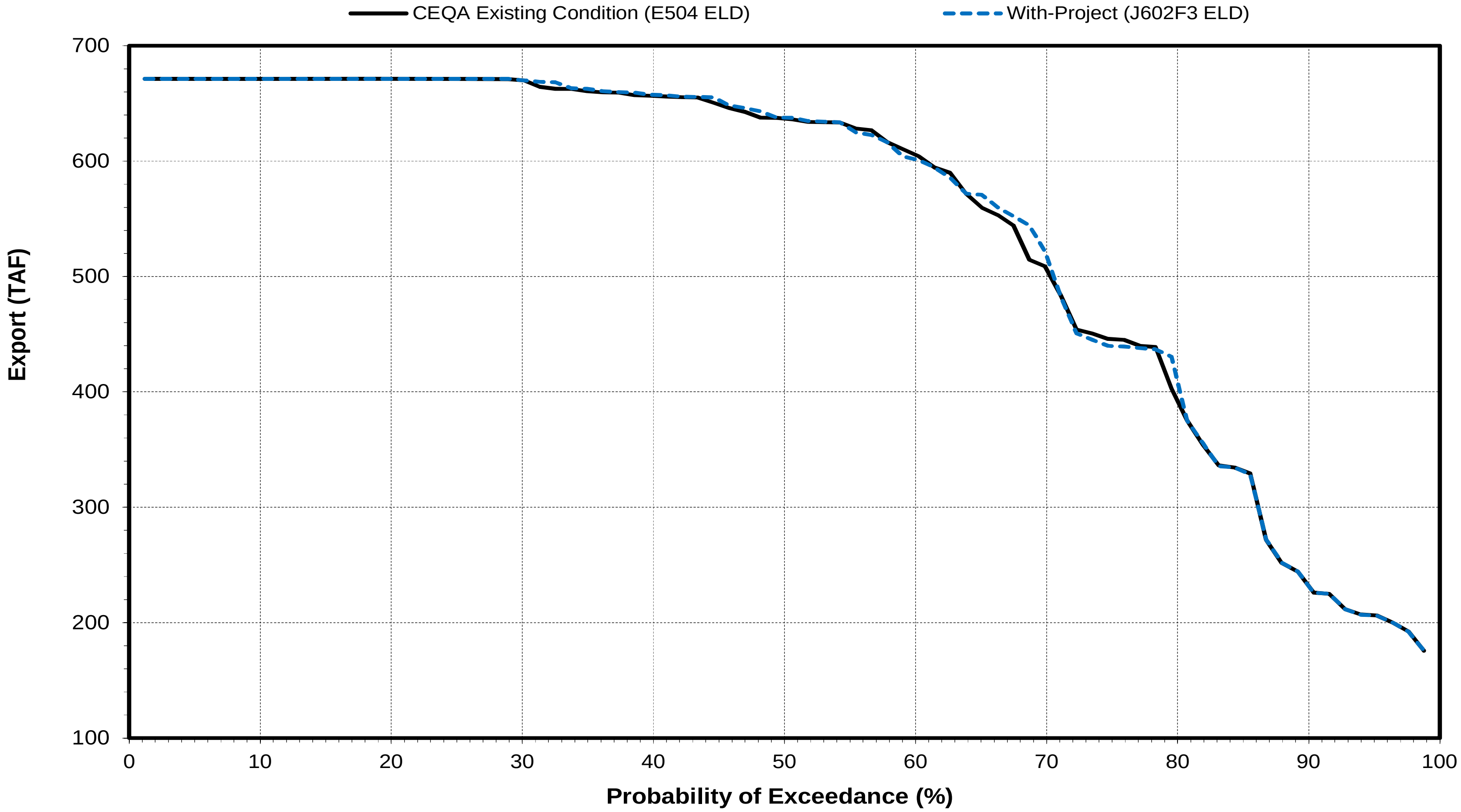


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Total Delta Export (Banks + Jones)

September

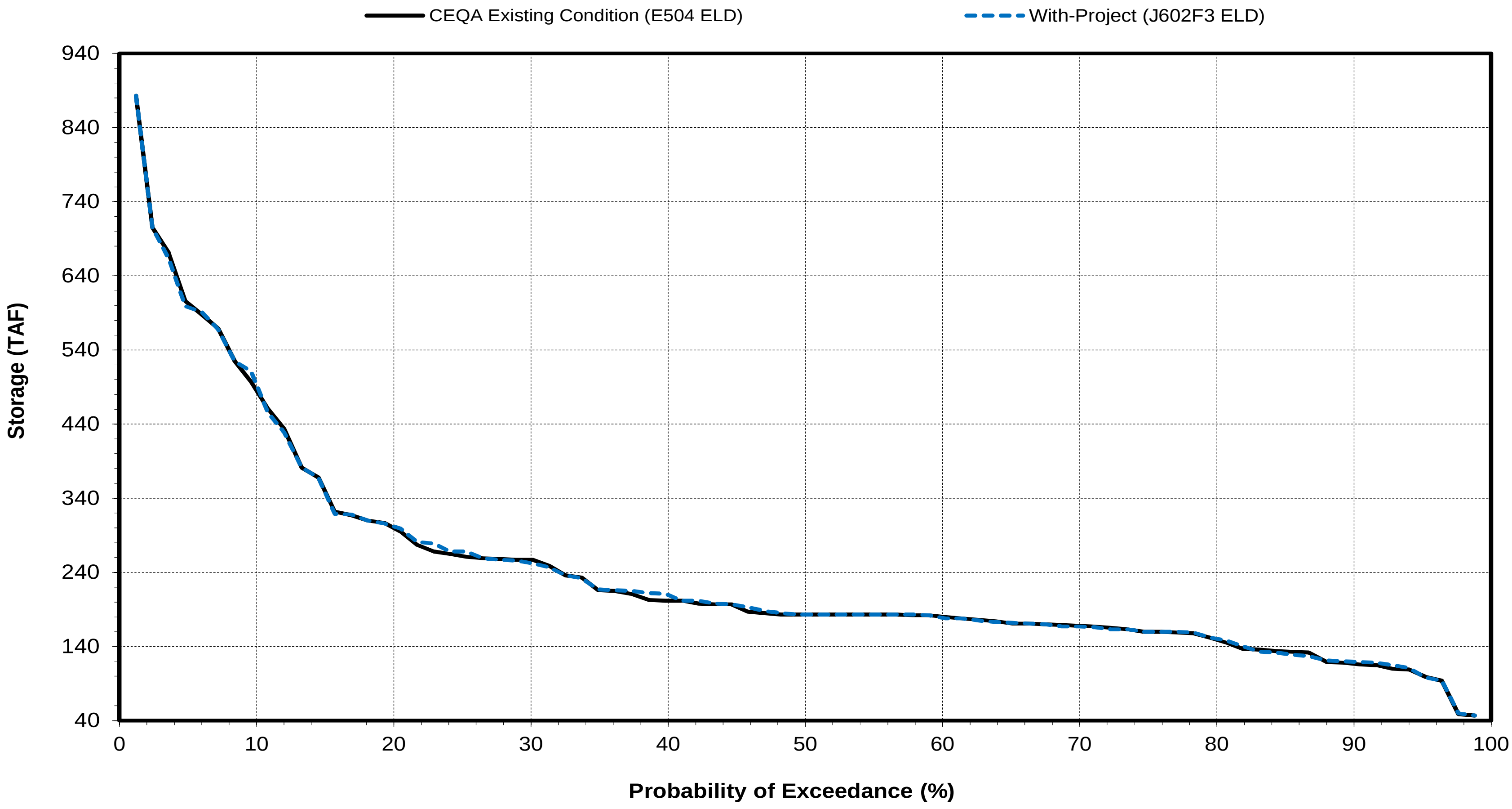


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

CVP San Luis Reservoir End of Month Storage

October

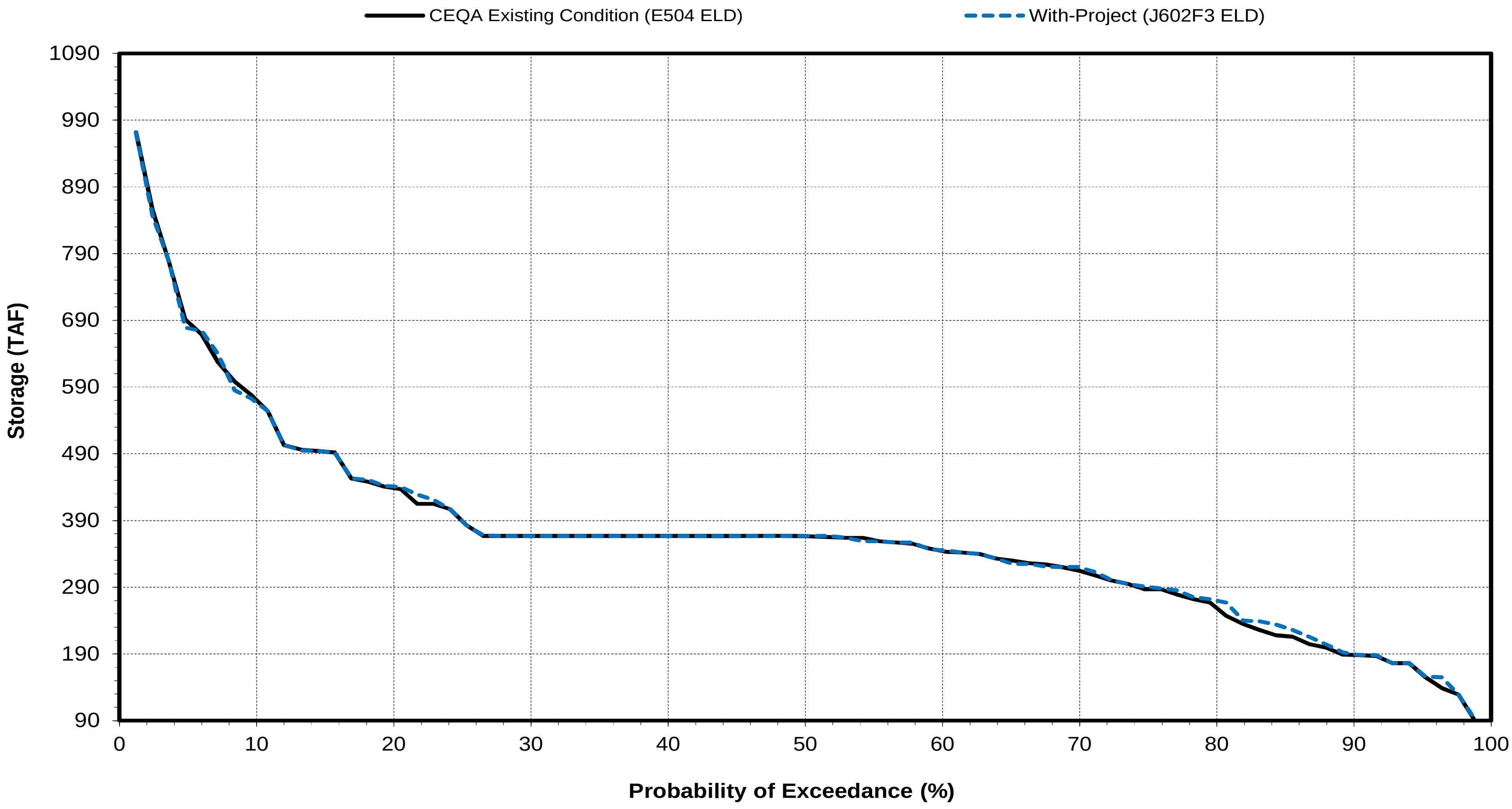


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

CVP San Luis Reservoir End of Month Storage

November

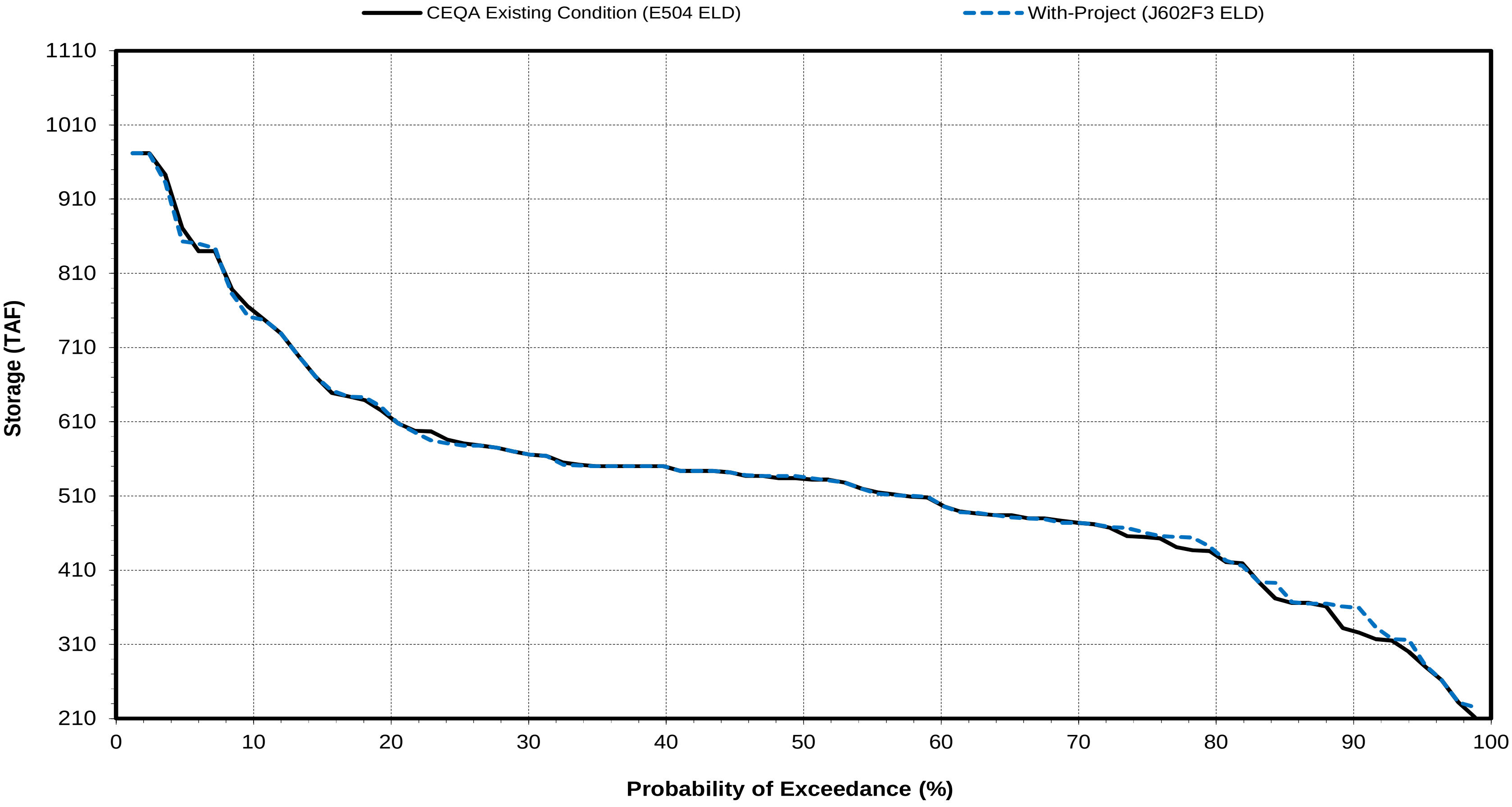


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

CVP San Luis Reservoir End of Month Storage

December

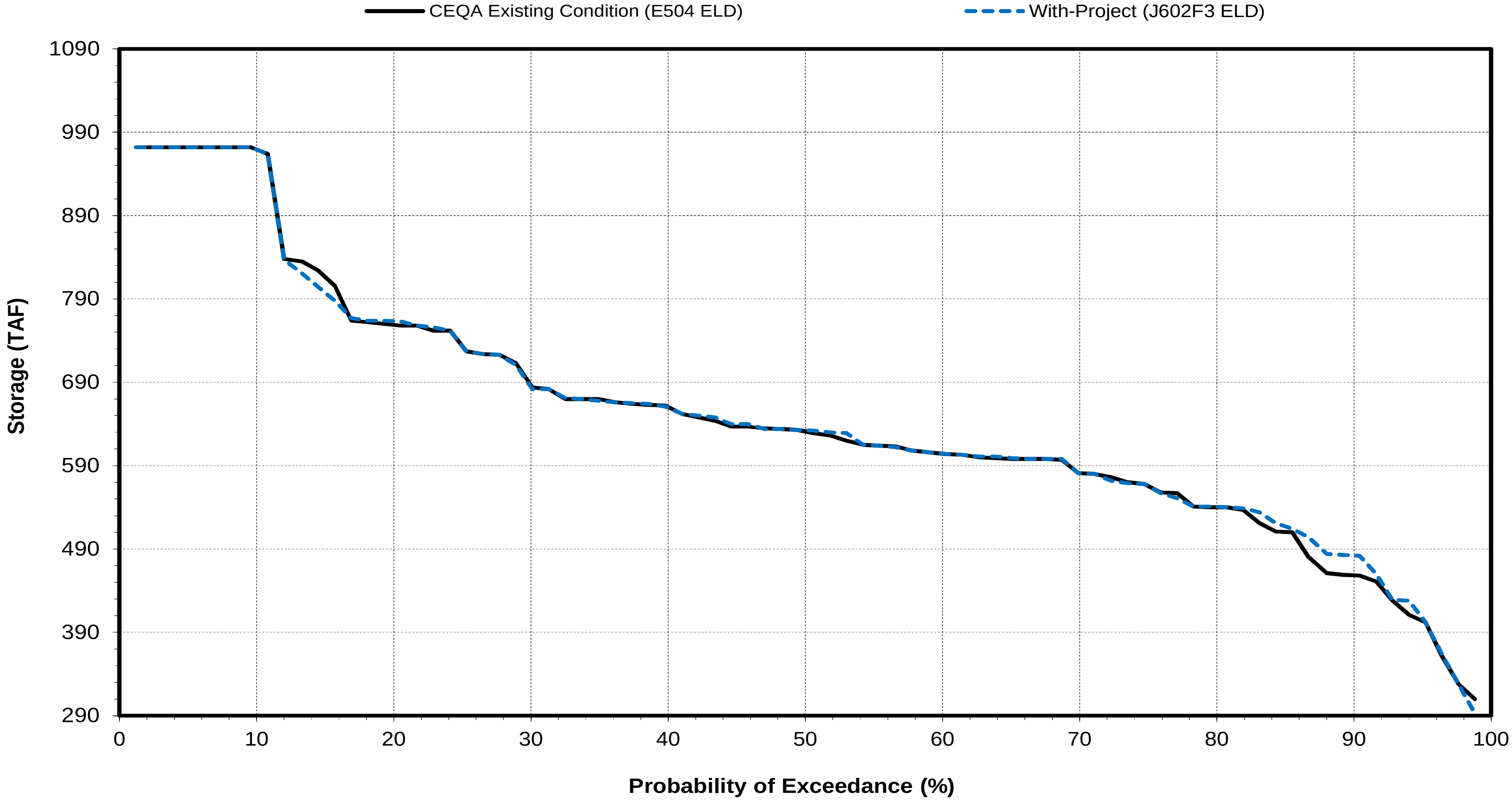


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

CVP San Luis Reservoir End of Month Storage

January

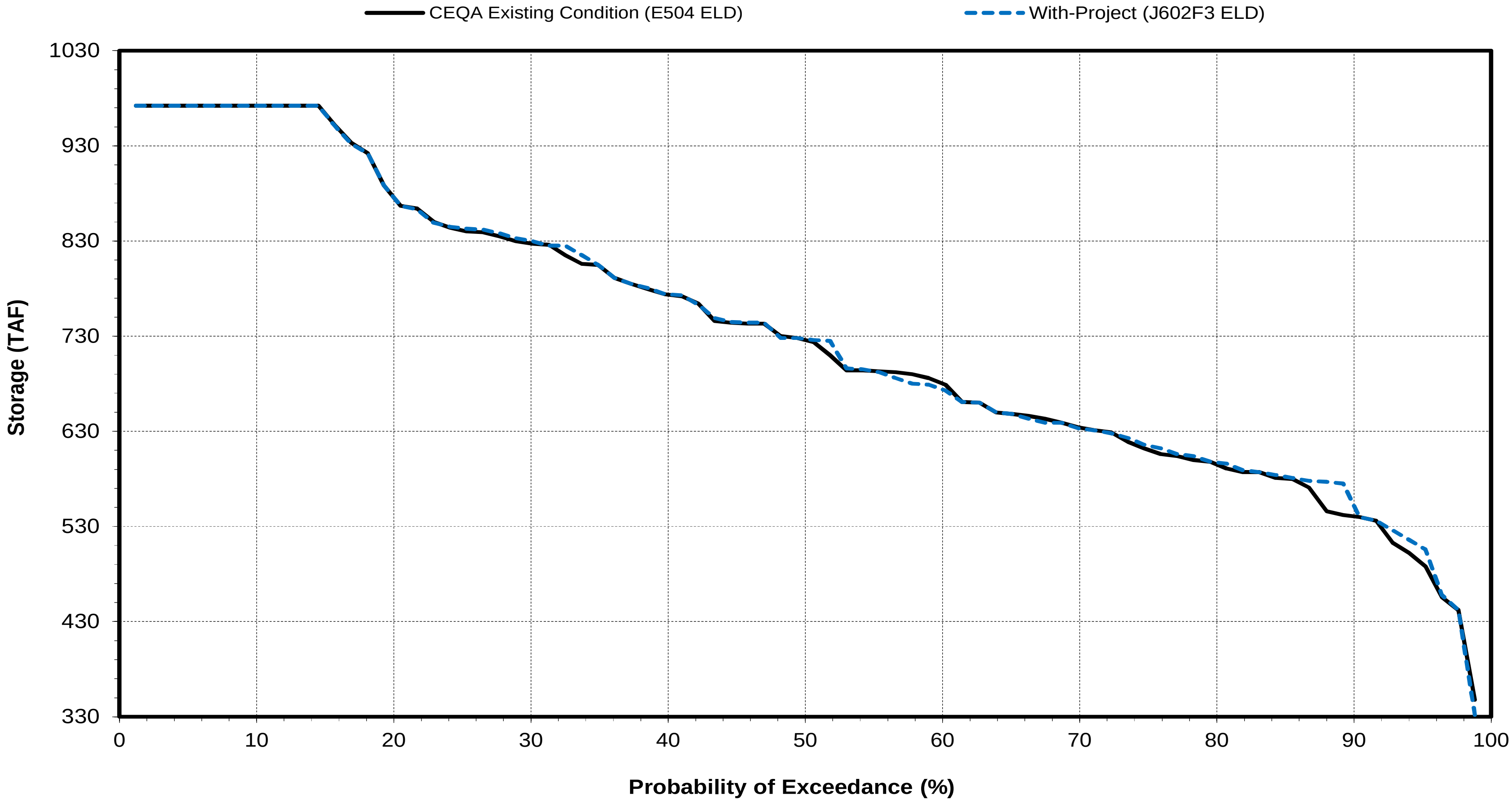


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

CVP San Luis Reservoir End of Month Storage

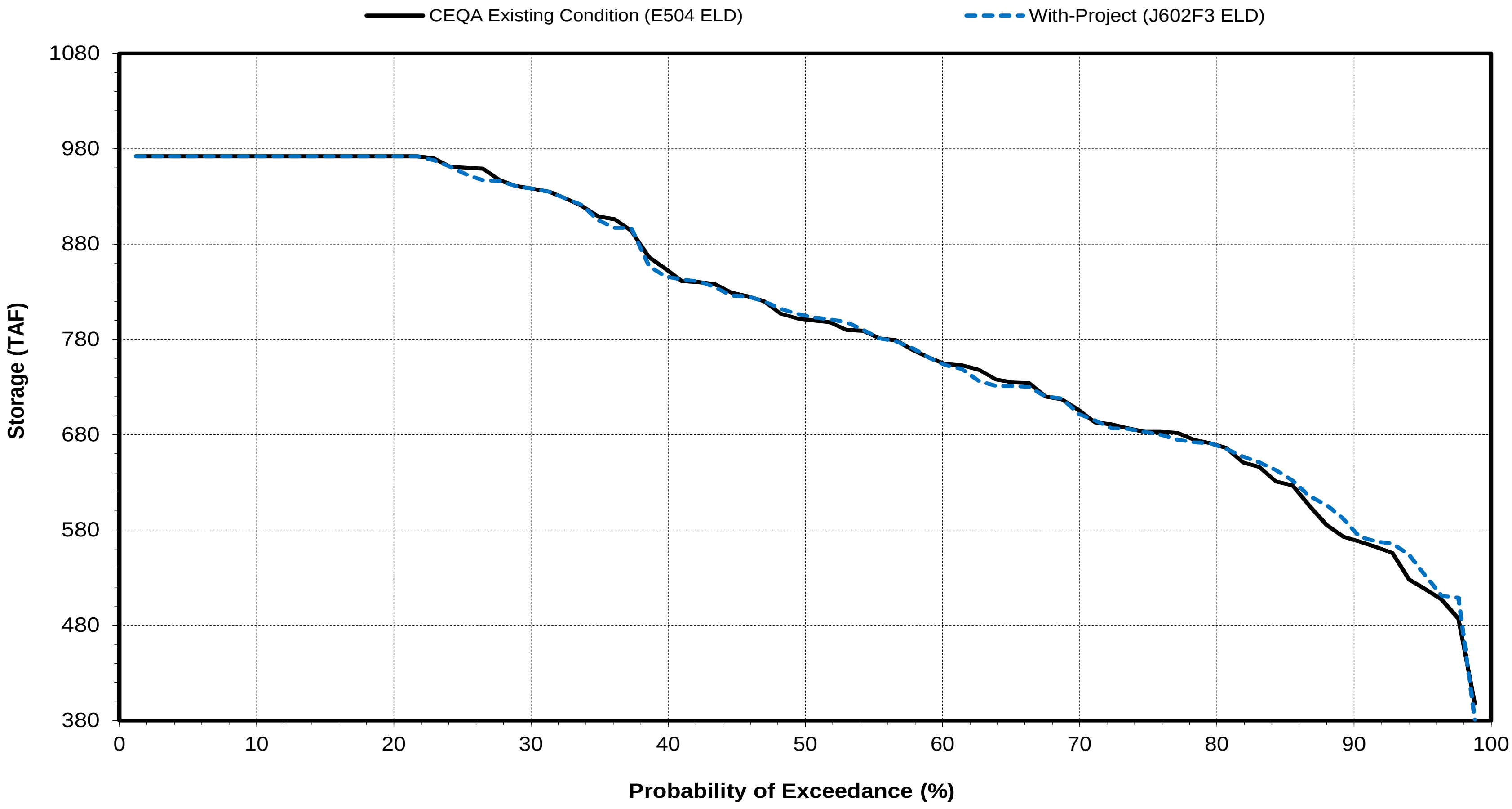
February



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

CVP San Luis Reservoir End of Month Storage

March

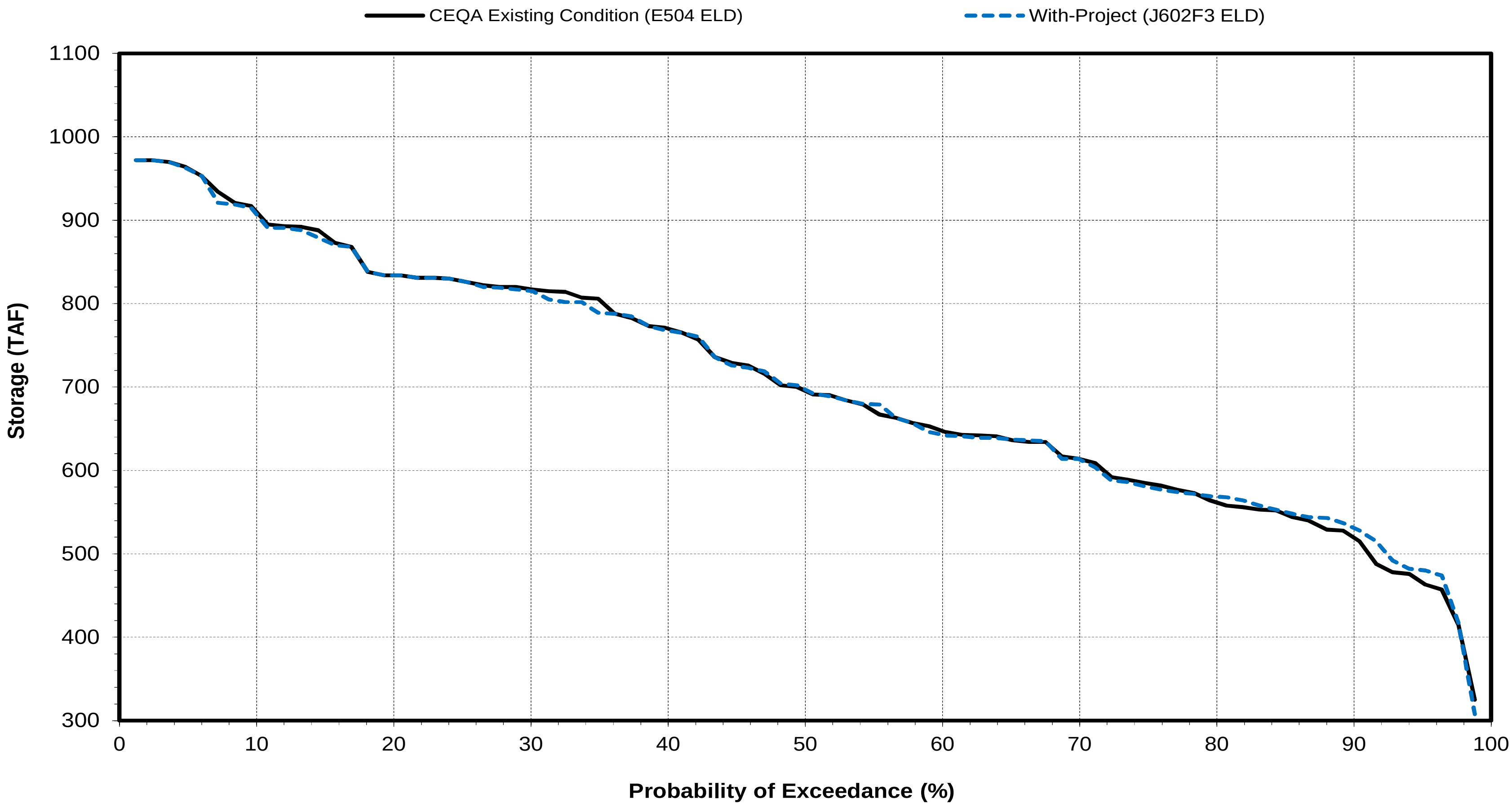


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

CVP San Luis Reservoir End of Month Storage

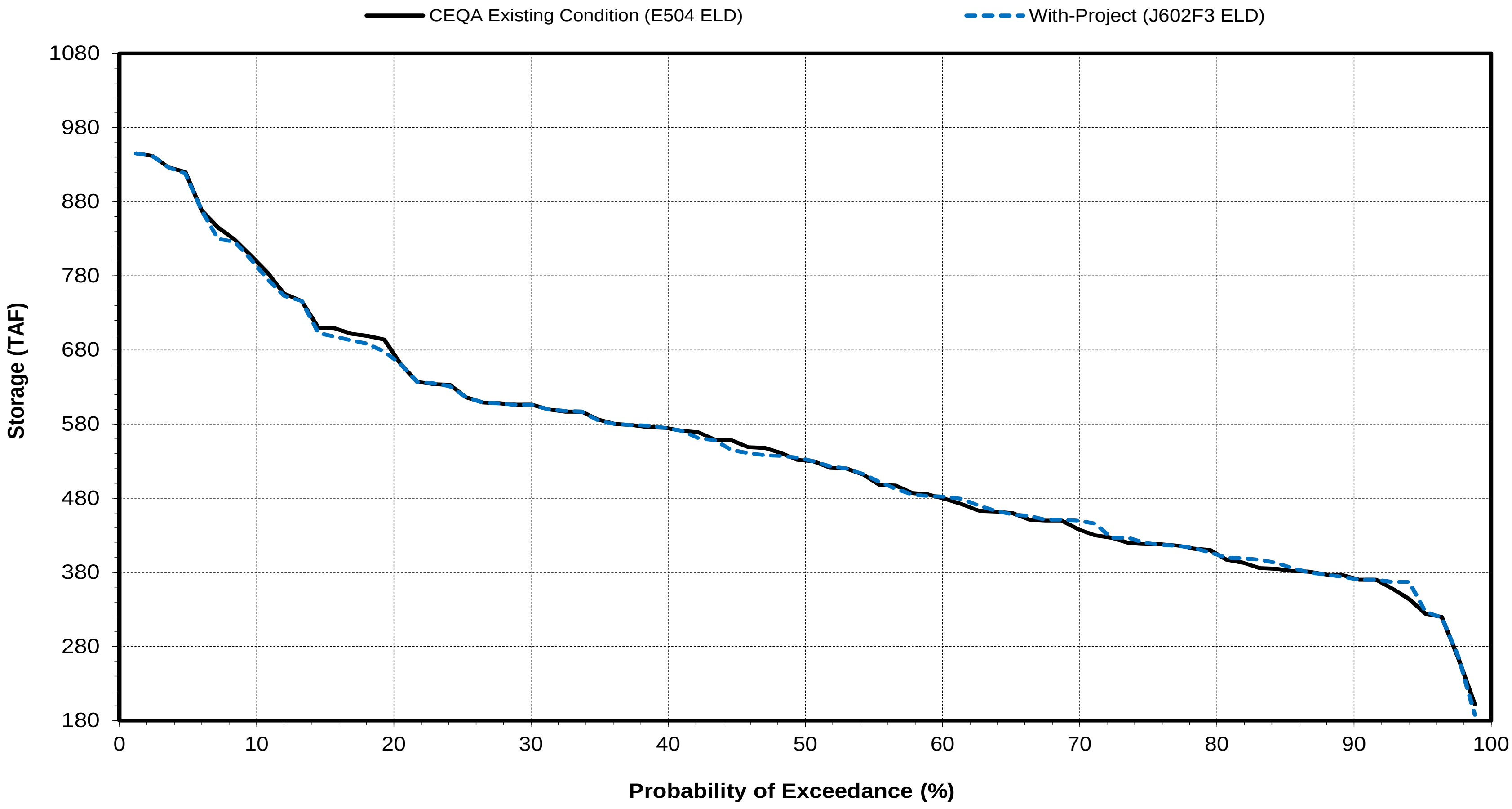
April



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

CVP San Luis Reservoir End of Month Storage

May

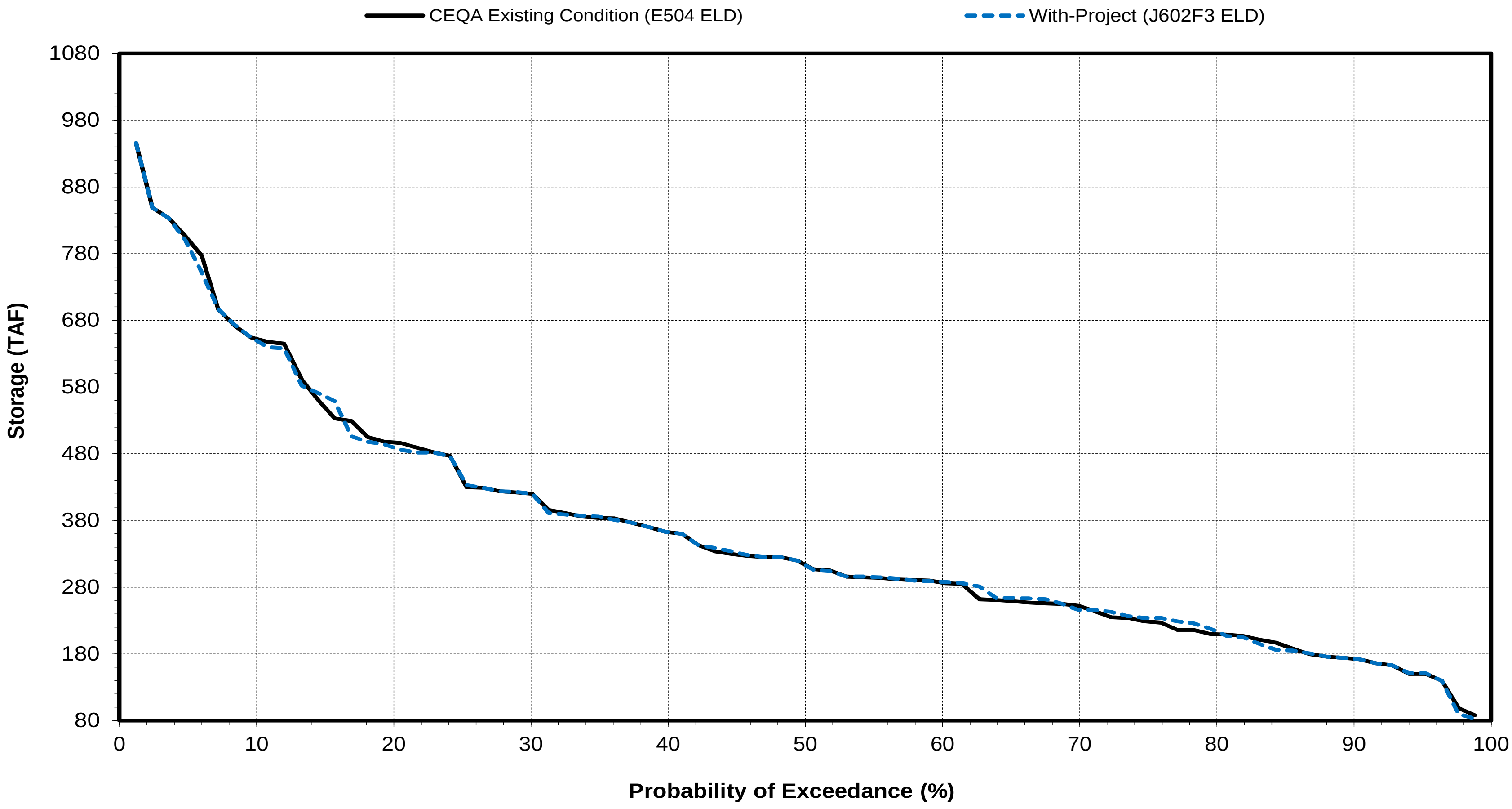


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

CVP San Luis Reservoir End of Month Storage

June

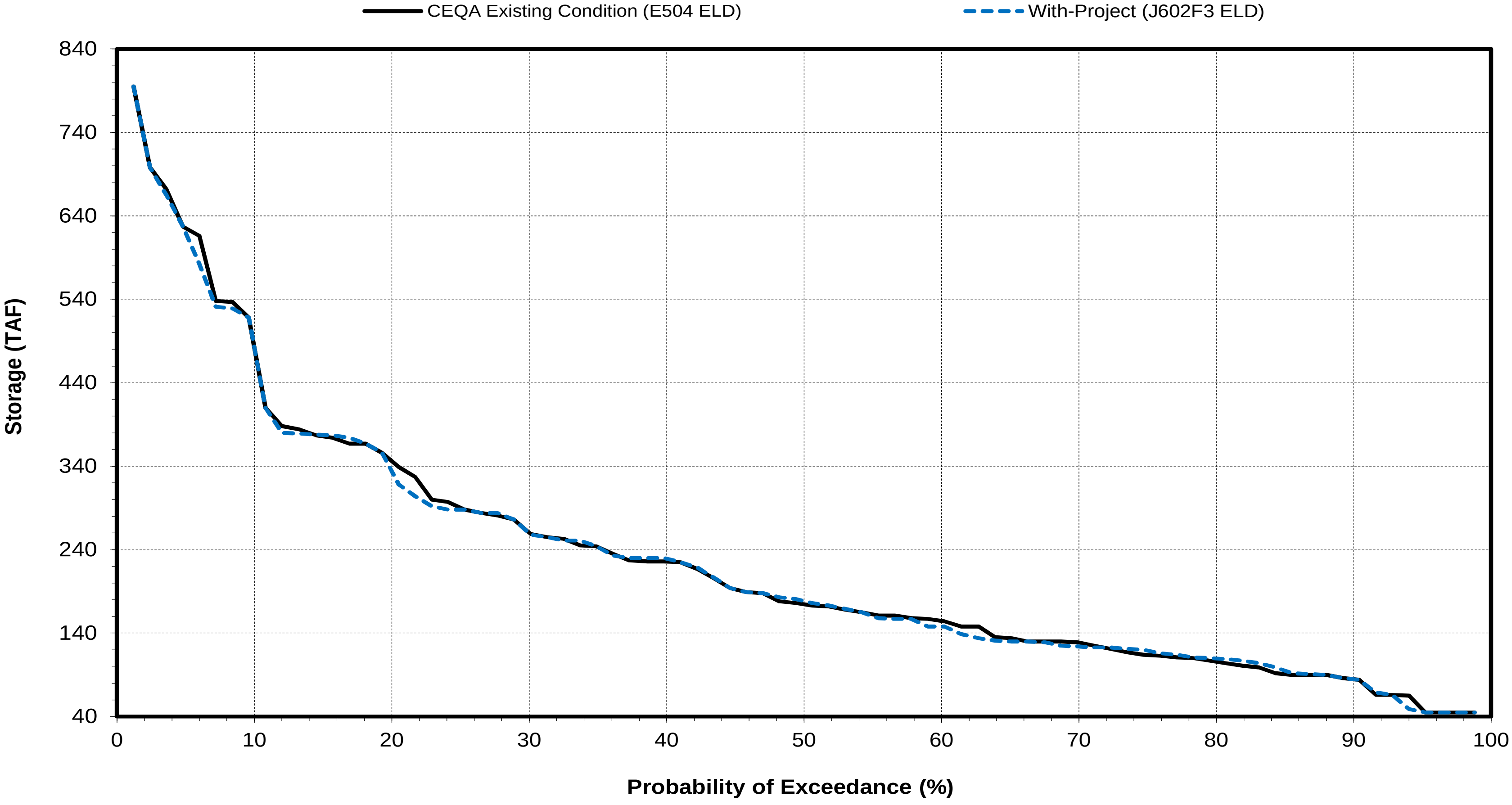


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

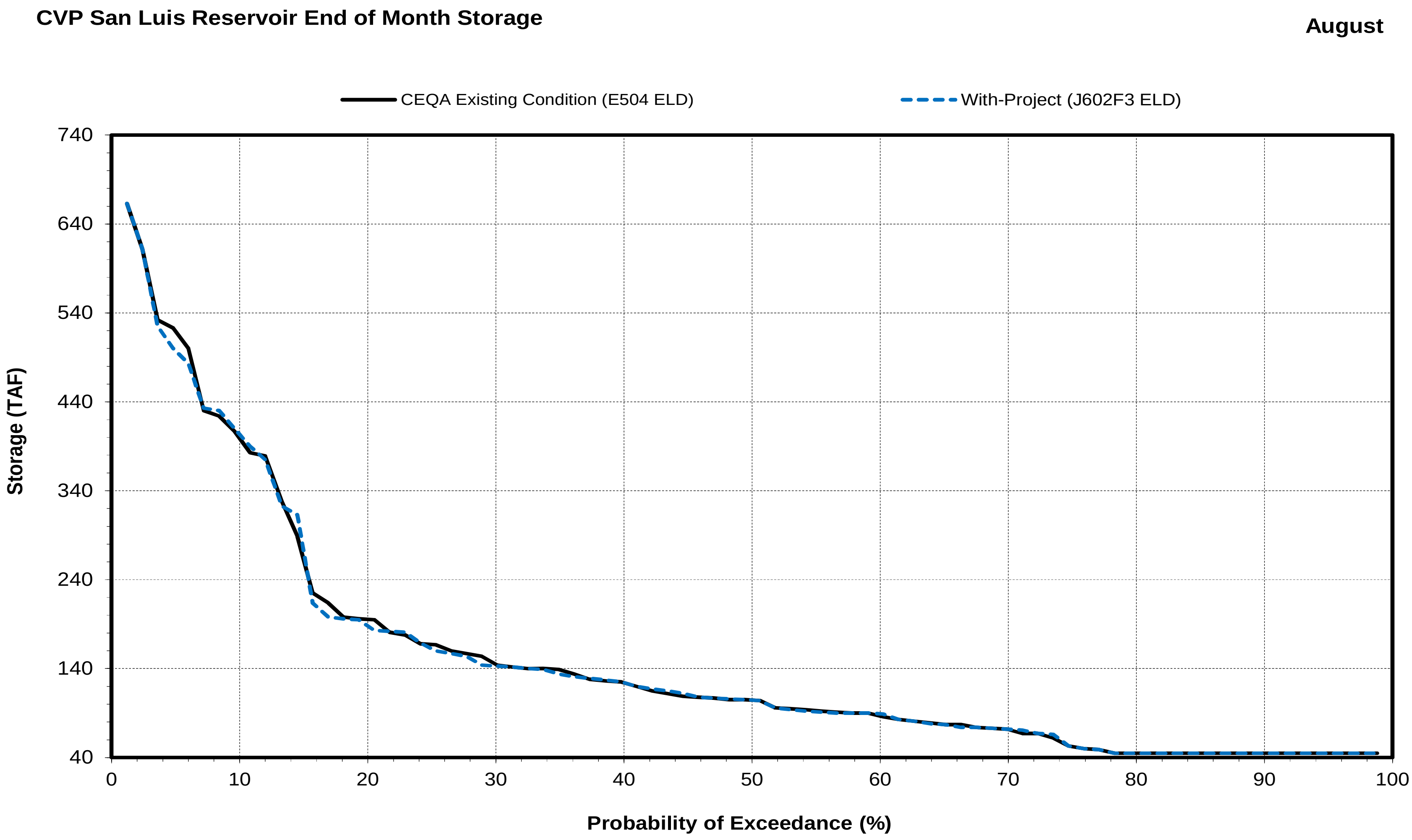
Created: 7/26/2016

CVP San Luis Reservoir End of Month Storage

July



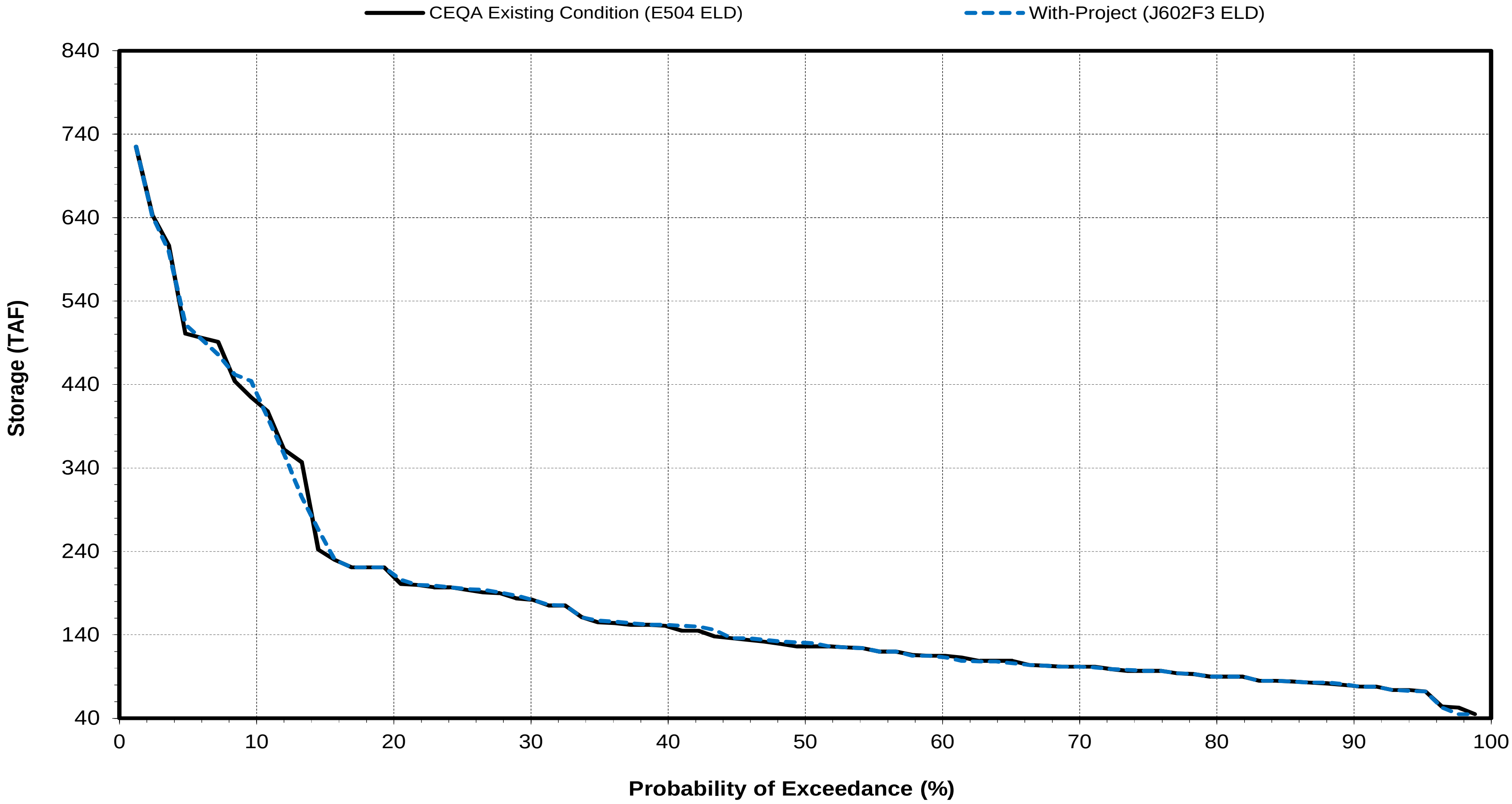
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

CVP San Luis Reservoir End of Month Storage

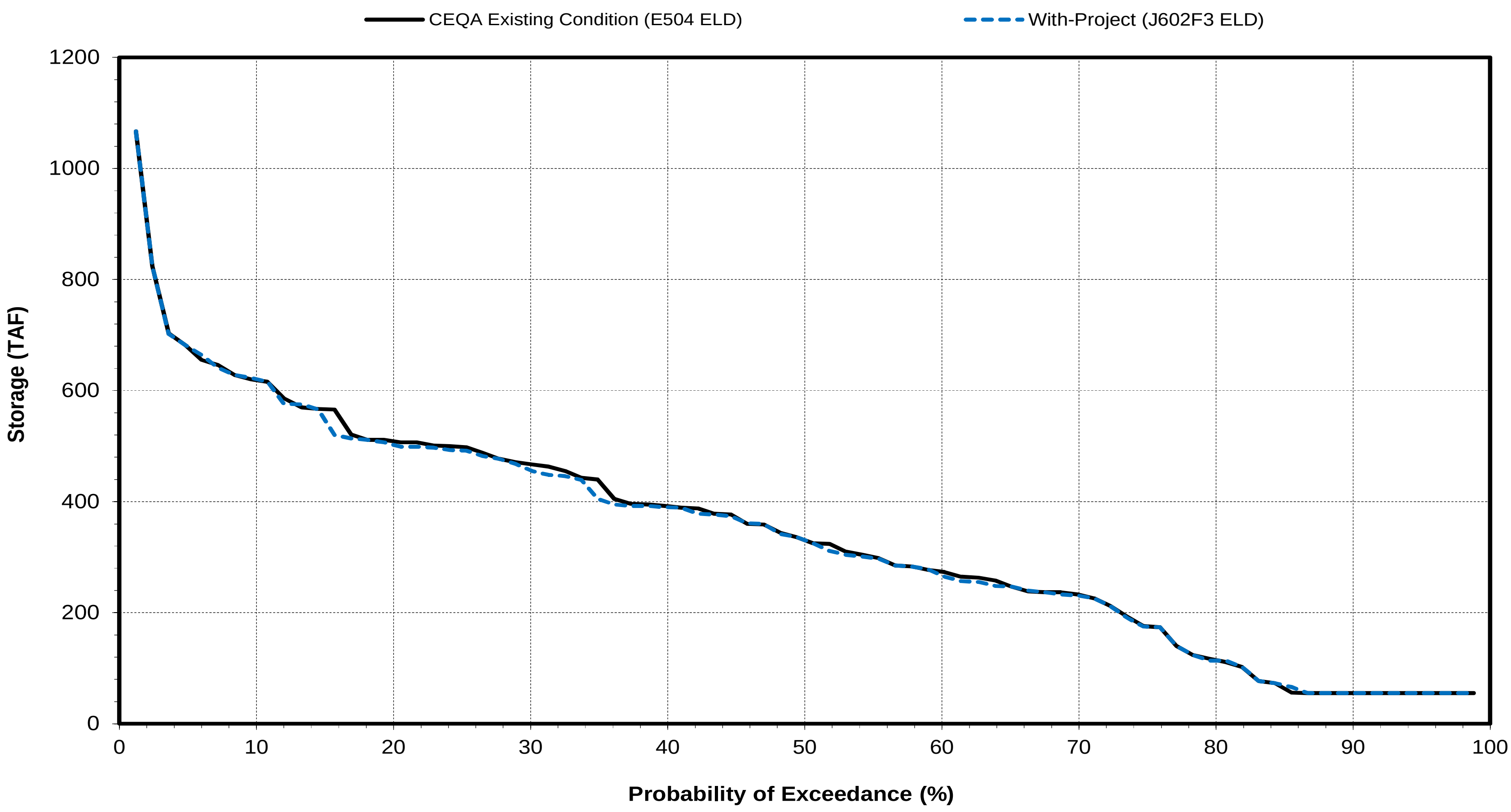
September



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

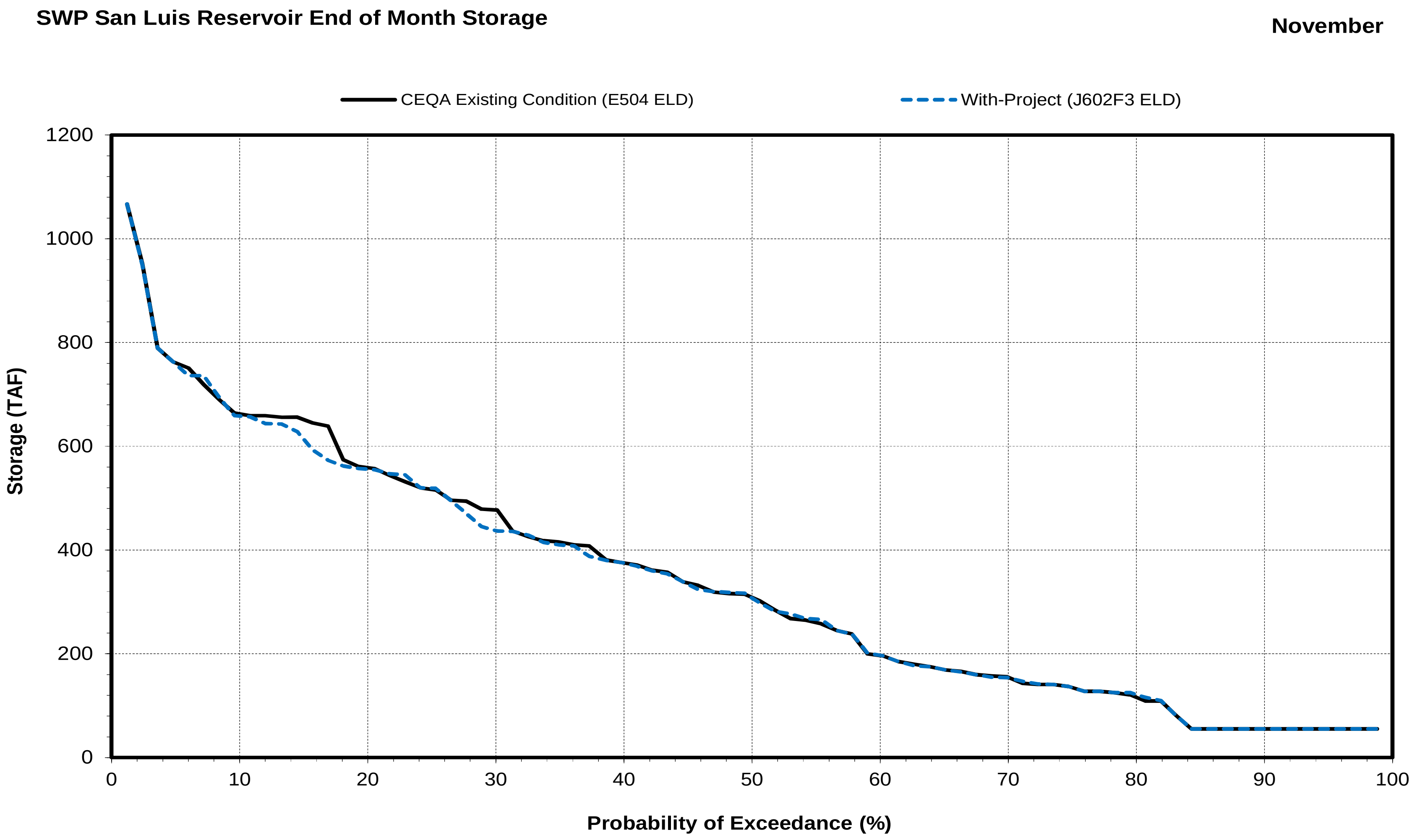
SWP San Luis Reservoir End of Month Storage

October



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

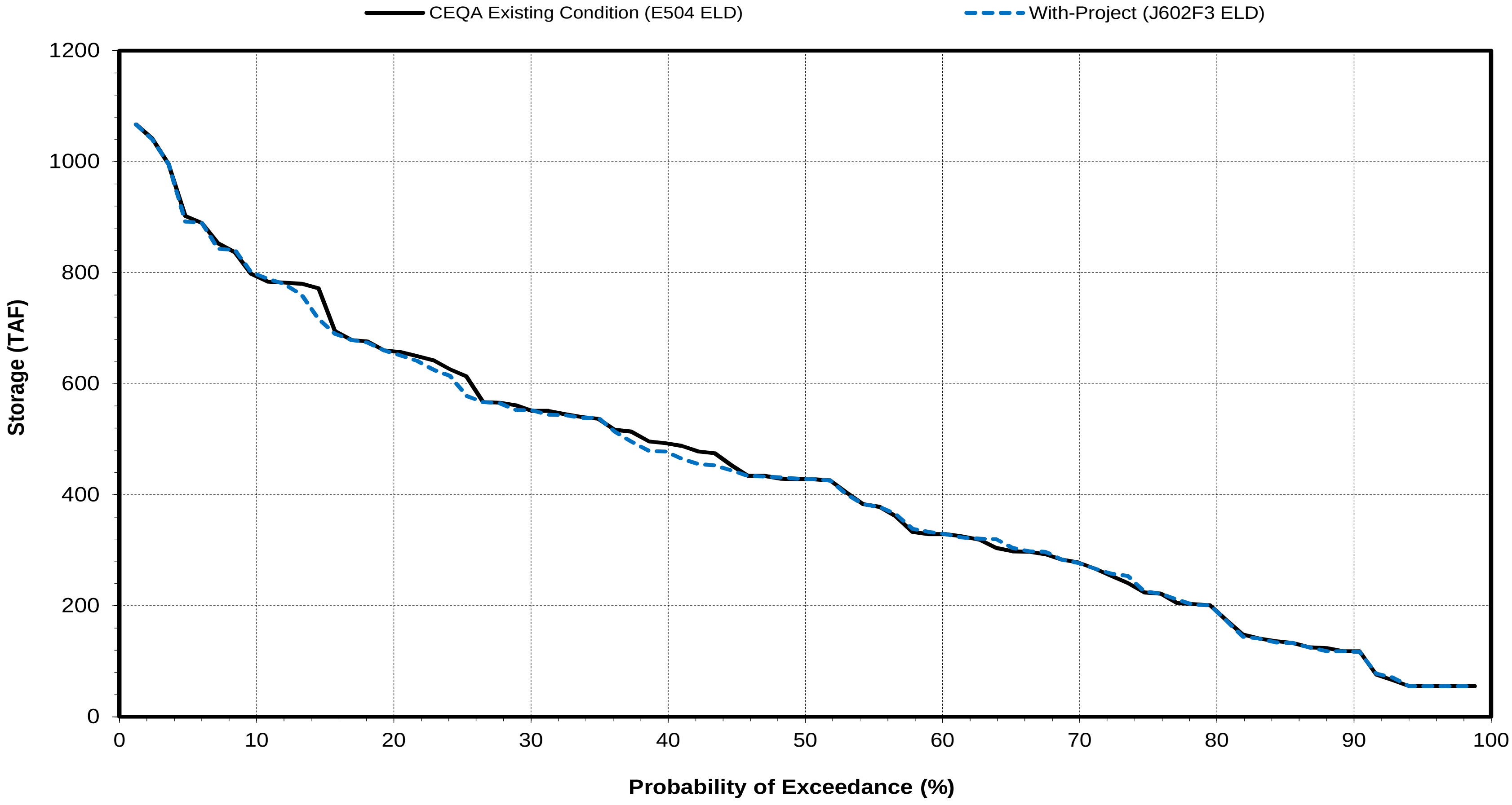


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

SWP San Luis Reservoir End of Month Storage

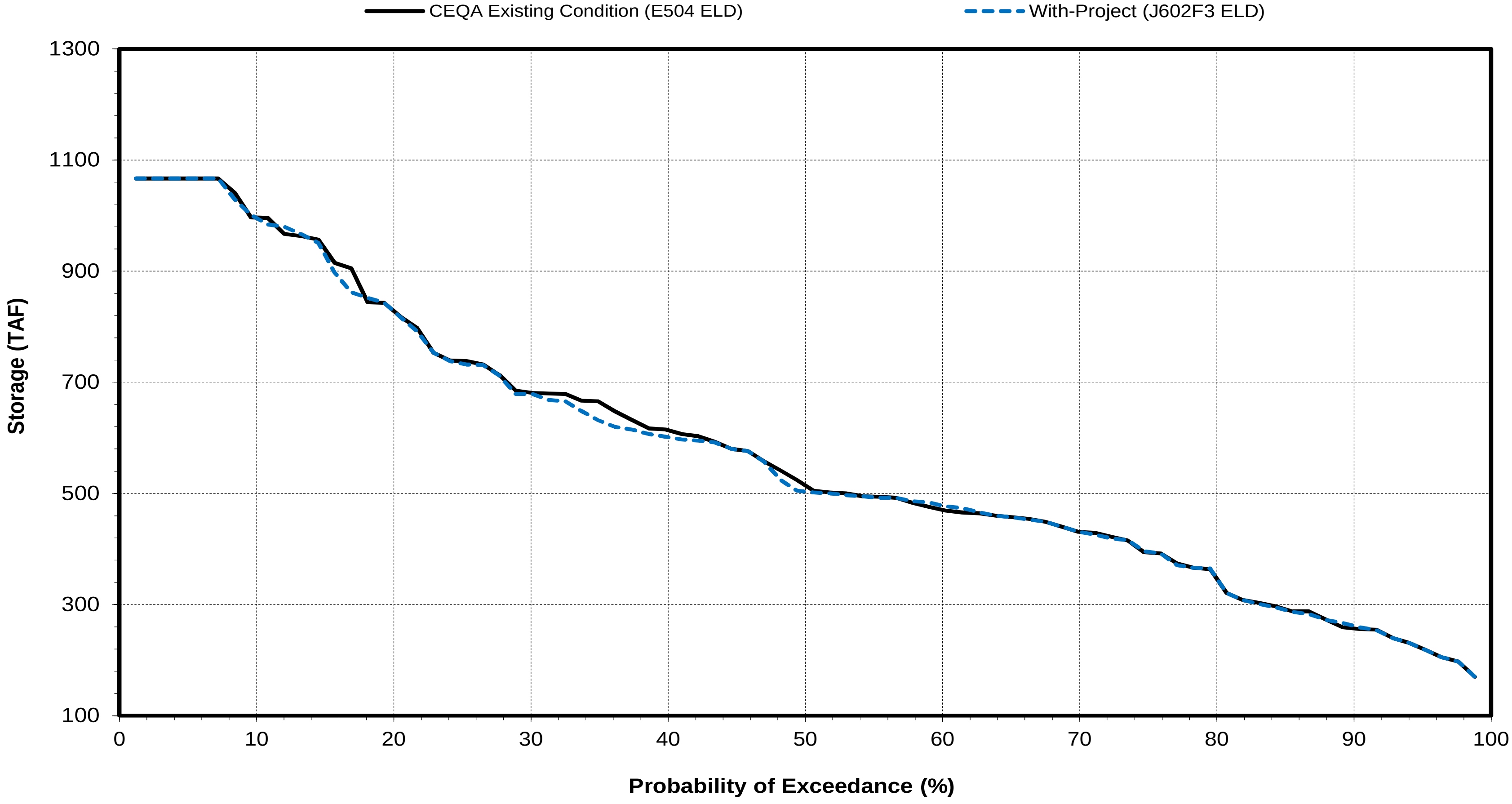
December



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

SWP San Luis Reservoir End of Month Storage

January

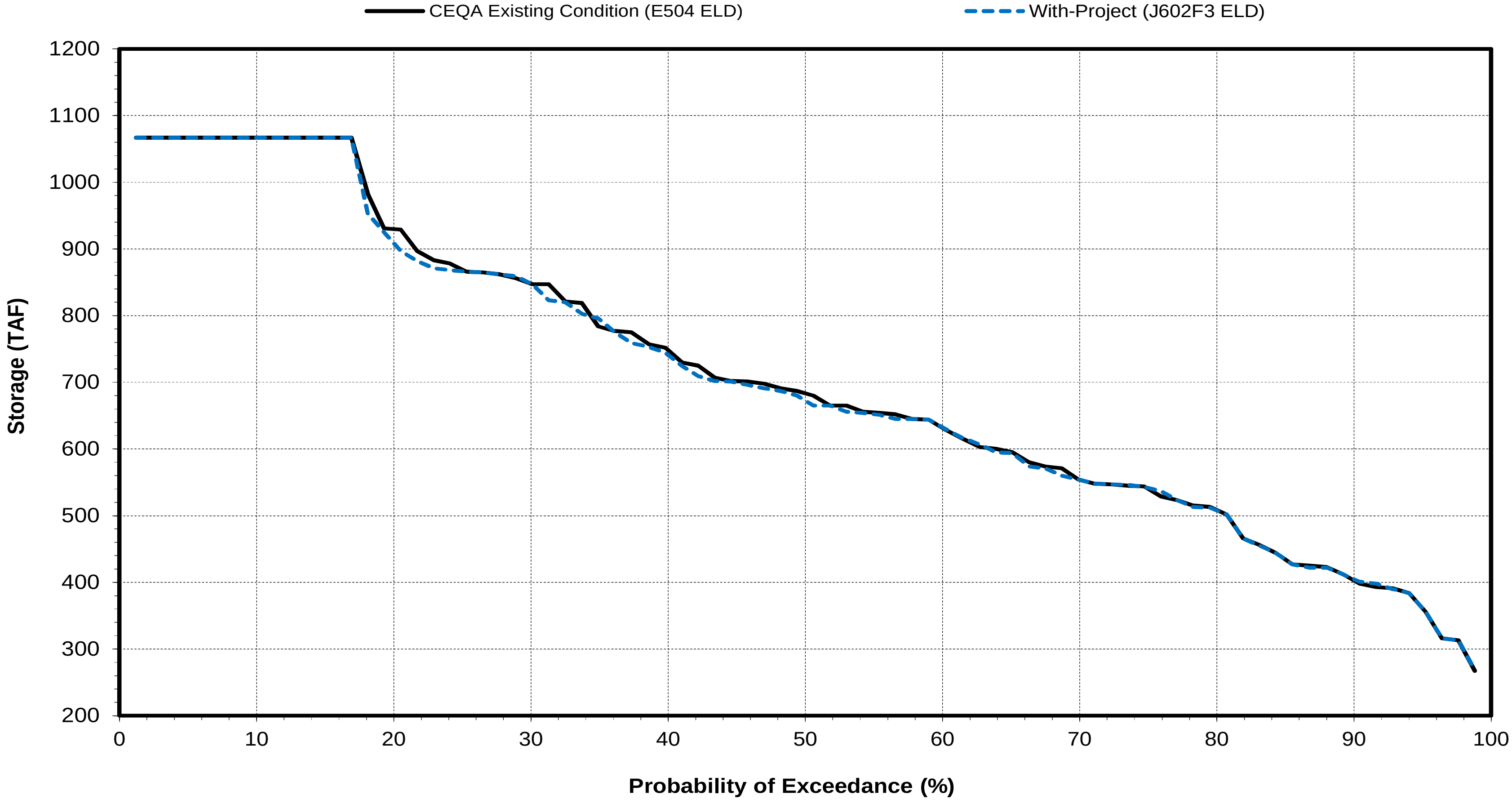


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

SWP San Luis Reservoir End of Month Storage

February

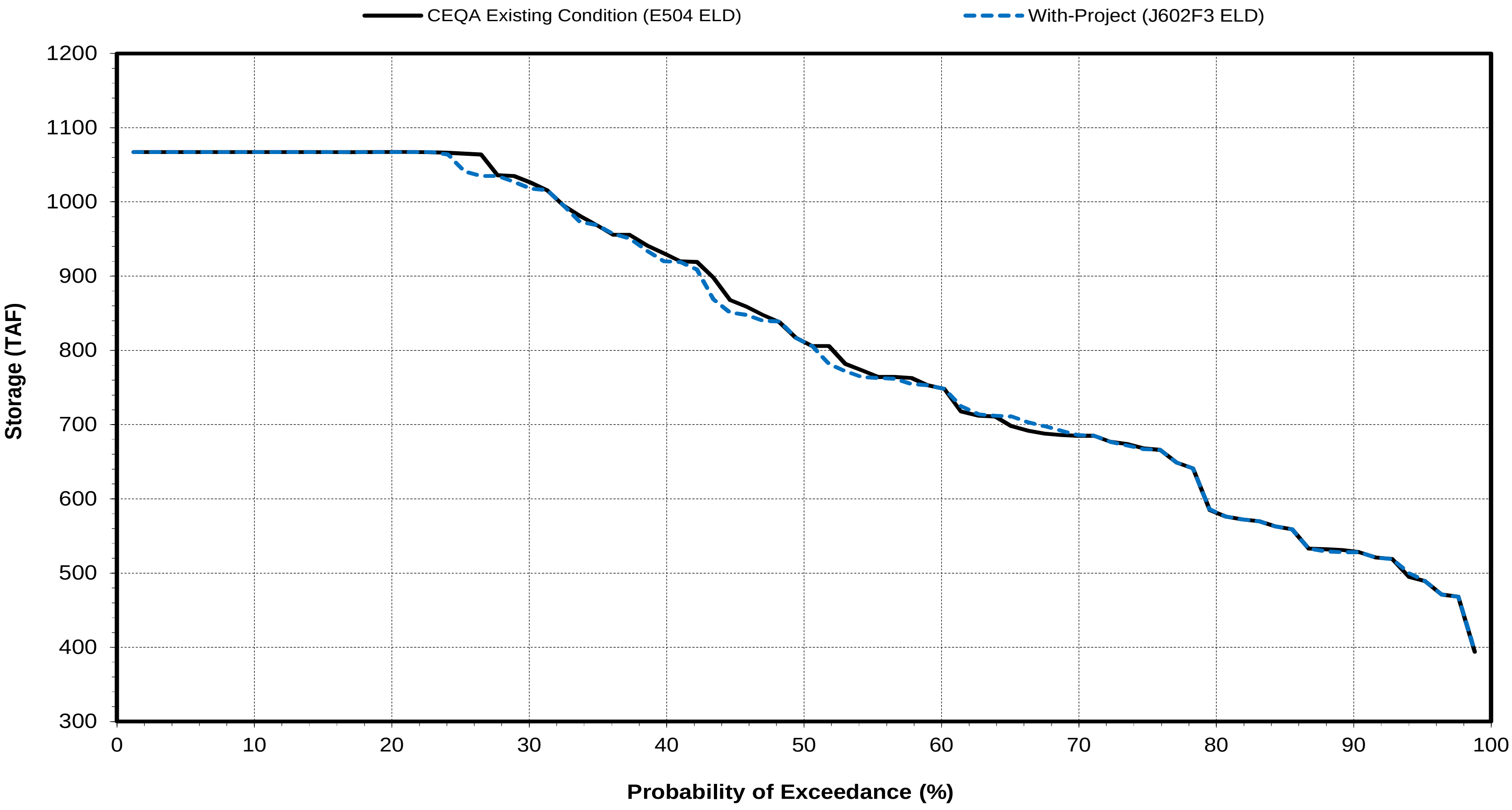


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

SWP San Luis Reservoir End of Month Storage

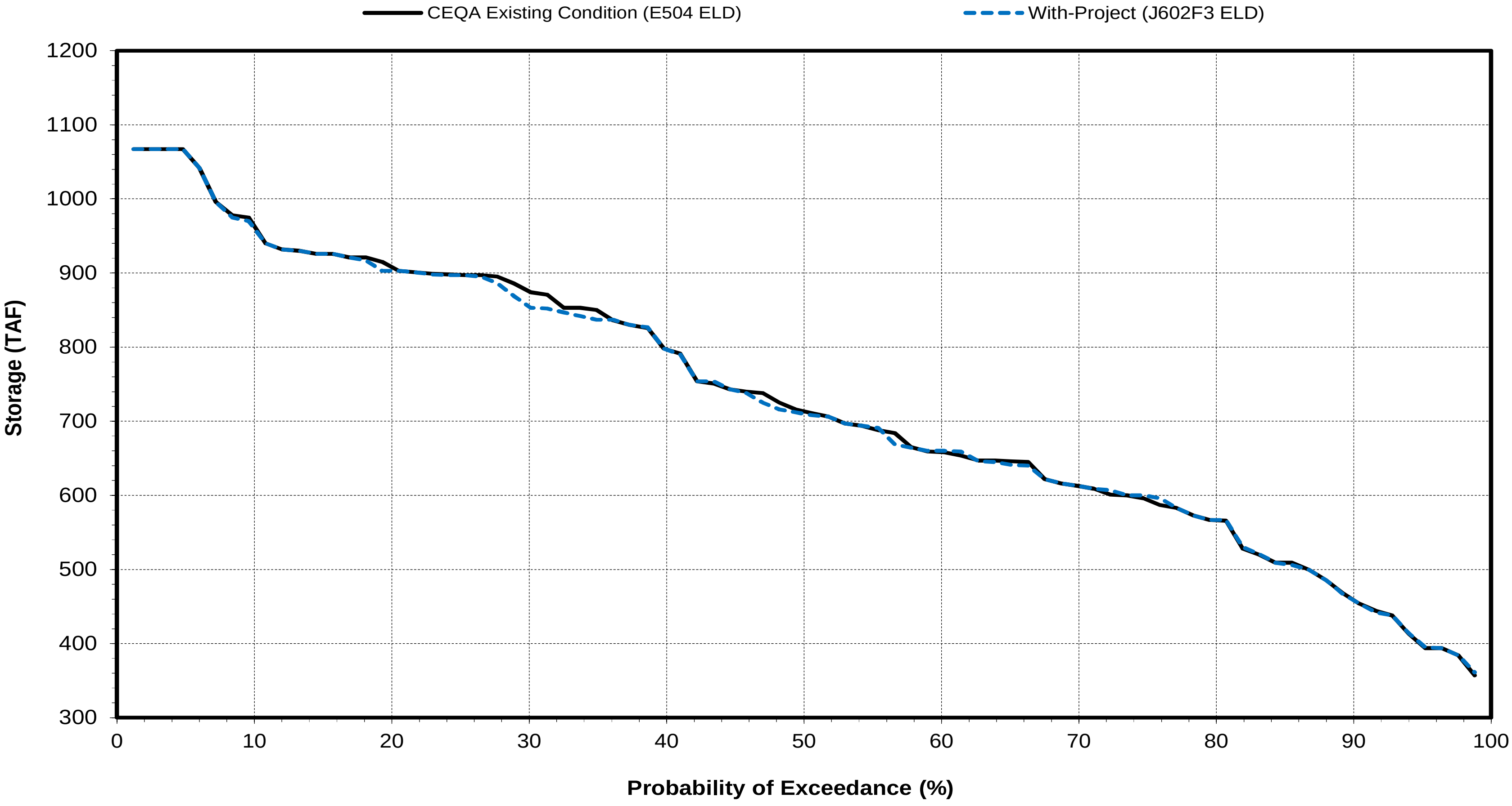
March



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

SWP San Luis Reservoir End of Month Storage

April

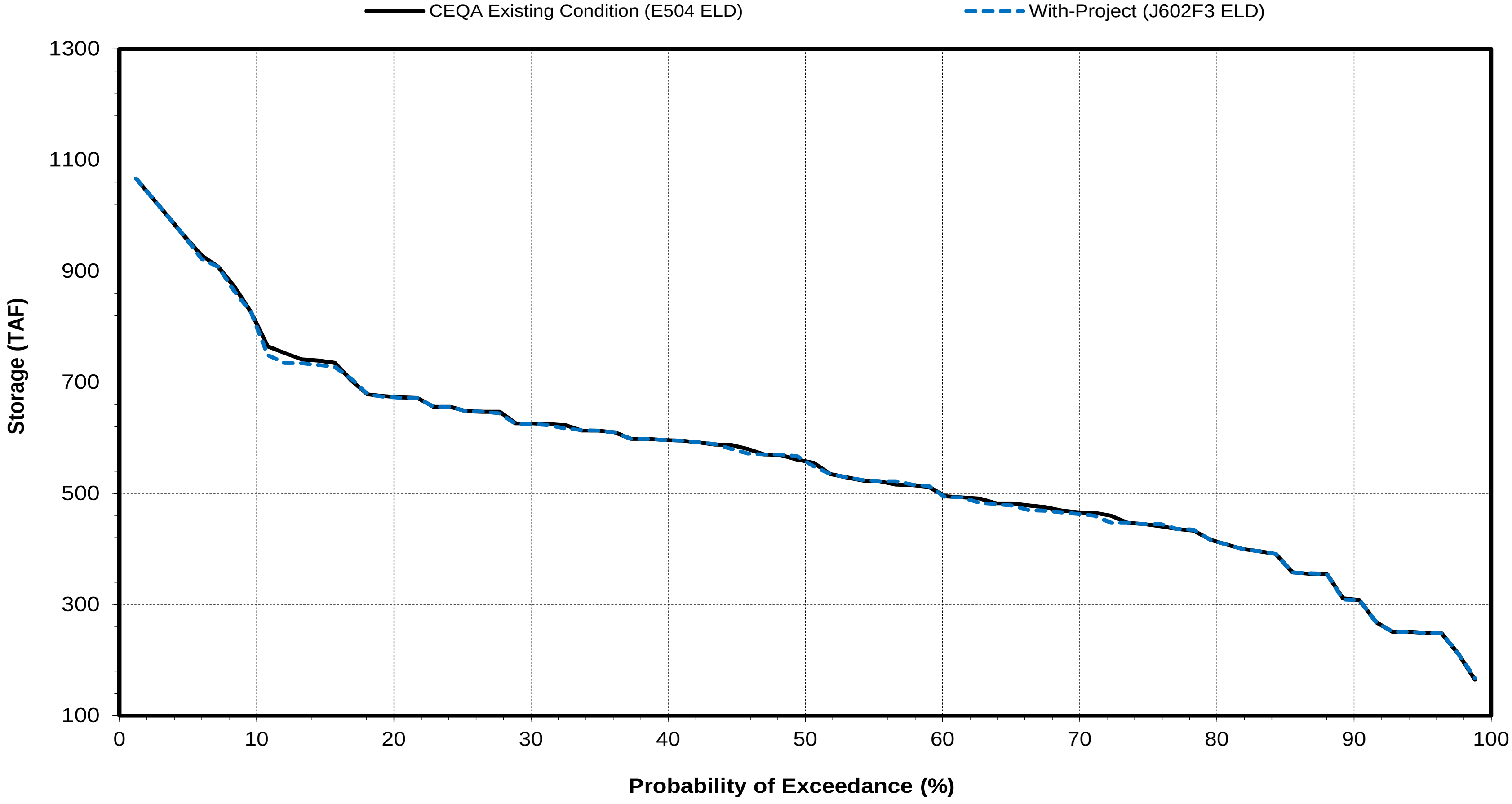


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

SWP San Luis Reservoir End of Month Storage

May

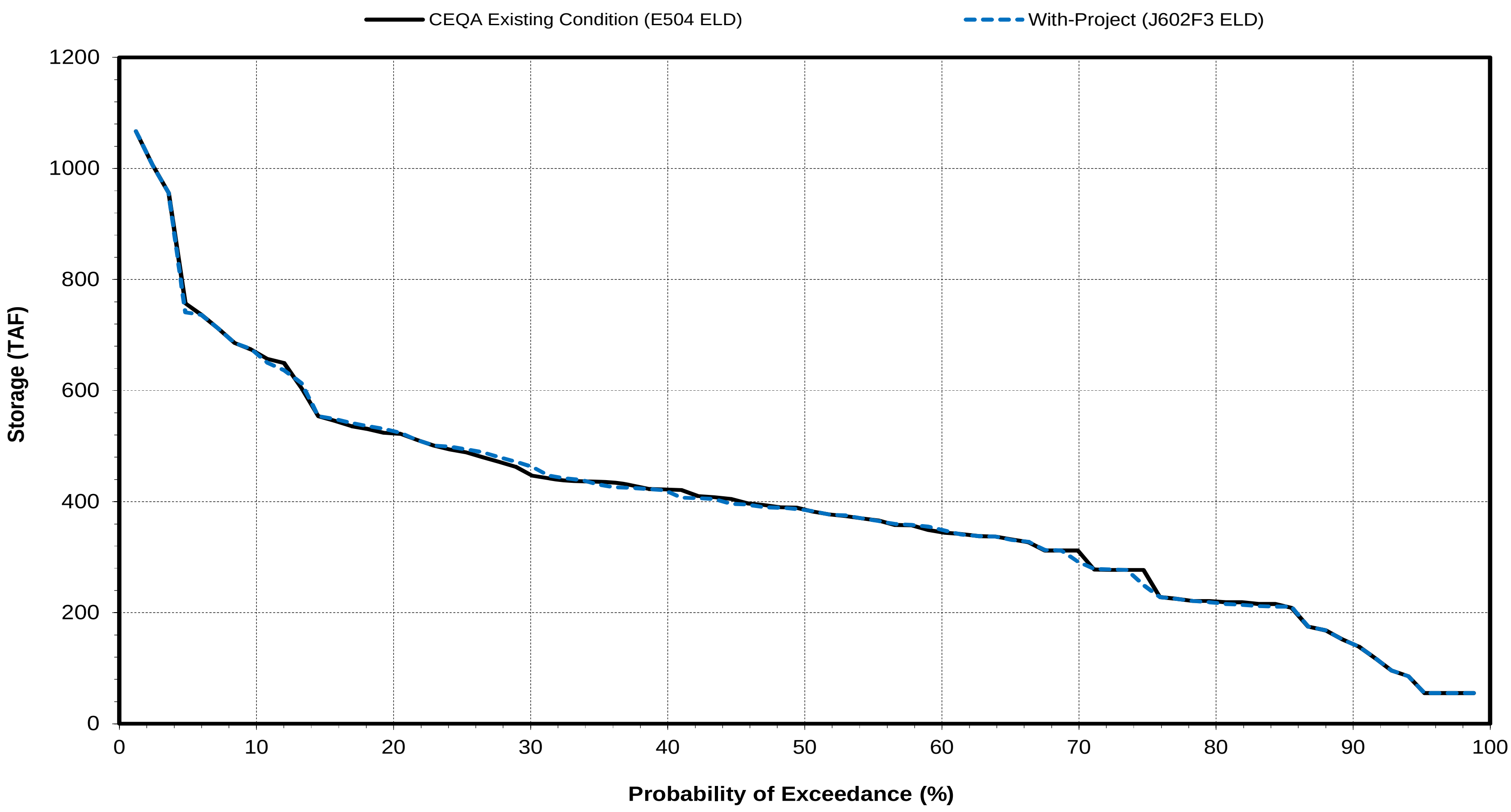


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

SWP San Luis Reservoir End of Month Storage

June

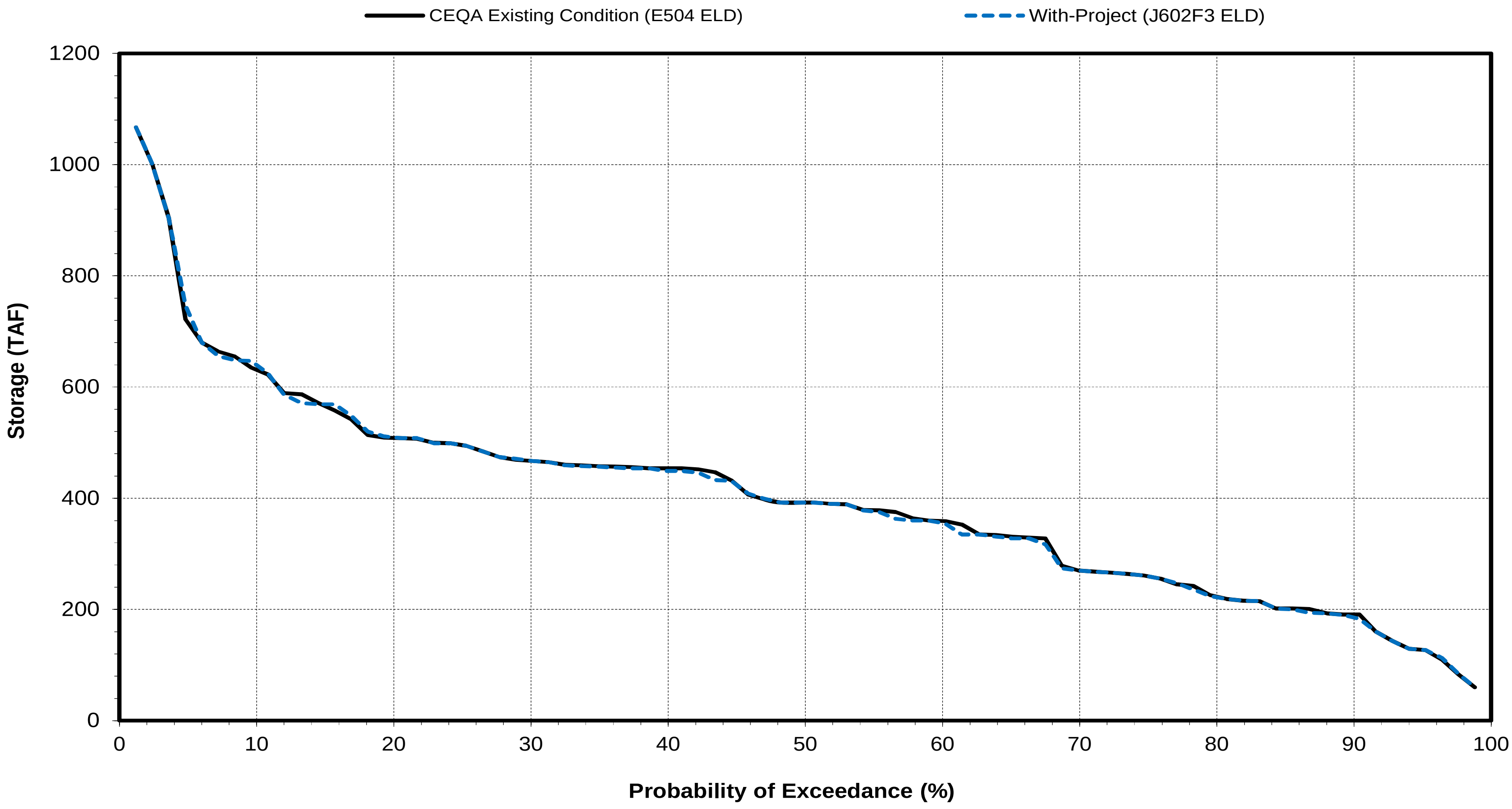


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

SWP San Luis Reservoir End of Month Storage

July

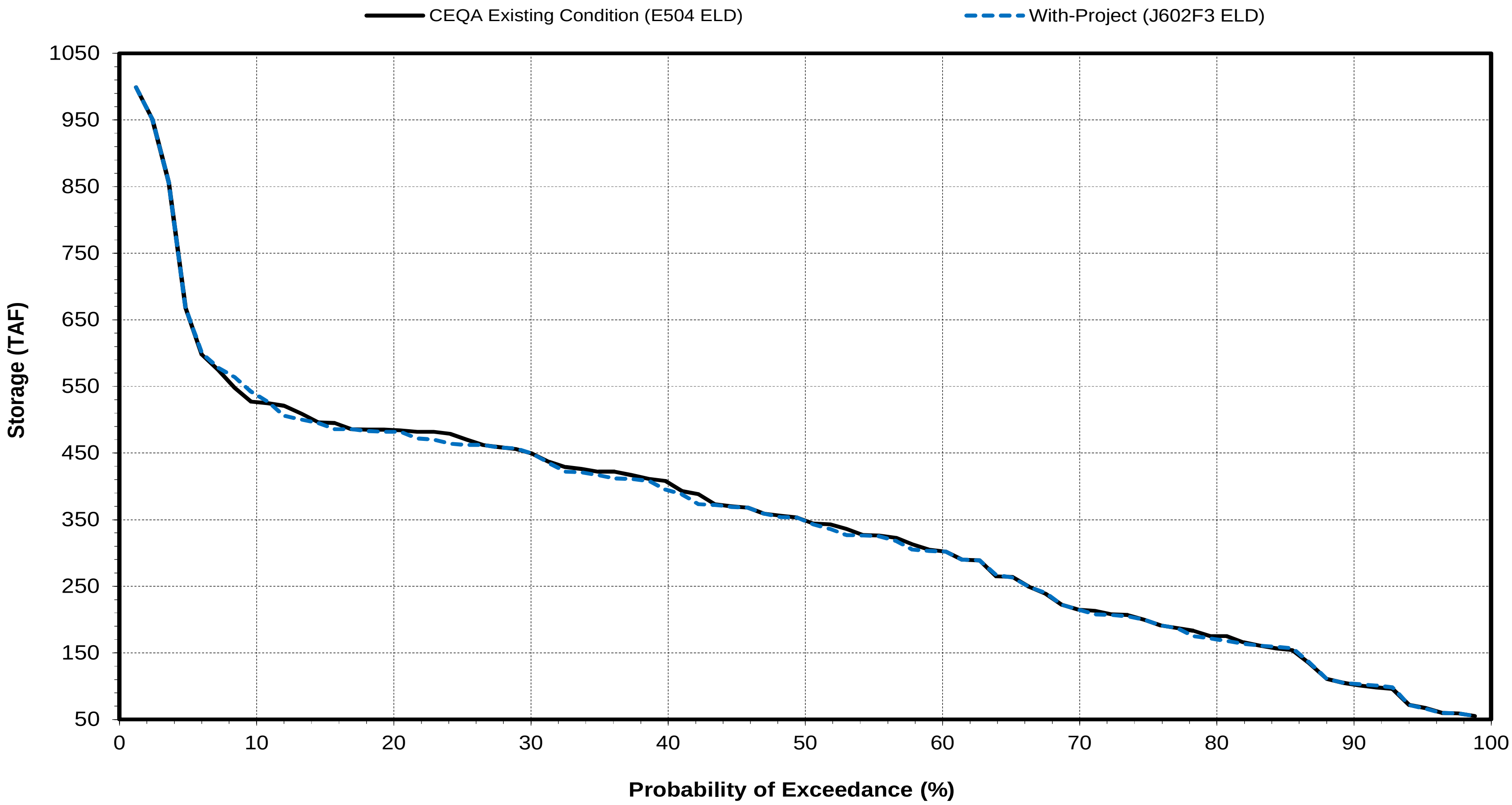


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

SWP San Luis Reservoir End of Month Storage

August

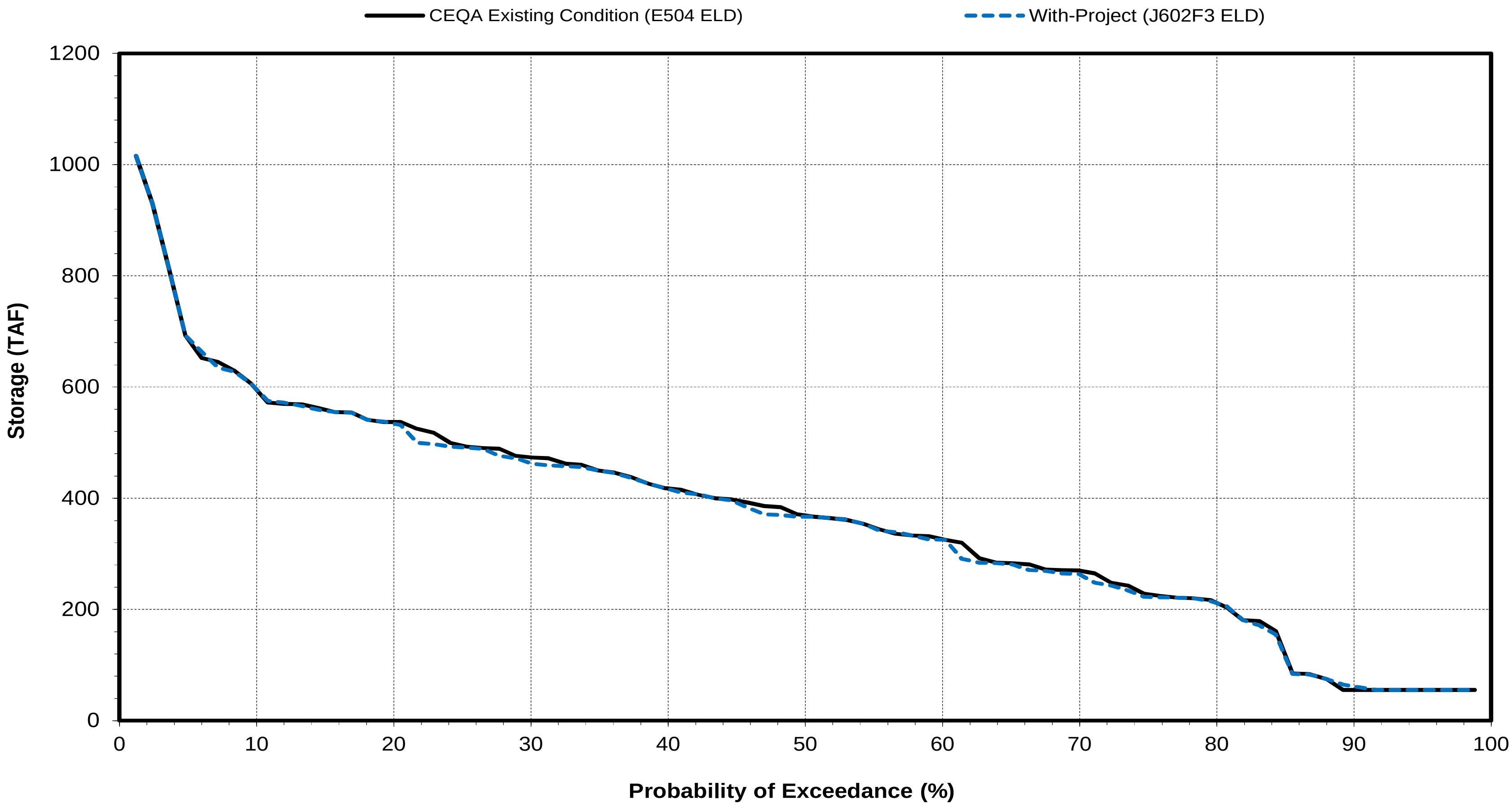


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

SWP San Luis Reservoir End of Month Storage

September

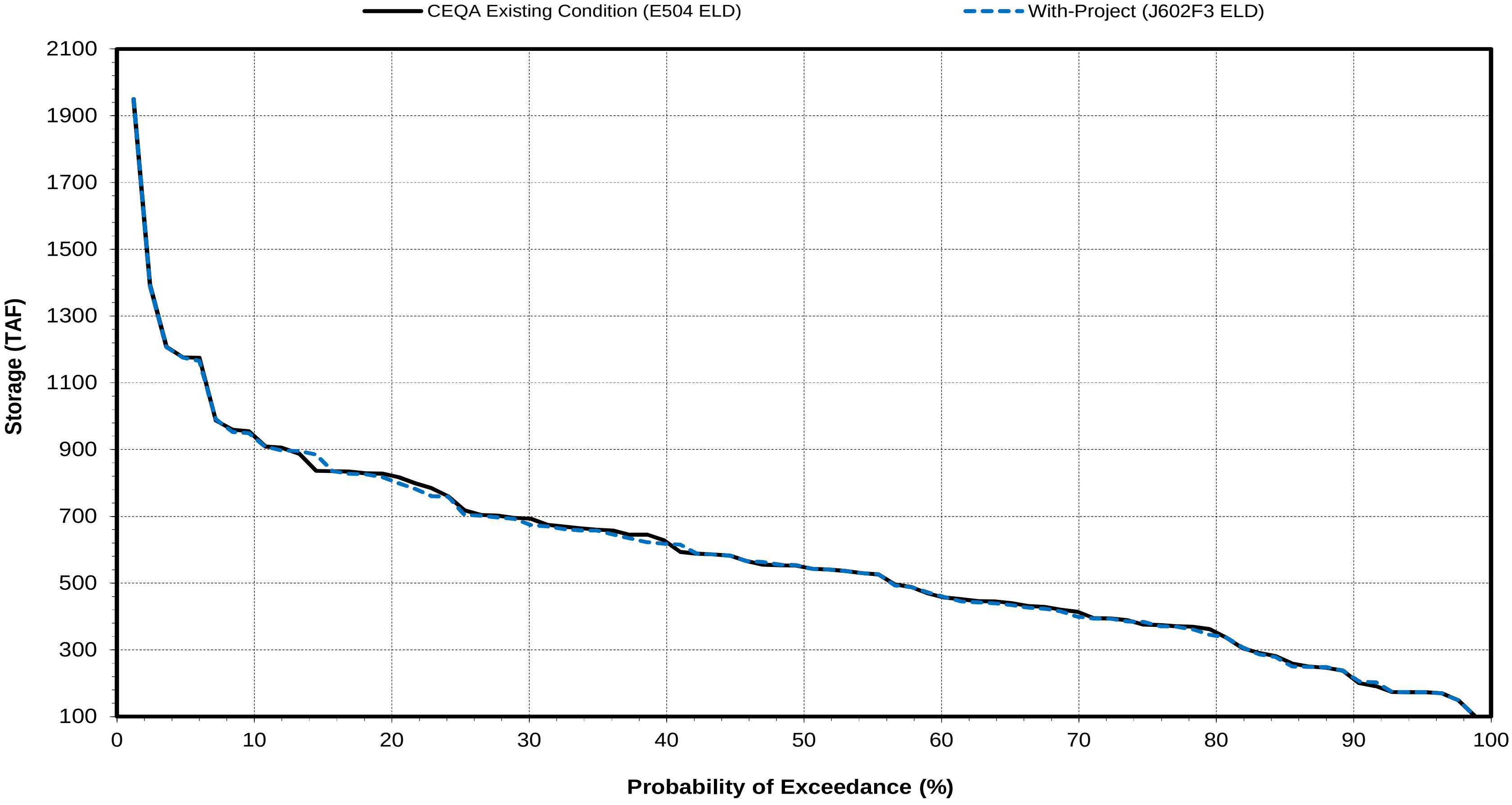


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

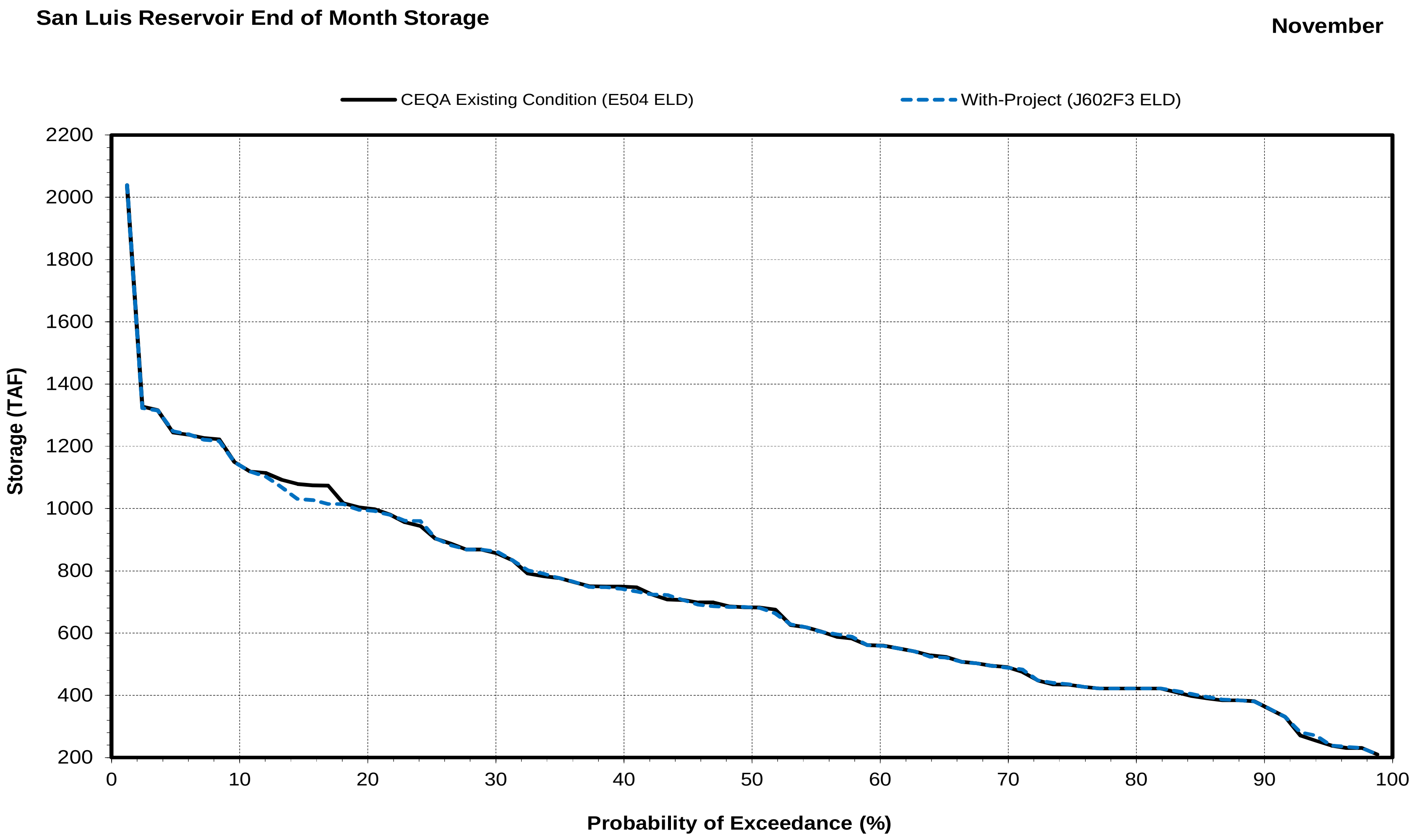
San Luis Reservoir End of Month Storage

October



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

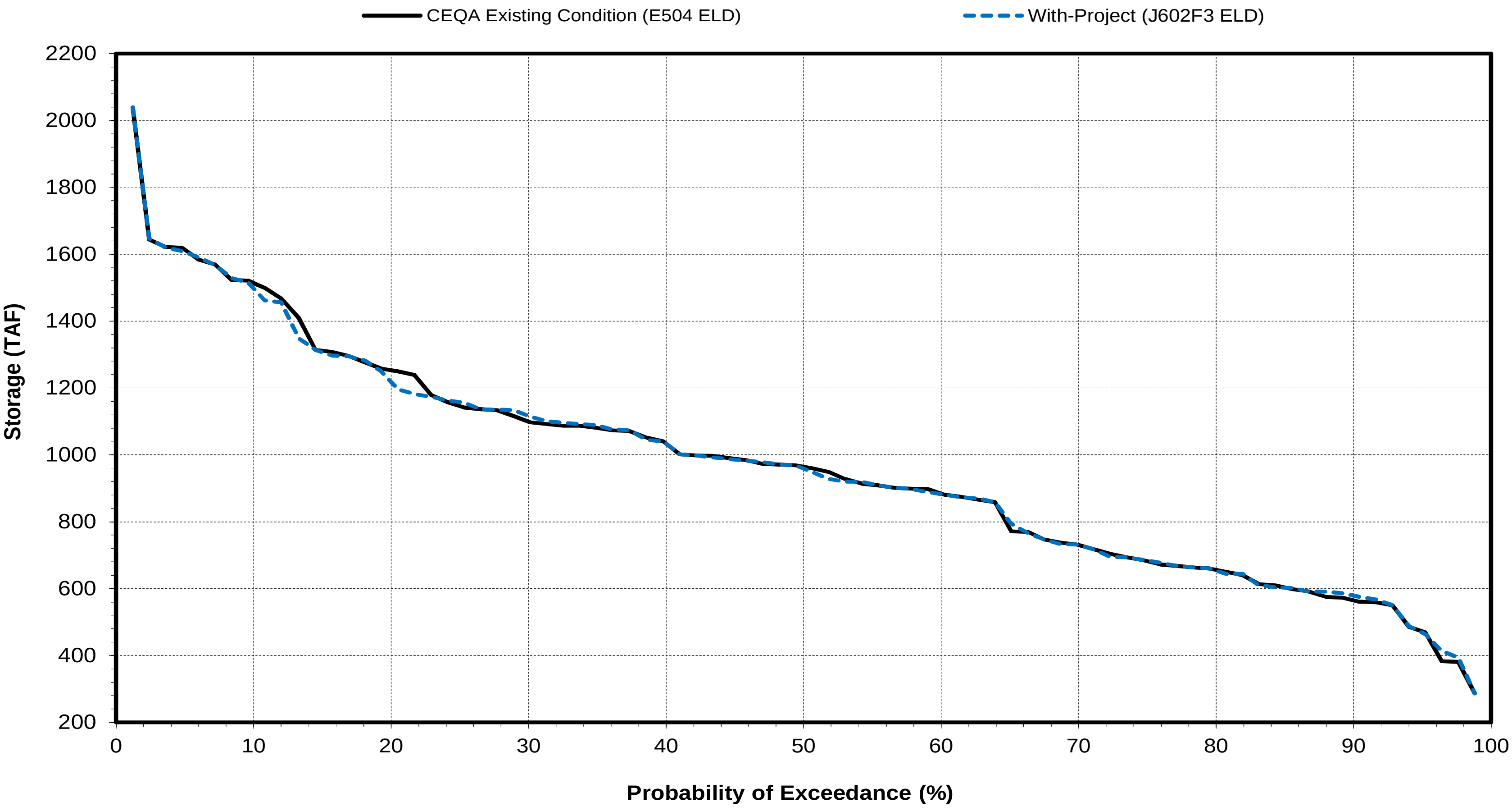
Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

San Luis Reservoir End of Month Storage

December

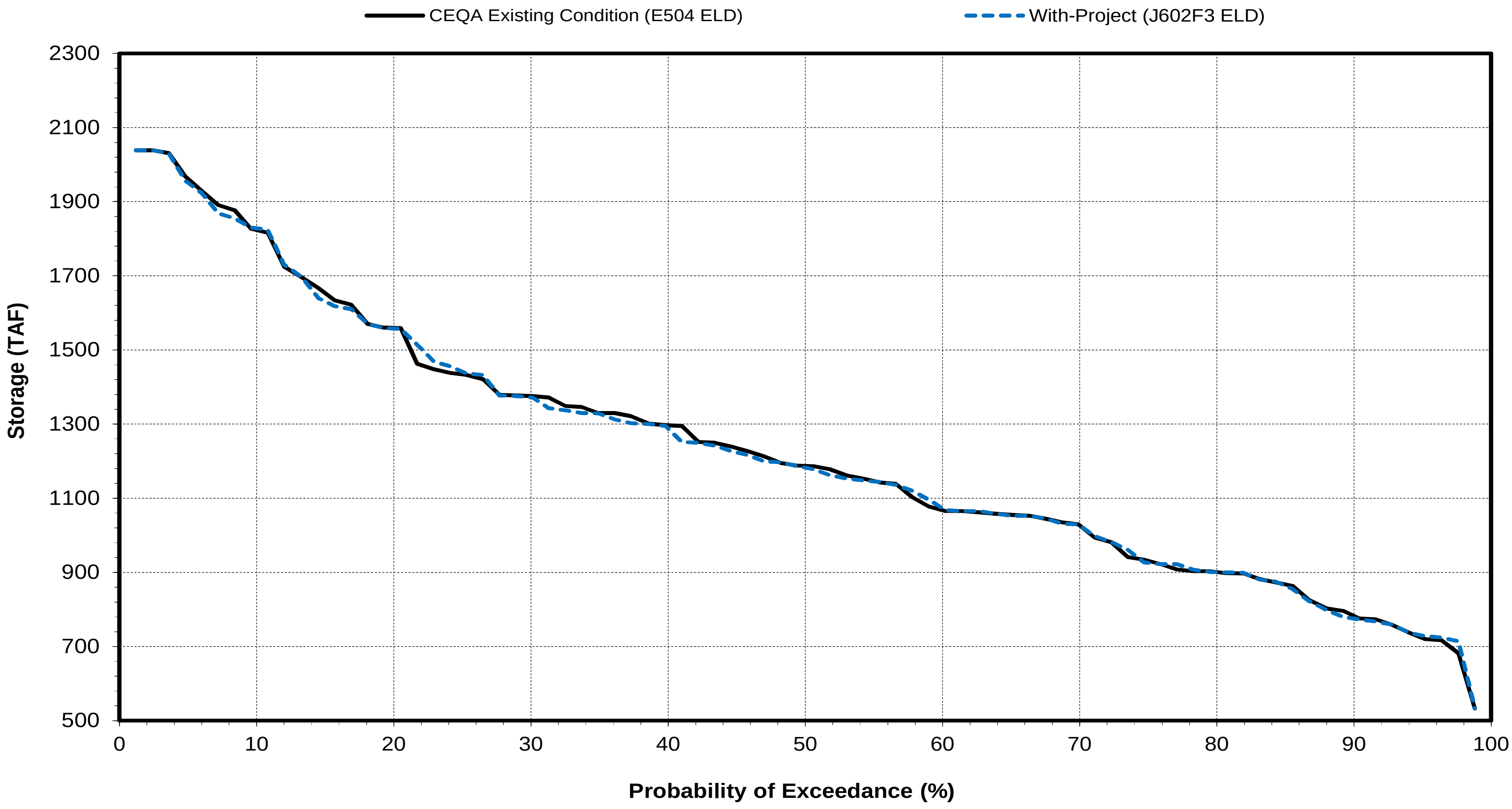


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

San Luis Reservoir End of Month Storage

January

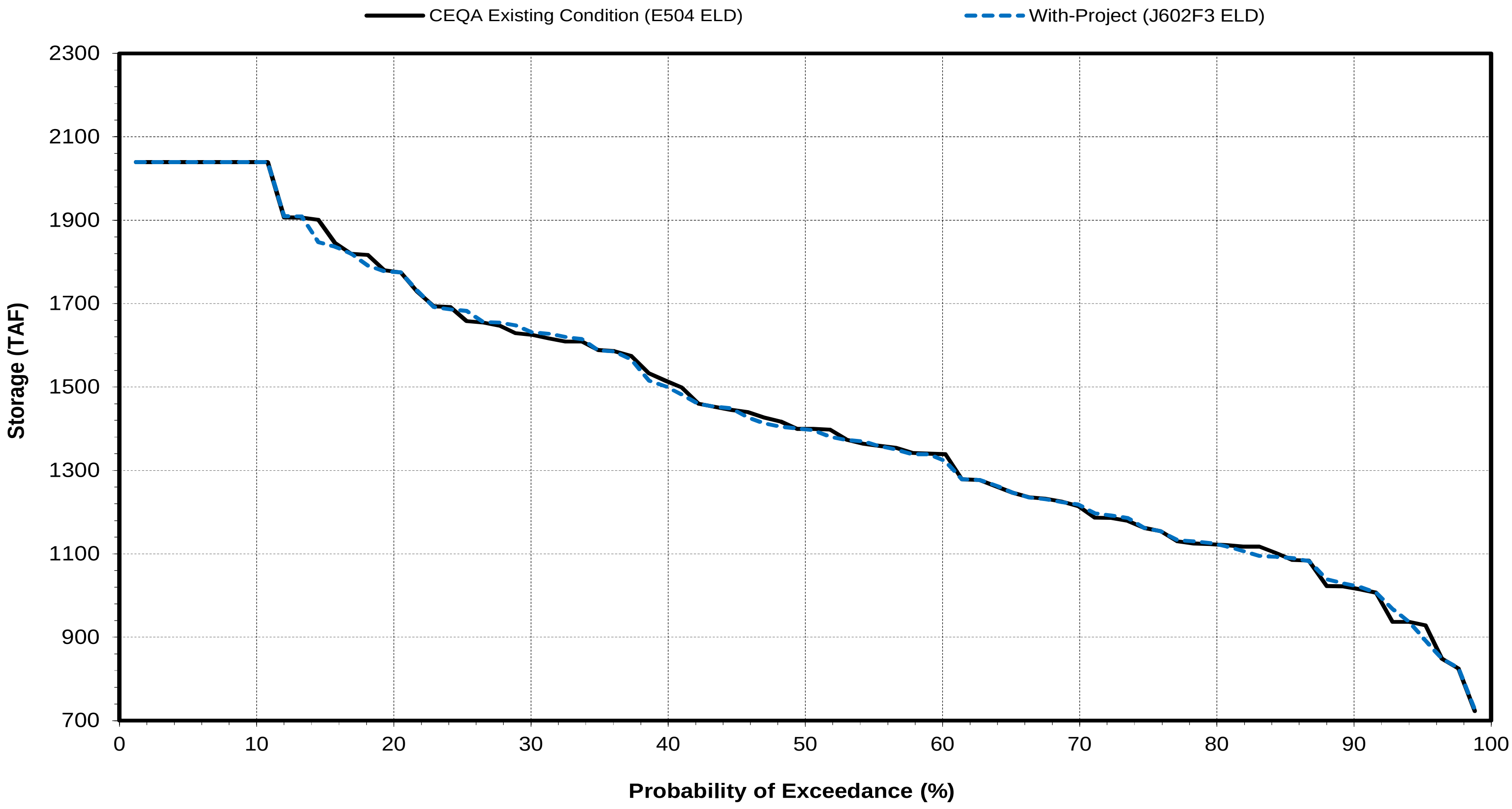


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

San Luis Reservoir End of Month Storage

February

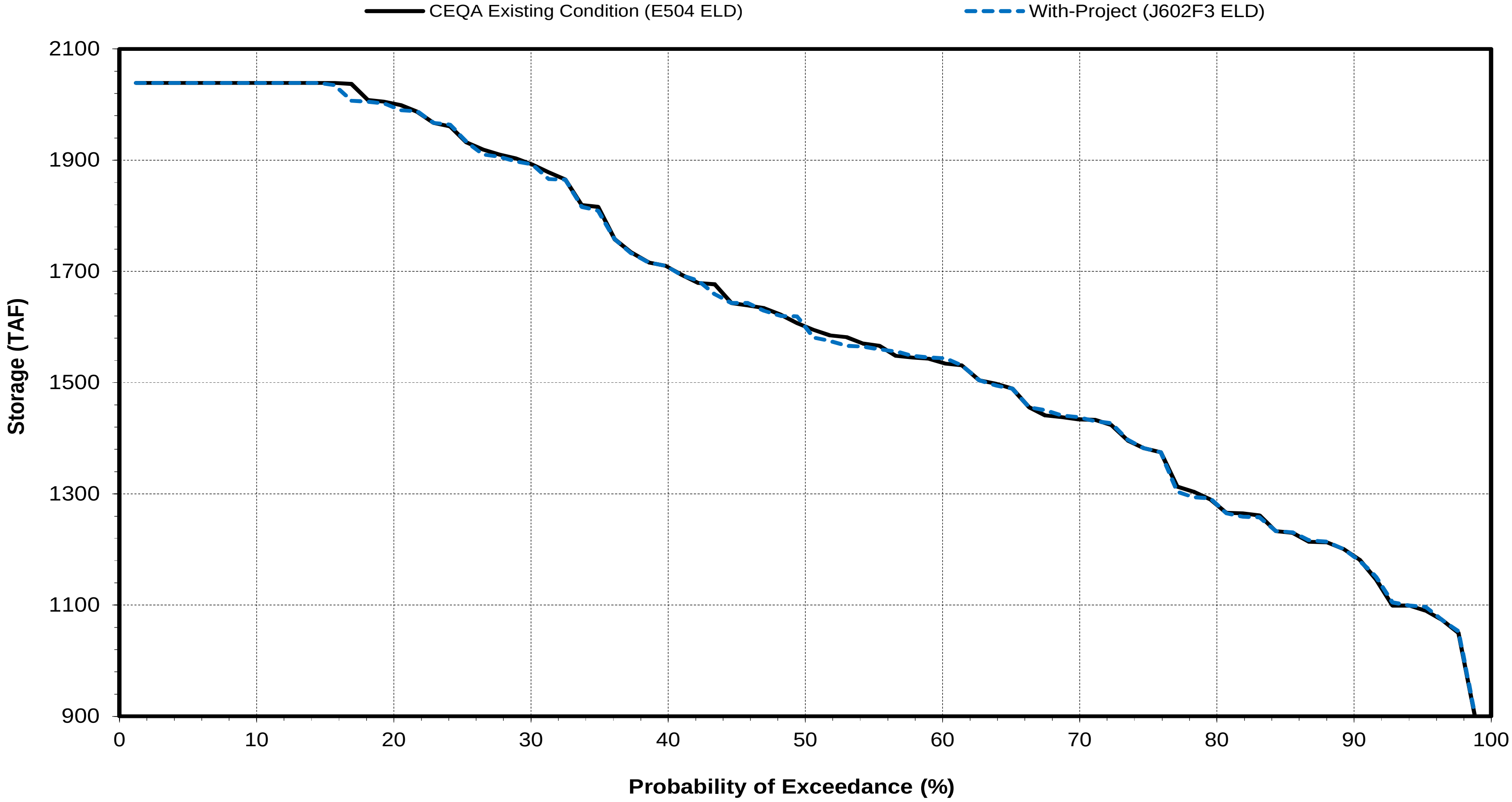


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

San Luis Reservoir End of Month Storage

March

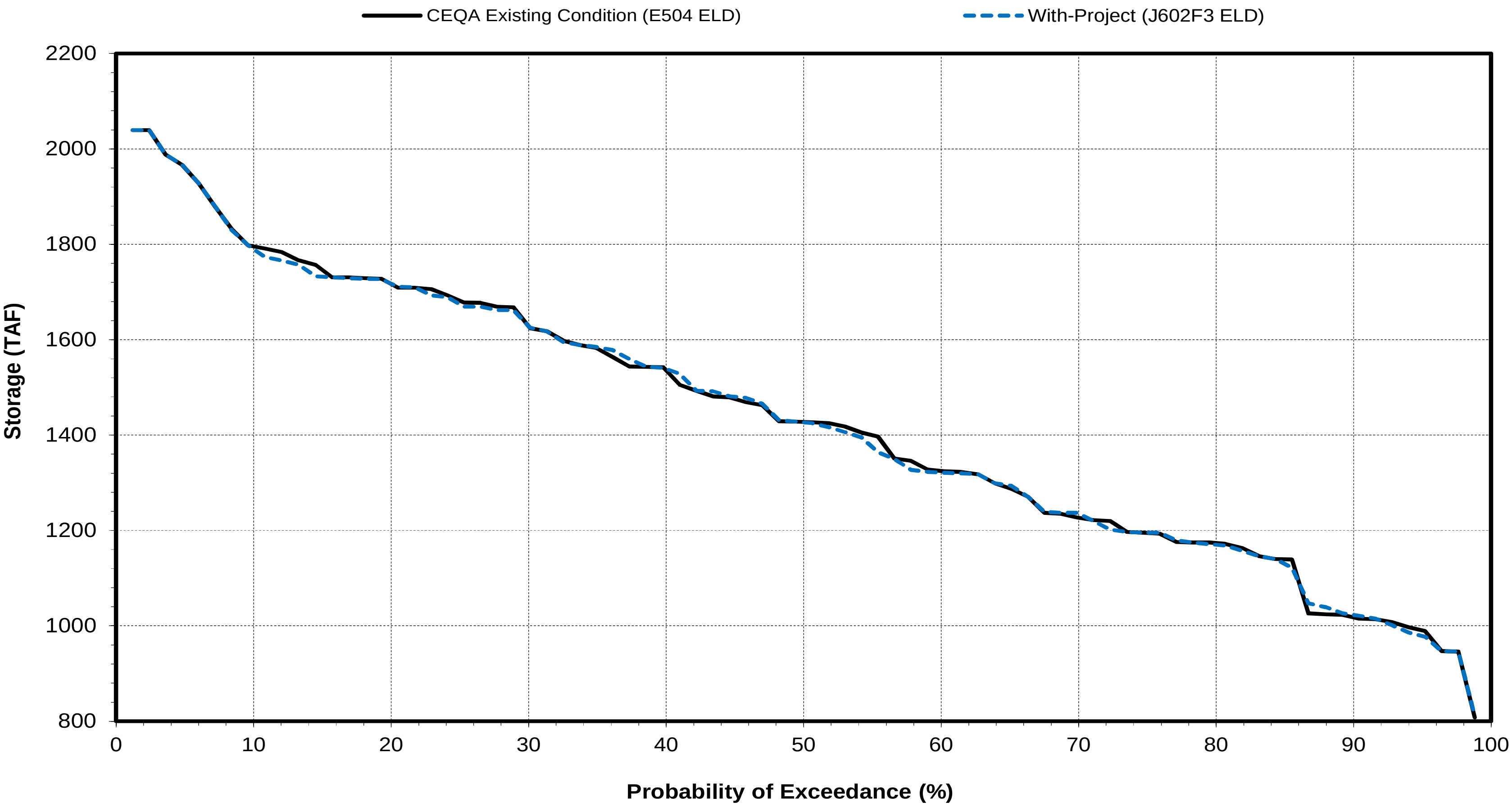


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

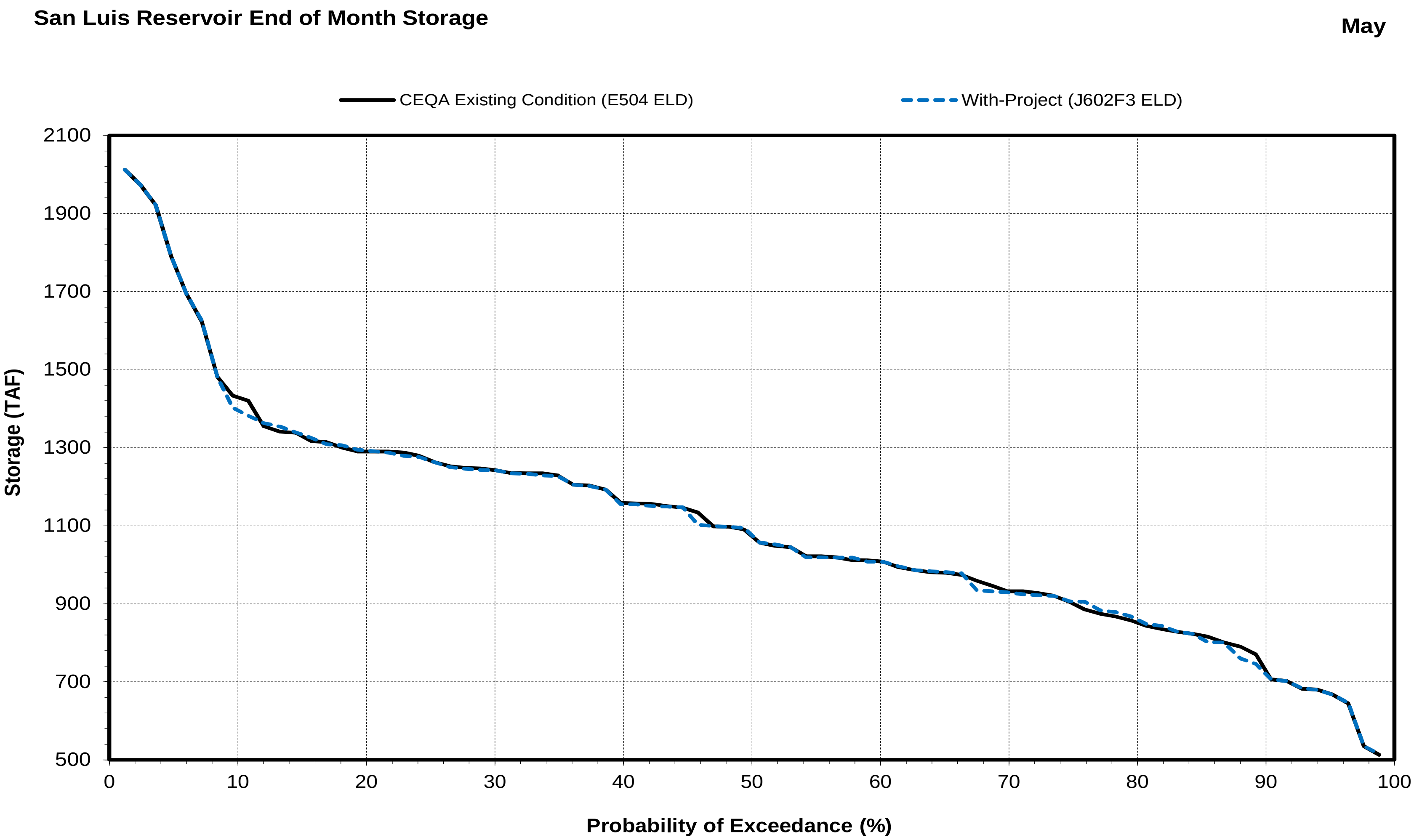
San Luis Reservoir End of Month Storage

April



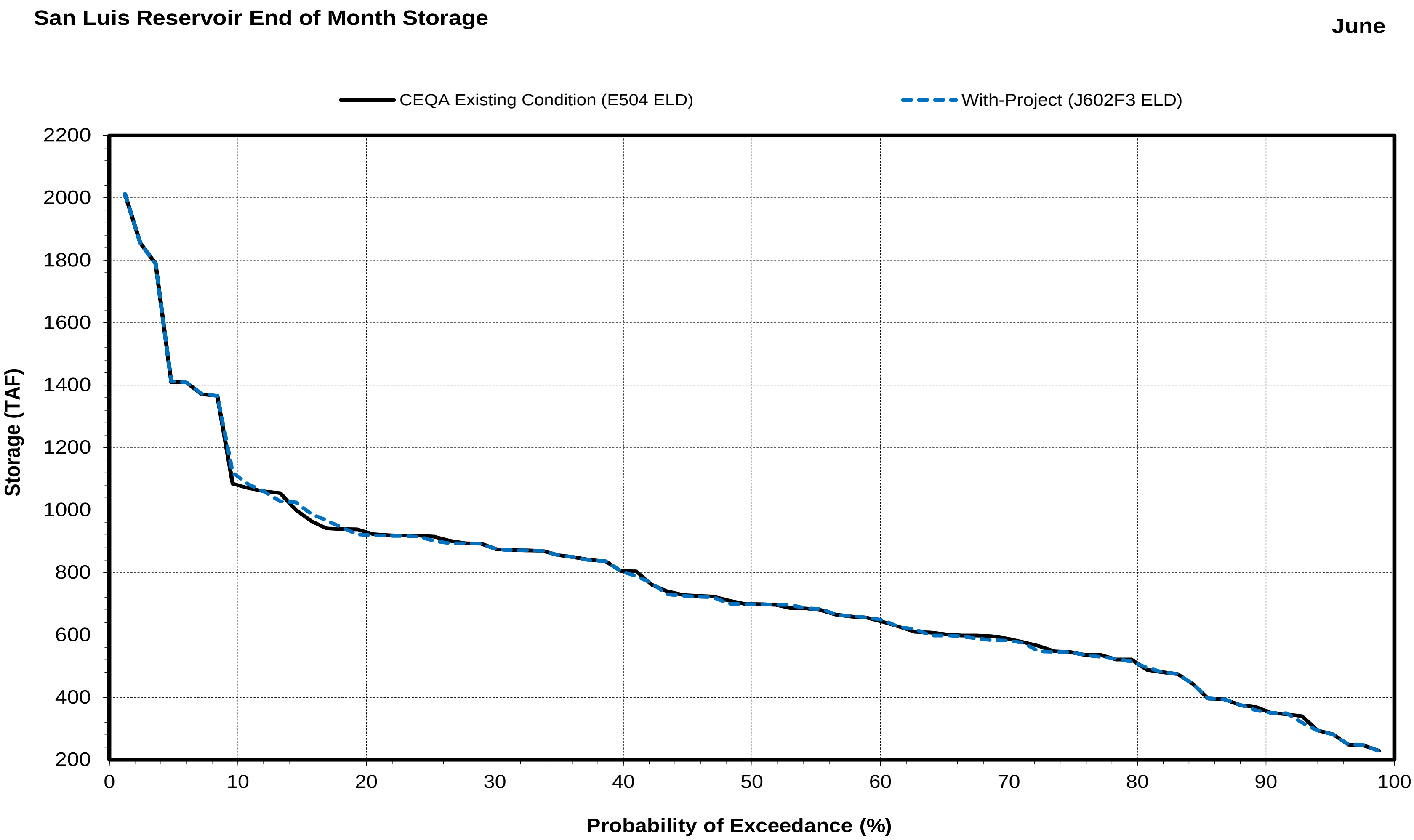
Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

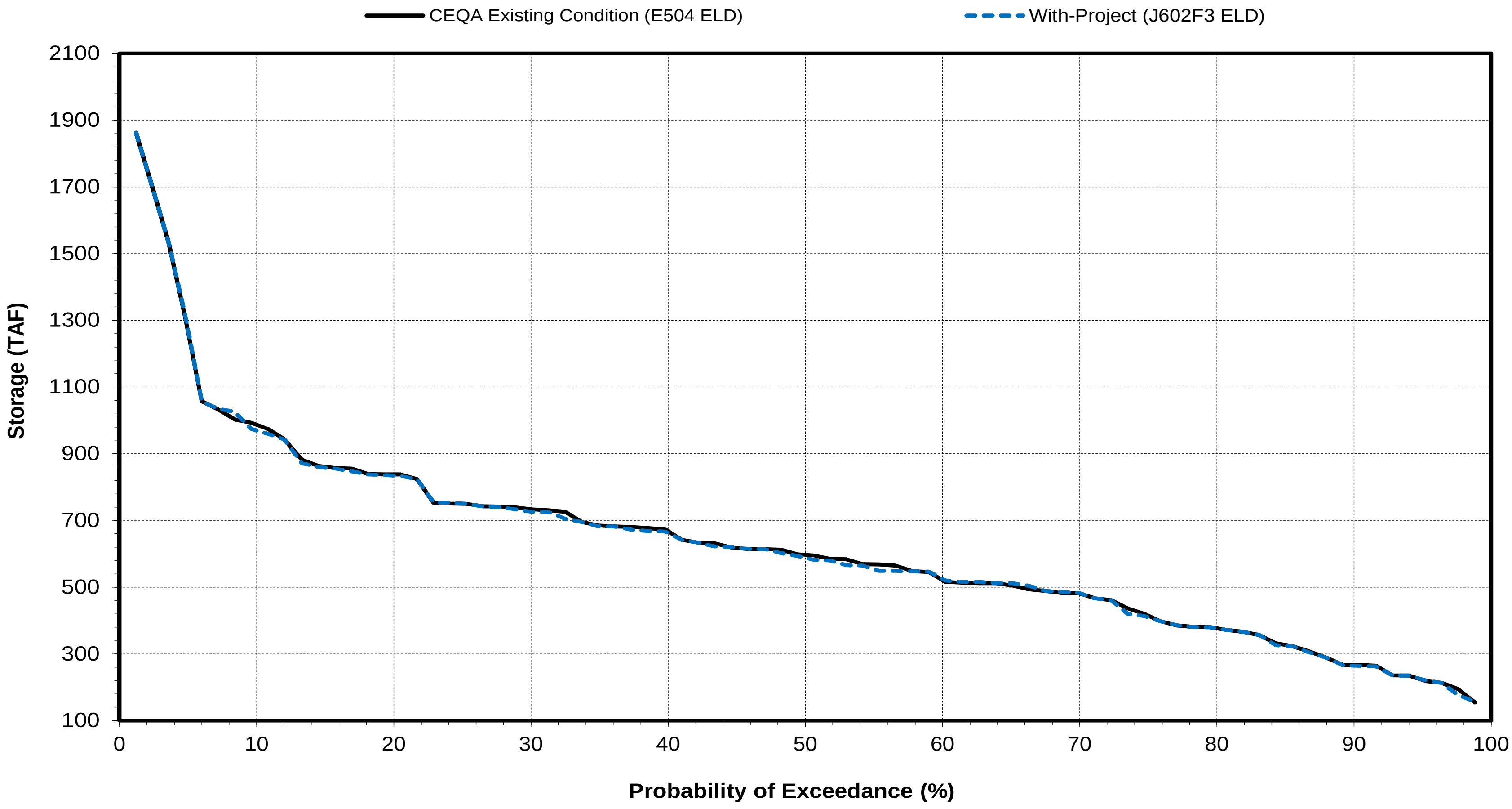
Created: 7/26/2016



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

San Luis Reservoir End of Month Storage

July

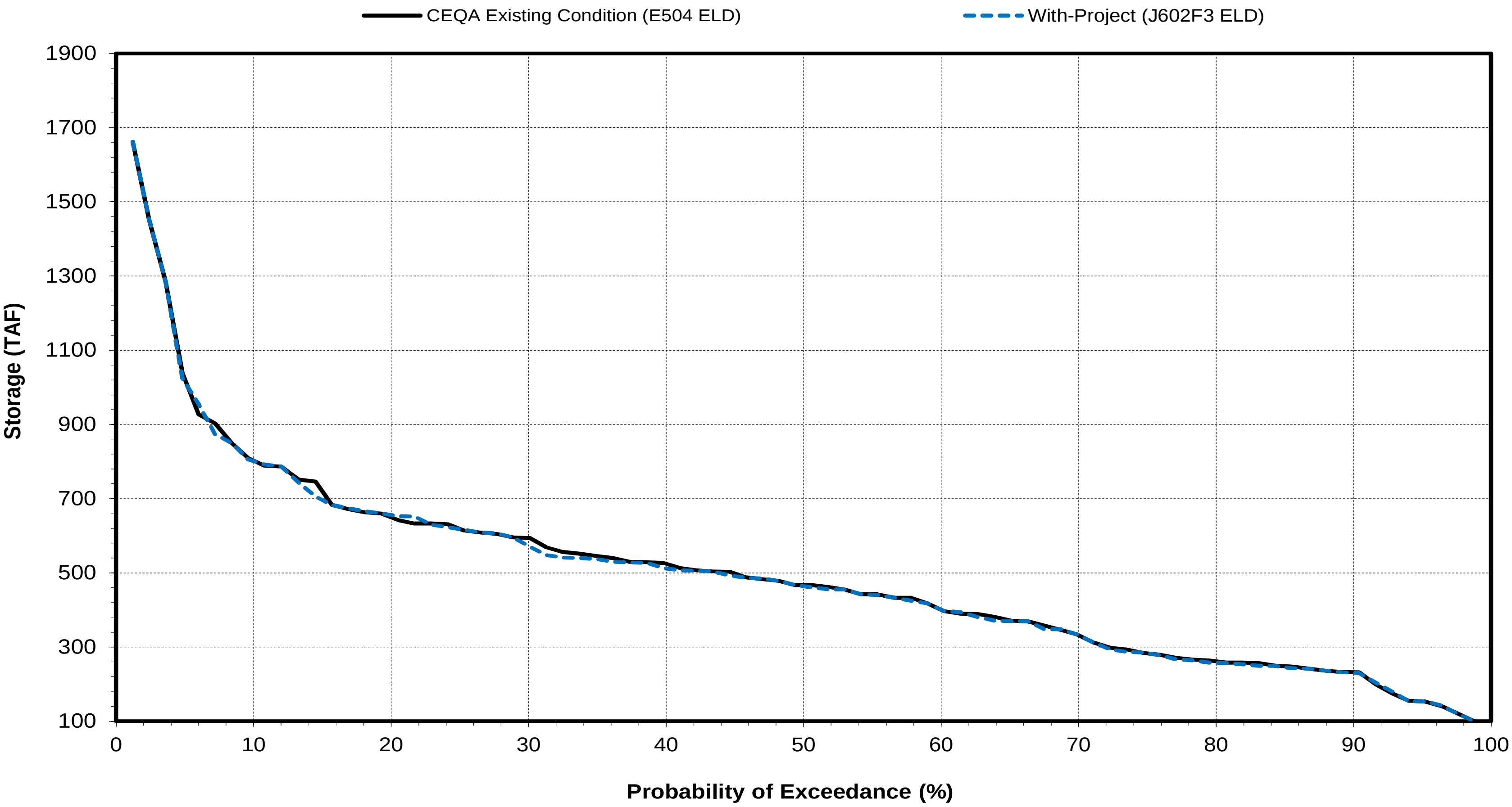


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

San Luis Reservoir End of Month Storage

August

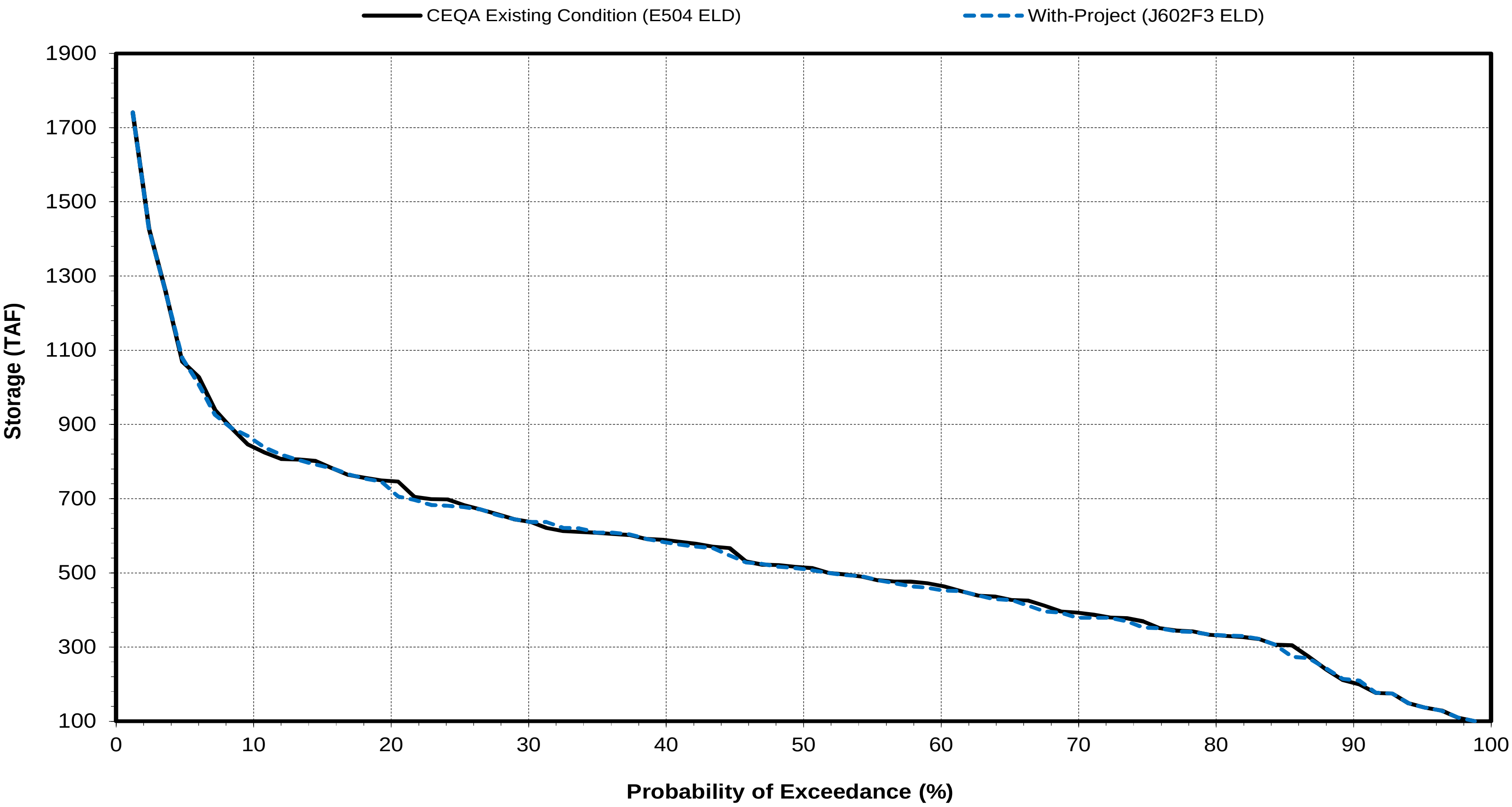


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

San Luis Reservoir End of Month Storage

September



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 7/26/2016

Long-term and Water Year Type Average Sacramento River Flow at Red Bluff Diversion Dam Under CEQA Existing Condition (E504 ELD) and With-Projec (J602F3 ELD) Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
						Long-term						
Full Simulation Period²												
CEQA Existing Condition (E504 ELD)	7,058	9,157	11,462	15,247	18,052	14,539	10,582	9,588	10,890	12,453	9,767	8,335
With-Project (J602F3 ELD)	7,035	9,183	11,475	15,258	18,075	14,538	10,584	9,592	10,856	12,383	9,758	8,332
Difference	-23	26	13	11	23	-1	2	4	-34	-70	-9	-3
Percent Difference³	-0.3	0.3	0.1	0.1	0.1	0.0	0.0	0.0	-0.3	-0.6	-0.1	0.0
						Water Year Types¹						
Wet												
CEQA Existing Condition (E504 ELD)	7,931	11,577	19,338	27,647	30,289	25,214	15,218	11,951	11,002	12,072	10,375	13,279
With-Project (J602F3 ELD)	7,816	11,578	19,349	27,679	30,337	25,215	15,218	11,924	11,001	12,058	10,375	13,272
Difference	-115	1	11	32	48	1	0	-27	-1	-14	0	-7
Percent Difference³	-1.5	0.0	0.1	0.1	0.2	0.0	0.0	-0.2	0.0	-0.1	0.0	-0.1
Above Normal												
CEQA Existing Condition (E504 ELD)	6,852	9,169	10,344	16,199	23,606	15,754	10,280	9,671	11,048	13,279	9,672	8,229
With-Project (J602F3 ELD)	6,828	9,227	10,385	16,197	23,601	15,740	10,276	9,747	10,988	13,249	9,636	8,278
Difference	-24	58	41	-2	-5	-14	-4	76	-60	-30	-36	49
Percent Difference³	-0.4	0.6	0.4	0.0	0.0	-0.1	0.0	0.8	-0.5	-0.2	-0.4	0.6
Below Normal												
CEQA Existing Condition (E504 ELD)	7,011	8,261	8,384	9,095	12,041	8,917	8,459	8,346	10,729	12,262	9,459	5,835
With-Project (J602F3 ELD)	7,007	8,252	8,383	9,095	12,009	8,909	8,459	8,350	10,638	12,263	9,439	5,841
Difference	-4	-9	-1	0	-32	-8	0	4	-91	1	-20	6
Percent Difference³	-0.1	-0.1	0.0	0.0	-0.3	-0.1	0.0	0.0	-0.8	0.0	-0.2	0.1
Dry												
CEQA Existing Condition (E504 ELD)	6,544	8,073	7,150	7,154	8,968	8,362	7,762	8,370	11,169	13,082	9,554	5,509
With-Project (J602F3 ELD)	6,575	8,126	7,150	7,155	9,025	8,362	7,776	8,377	11,131	12,922	9,637	5,477
Difference	31	53	0	1	57	0	14	7	-38	-160	83	-32
Percent Difference³	0.5	0.7	0.0	0.0	0.6	0.0	0.2	0.1	-0.3	-1.2	0.9	-0.6
Critical												
CEQA Existing Condition (E504 ELD)	6,201	6,573	5,572	6,749	6,624	6,018	7,543	7,662	10,260	11,734	9,220	4,881
With-Project (J602F3 ELD)	6,274	6,620	5,601	6,750	6,636	6,033	7,543	7,655	10,252	11,554	9,098	4,870
Difference	73	47	29	1	12	15	0	-7	-8	-180	-122	-11
Percent Difference³	1.2	0.7	0.5	0.0	0.2	0.2	0.0	-0.1	-0.1	-1.5	-1.3	-0.2

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

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	10975	10975	0	0.0
2.4	10945	10691	-254	-2.3
3.6	10691	10685	-6	-0.1
4.8	10292	10292	0	0.0
6.0	9764	9764	0	0.0
7.2	9657	9657	0	0.0
8.4	9529	9529	0	0.0
9.6	9234	9234	0	0.0
10.8	9012	9011	-1	0.0
12.0	8977	8946	-31	-0.3
13.3	8869	8786	-83	-0.9
14.5	8804	8722	-82	-0.9
15.7	8781	8654	-127	-1.4
16.9	8722	8558	-164	-1.9
18.1	8654	8419	-235	-2.7
19.3	8558	8385	-173	-2.0
20.5	8419	8117	-302	-3.6
21.7	8384	7957	-427	-5.1
22.9	8117	7914	-203	-2.5
24.1	7995	7890	-105	-1.3
25.3	7894	7874	-20	-0.3
26.5	7876	7785	-91	-1.2
27.7	7692	7652	-40	-0.5
28.9	7655	7639	-16	-0.2
30.1	7652	7615	-37	-0.5
31.3	7601	7611	10	0.1
32.5	7555	7543	-12	-0.2
33.7	7539	7532	-7	-0.1
34.9	7483	7483	0	0.0
36.1	7472	7369	-103	-1.4
37.3	7369	7317	-52	-0.7
38.6	7322	7287	-35	-0.5
39.8	7317	7266	-51	-0.7
41.0	7273	7240	-33	-0.5
42.2	7225	7213	-12	-0.2
43.4	7087	7081	-6	-0.1
44.6	6888	7019	131	1.9
45.8	6847	6917	70	1.0
47.0	6828	6895	67	1.0
48.2	6763	6763	0	0.0
49.4	6759	6759	0	0.0
50.6	6644	6644	0	0.0
51.8	6614	6618	4	0.1
53.0	6614	6614	0	0.0
54.2	6540	6539	-1	0.0
55.4	6510	6536	26	0.4
56.6	6433	6530	97	1.5
57.8	6366	6519	153	2.4
59.0	6352	6510	158	2.5
60.2	6342	6350	8	0.1
61.4	6331	6342	11	0.2
62.7	6272	6272	0	0.0
63.9	6264	6264	0	0.0
65.1	6120	6133	13	0.2
66.3	6068	6066	-2	0.0
67.5	6052	6052	0	0.0
68.7	6042	6012	-30	-0.5
69.9	6009	5994	-15	-0.2
71.1	5992	5985	-7	-0.1
72.3	5986	5908	-78	-1.3
73.5	5908	5887	-21	-0.4
74.7	5885	5887	2	0.0
75.9	5884	5851	-33	-0.6
77.1	5786	5783	-3	-0.1
78.3	5771	5776	5	0.1
79.5	5757	5771	14	0.2
80.7	5747	5738	-9	-0.2
81.9	5740	5664	-76	-1.3
83.1	5663	5649	-14	-0.2
84.3	5661	5607	-54	-1.0
85.5	5607	5557	-50	-0.9
86.7	5557	5555	-2	0.0
88.0	5450	5483	33	0.6
89.2	5396	5414	18	0.3
90.4	5342	5397	55	1.0
91.6	5303	5342	39	0.7
92.8	5207	5325	118	2.3
94.0	5177	5303	126	2.4
95.2	5120	5177	57	1.1
96.4	5059	5057	-2	0.0
97.6	4968	4969	1	0.0
98.8	4754	4754	0	0.0
Min	4754	4754	-427	-5.1
Max	10975	10975	158	2.5
Mean	7058	7035	-23	-0.2
Median	6702	6702	-2	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	75.6
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		15.9
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	35878	35878	0	0.0
2.4	20446	20446	0	0.0
3.6	14726	14789	63	0.4
4.8	14560	14560	0	0.0
6.0	14199	14213	14	0.1
7.2	13196	13196	0	0.0
8.4	12873	12884	11	0.1
9.6	12801	12872	71	0.6
10.8	12797	12790	-7	-0.1
12.0	12774	12773	-1	0.0
13.3	12751	12756	5	0.0
14.5	12431	12480	49	0.4
15.7	12334	12370	36	0.3
16.9	12316	12316	0	0.0
18.1	12075	12264	189	1.6
19.3	11992	12205	213	1.8
20.5	11953	11992	39	0.3
21.7	11941	11954	13	0.1
22.9	11904	11904	0	0.0
24.1	11866	11866	0	0.0
25.3	11830	11829	-1	0.0
26.5	11565	11540	-25	-0.2
27.7	11287	11295	8	0.1
28.9	11162	11135	-27	-0.2
30.1	11028	11107	79	0.7
31.3	10813	10848	35	0.3
32.5	10771	10814	43	0.4
33.7	10751	10771	20	0.2
34.9	10595	10689	94	0.9
36.1	10583	10595	12	0.1
37.3	10070	10391	321	3.2
38.6	9973	9985	12	0.1
39.8	9628	9654	26	0.3
41.0	9576	9570	-6	-0.1
42.2	9409	9409	0	0.0
43.4	9345	9387	42	0.4
44.6	9078	9346	268	3.0
45.8	8773	9078	305	3.5
47.0	8368	8348	-20	-0.2
48.2	8273	8250	-23	-0.3
49.4	8250	7995	-255	-3.1
50.6	7927	7919	-8	-0.1
51.8	7906	7889	-17	-0.2
53.0	7892	7786	-106	-1.3
54.2	7751	7751	0	0.0
55.4	7724	7724	0	0.0
56.6	7691	7691	0	0.0
57.8	7668	7648	-20	-0.3
59.0	7361	7361	0	0.0
60.2	7335	7336	1	0.0
61.4	7279	7279	0	0.0
62.7	7259	7261	2	0.0
63.9	7192	7190	-2	0.0
65.1	6836	6836	0	0.0
66.3	6796	6798	2	0.0
67.5	6671	6599	-72	-1.1
68.7	6562	6567	5	0.1
69.9	6463	6563	100	1.5
71.1	6376	6376	0	0.0
72.3	6292	6297	5	0.1
73.5	6232	6216	-16	-0.3
74.7	6207	6208	1	0.0
75.9	6136	6136	0	0.0
77.1	5980	5980	0	0.0
78.3	5894	5893	-1	0.0
79.5	5799	5851	52	0.9
80.7	5779	5798	19	0.3
81.9	5687	5687	0	0.0
83.1	5668	5669	1	0.0
84.3	5658	5657	-1	0.0
85.5	5624	5623	-1	0.0
86.7	5297	5297	0	0.0
88.0	5296	5296	0	0.0
89.2	5164	5164	0	0.0
90.4	4944	4946	2	0.0
91.6	4939	4938	-1	0.0
92.8	4752	4824	72	1.5
94.0	4612	4754	142	3.1
95.2	4514	4741	227	5.0
96.4	4391	4523	132	3.0
97.6	4272	4270	-2	0.0
98.8	4097	4097	0	0.0
Min	4097	4097	-255	-3.1
Max	35878	35878	321	5.0
Mean	9157	9183	26	0.3
Median	8089	7957	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		12.2
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		20.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	43106	43106	0	0.0
2.4	41276	40759	-517	-1.3
3.6	35161	35162	1	0.0
4.8	35070	35069	-1	0.0
6.0	31849	31667	-182	-0.6
7.2	30914	30903	-11	0.0
8.4	30007	30008	1	0.0
9.6	29371	29663	292	1.0
10.8	24339	24338	-1	0.0
12.0	23894	23894	0	0.0
13.3	22386	22886	500	2.2
14.5	21549	21549	0	0.0
15.7	21479	21479	0	0.0
16.9	19280	19068	-212	-1.1
18.1	18308	18301	-7	0.0
19.3	17251	17892	641	3.7
20.5	15864	16156	292	1.8
21.7	14914	14914	0	0.0
22.9	14699	14699	0	0.0
24.1	14172	14173	1	0.0
25.3	13981	13982	1	0.0
26.5	13595	13595	0	0.0
27.7	12052	12050	-2	0.0
28.9	11937	11931	-6	-0.1
30.1	11602	11603	1	0.0
31.3	10342	10341	-1	0.0
32.5	9365	9366	1	0.0
33.7	9171	9171	0	0.0
34.9	9145	9146	1	0.0
36.1	9133	9133	0	0.0
37.3	8987	8988	1	0.0
38.6	8979	8979	0	0.0
39.8	8912	8912	0	0.0
41.0	8772	8772	0	0.0
42.2	8498	8498	0	0.0
43.4	7843	7843	0	0.0
44.6	7475	7475	0	0.0
45.8	7415	7415	0	0.0
47.0	7404	7405	1	0.0
48.2	7377	7378	1	0.0
49.4	7272	7272	0	0.0
50.6	7052	7051	-1	0.0
51.8	6977	6975	-2	0.0
53.0	6969	6967	-2	0.0
54.2	6946	6950	4	0.1
55.4	6803	6803	0	0.0
56.6	6796	6796	0	0.0
57.8	6679	6683	4	0.1
59.0	6593	6595	2	0.0
60.2	6410	6406	-4	-0.1
61.4	6390	6389	-1	0.0
62.7	6314	6314	0	0.0
63.9	6289	6289	0	0.0
65.1	6237	6237	0	0.0
66.3	6204	6204	0	0.0
67.5	6195	6194	-1	0.0
68.7	6156	6156	0	0.0
69.9	6010	6010	0	0.0
71.1	5965	5965	0	0.0
72.3	5962	5963	1	0.0
73.5	5860	5860	0	0.0
74.7	5761	5761	0	0.0
75.9	5734	5734	0	0.0
77.1	5567	5567	0	0.0
78.3	5557	5557	0	0.0
79.5	5543	5543	0	0.0
80.7	5441	5441	0	0.0
81.9	5355	5395	40	0.7
83.1	5297	5355	58	1.1
84.3	5251	5251	0	0.0
85.5	5246	5246	0	0.0
86.7	5165	5165	0	0.0
88.0	5158	5153	-5	-0.1
89.2	5148	5148	0	0.0
90.4	4939	4939	0	0.0
91.6	4821	4874	53	1.1
92.8	4741	4821	80	1.7
94.0	4725	4741	16	0.3
95.2	4692	4725	33	0.7
96.4	4611	4611	0	0.0
97.6	4147	4222	75	1.8
98.8	3990	3990	0	0.0
Min	3990	3990	-517	-1.3
Max	43106	43106	641	3.7
Mean	11461	11475	14	0.2
Median	7162	7162	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	89.0
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		2.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		20.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	78102	78102	0	0.0
2.4	57397	57397	0	0.0
3.6	52227	52229	2	0.0
4.8	51066	51067	1	0.0
6.0	44405	44405	0	0.0
7.2	41042	41615	573	1.4
8.4	40898	40898	0	0.0
9.6	34733	34823	90	0.3
10.8	32245	32245	0	0.0
12.0	30880	30880	0	0.0
13.3	27425	27405	-20	-0.1
14.5	27058	27058	0	0.0
15.7	26890	26891	1	0.0
16.9	26606	26776	170	0.6
18.1	26580	26577	-3	0.0
19.3	23631	23627	-4	0.0
20.5	22960	22960	0	0.0
21.7	20632	20632	0	0.0
22.9	20457	20455	-2	0.0
24.1	19749	19750	1	0.0
25.3	18932	18933	1	0.0
26.5	18220	18223	3	0.0
27.7	18105	18106	1	0.0
28.9	15605	15606	1	0.0
30.1	15567	15567	0	0.0
31.3	15209	15208	-1	0.0
32.5	14574	14574	0	0.0
33.7	14023	14023	0	0.0
34.9	13982	13982	0	0.0
36.1	12563	12562	-1	0.0
37.3	12432	12432	0	0.0
38.6	12273	12273	0	0.0
39.8	11751	11751	0	0.0
41.0	11395	11395	0	0.0
42.2	11210	11210	0	0.0
43.4	10749	10749	0	0.0
44.6	10491	10494	3	0.0
45.8	10321	10340	19	0.2
47.0	10313	10313	0	0.0
48.2	10275	10273	-2	0.0
49.4	10009	10009	0	0.0
50.6	9413	9421	8	0.1
51.8	9344	9344	0	0.0
53.0	9037	9037	0	0.0
54.2	8459	8459	0	0.0
55.4	8387	8387	0	0.0
56.6	8365	8365	0	0.0
57.8	8048	8048	0	0.0
59.0	7927	7927	0	0.0
60.2	7755	7754	-1	0.0
61.4	7623	7623	0	0.0
62.7	7535	7535	0	0.0
63.9	7521	7520	-1	0.0
65.1	7313	7313	0	0.0
66.3	7226	7226	0	0.0
67.5	6862	6864	2	0.0
68.7	6767	6767	0	0.0
69.9	6661	6661	0	0.0
71.1	6621	6620	-1	0.0
72.3	6533	6533	0	0.0
73.5	6328	6329	1	0.0
74.7	6245	6245	0	0.0
75.9	6179	6179	0	0.0
77.1	6161	6162	1	0.0
78.3	6112	6112	0	0.0
79.5	6084	6084	0	0.0
80.7	6035	6029	-6	-0.1
81.9	6006	6006	0	0.0
83.1	5896	5896	0	0.0
84.3	5513	5509	-4	-0.1
85.5	5484	5484	0	0.0
86.7	5288	5288	0	0.0
88.0	5127	5127	0	0.0
89.2	5084	5085	1	0.0
90.4	5040	5040	0	0.0
91.6	4999	5000	1	0.0
92.8	4940	4940	0	0.0
94.0	4896	4895	-1	0.0
95.2	4726	4726	0	0.0
96.4	4698	4698	0	0.0
97.6	4609	4609	0	0.0
98.8	4463	4463	0	0.0
Min	4463	4463	-20	-0.1
Max	78102	78102	573	1.4
Mean	15247	15258	10	0.0
Median	9711	9715	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	98.8
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	74361	74359	-2	0.0
2.4	64537	64624	87	0.1
3.6	63778	63778	0	0.0
4.8	55710	55710	0	0.0
6.0	48310	48310	0	0.0
7.2	46889	47755	866	1.8
8.4	46586	46873	287	0.6
9.6	44222	44223	1	0.0
10.8	43526	43526	0	0.0
12.0	41261	41211	-50	-0.1
13.3	40827	40827	0	0.0
14.5	39847	39847	0	0.0
15.7	38292	38289	-3	0.0
16.9	33025	33024	-1	0.0
18.1	32947	32947	0	0.0
19.3	31205	31204	-1	0.0
20.5	30232	30233	1	0.0
21.7	28067	28067	0	0.0
22.9	27339	27339	0	0.0
24.1	25633	25181	-452	-1.8
25.3	24348	24348	0	0.0
26.5	23543	23543	0	0.0
27.7	21735	21744	9	0.0
28.9	20937	20937	0	0.0
30.1	20839	20839	0	0.0
31.3	18441	18439	-2	0.0
32.5	16778	17097	319	1.9
33.7	16084	16778	694	4.3
34.9	15992	15992	0	0.0
36.1	15465	15465	0	0.0
37.3	15154	15154	0	0.0
38.6	14023	14023	0	0.0
39.8	13811	13811	0	0.0
41.0	13200	13201	1	0.0
42.2	13024	13024	0	0.0
43.4	13000	13000	0	0.0
44.6	12521	12522	1	0.0
45.8	11243	11243	0	0.0
47.0	11184	11185	1	0.0
48.2	11124	11124	0	0.0
49.4	10802	10802	0	0.0
50.6	10788	10788	0	0.0
51.8	10524	10525	1	0.0
53.0	9985	9985	0	0.0
54.2	9830	9830	0	0.0
55.4	9306	9306	0	0.0
56.6	9064	9066	2	0.0
57.8	9045	9045	0	0.0
59.0	8725	8725	0	0.0
60.2	8660	8660	0	0.0
61.4	8612	8612	0	0.0
62.7	8501	8501	0	0.0
63.9	8218	8219	1	0.0
65.1	8129	8130	1	0.0
66.3	7915	7915	0	0.0
67.5	7882	7882	0	0.0
68.7	7694	7695	1	0.0
69.9	7621	7621	0	0.0
71.1	7612	7612	0	0.0
72.3	7381	7380	-1	0.0
73.5	7217	7299	82	1.1
74.7	7163	7217	54	0.8
75.9	6883	6883	0	0.0
77.1	6857	6858	1	0.0
78.3	6657	6657	0	0.0
79.5	6643	6643	0	0.0
80.7	6586	6585	-1	0.0
81.9	6550	6550	0	0.0
83.1	5889	5890	1	0.0
84.3	5454	5454	0	0.0
85.5	5408	5409	1	0.0
86.7	5282	5282	0	0.0
88.0	5177	5177	0	0.0
89.2	5158	5158	0	0.0
90.4	5094	5094	0	0.0
91.6	4999	4999	0	0.0
92.8	4982	4982	0	0.0
94.0	4922	4923	1	0.0
95.2	4685	4685	0	0.0
96.4	4504	4504	0	0.0
97.6	4460	4460	0	0.0
98.8	4369	4369	0	0.0
Min	4369	4369	-452	-1.8
Max	74361	74359	866	4.3
Mean	18052	18075	23	0.1
Median	10795	10795	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	93.9
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	69684	69684	0	0.0
2.4	69649	69649	0	0.0
3.6	53838	53839	1	0.0
4.8	50429	50429	0	0.0
6.0	47079	47079	0	0.0
7.2	39561	39562	1	0.0
8.4	33328	33327	-1	0.0
9.6	32122	32122	0	0.0
10.8	29624	29624	0	0.0
12.0	27032	27032	0	0.0
13.3	25390	25390	0	0.0
14.5	23868	23969	101	0.4
15.7	21576	21576	0	0.0
16.9	20582	20582	0	0.0
18.1	20063	20063	0	0.0
19.3	20027	20039	12	0.1
20.5	19548	19554	6	0.0
21.7	19217	19217	0	0.0
22.9	18638	18638	0	0.0
24.1	18449	18407	-42	-0.2
25.3	17831	17831	0	0.0
26.5	17498	17499	1	0.0
27.7	15970	15862	-108	-0.7
28.9	15030	15031	1	0.0
30.1	14379	14379	0	0.0
31.3	13693	13688	-5	0.0
32.5	13669	13665	-4	0.0
33.7	12710	12711	1	0.0
34.9	12404	12404	0	0.0
36.1	12368	12198	-170	-1.4
37.3	11800	11800	0	0.0
38.6	11789	11790	1	0.0
39.8	11036	11029	-7	-0.1
41.0	10689	10684	-5	0.0
42.2	10290	10292	2	0.0
43.4	9956	9956	0	0.0
44.6	9924	9925	1	0.0
45.8	9805	9806	1	0.0
47.0	9770	9770	0	0.0
48.2	9531	9531	0	0.0
49.4	9216	9217	1	0.0
50.6	9215	9216	1	0.0
51.8	8804	8804	0	0.0
53.0	8748	8748	0	0.0
54.2	8645	8645	0	0.0
55.4	8579	8579	0	0.0
56.6	8574	8575	1	0.0
57.8	8197	8198	1	0.0
59.0	8133	8133	0	0.0
60.2	8026	8027	1	0.0
61.4	7881	7881	0	0.0
62.7	7817	7807	-10	-0.1
63.9	7778	7776	-2	0.0
65.1	7755	7754	-1	0.0
66.3	7677	7678	1	0.0
67.5	7622	7622	0	0.0
68.7	7517	7517	0	0.0
69.9	7264	7264	0	0.0
71.1	7141	7141	0	0.0
72.3	6915	6915	0	0.0
73.5	6870	6870	0	0.0
74.7	6843	6842	-1	0.0
75.9	6833	6833	0	0.0
77.1	6743	6734	-9	-0.1
78.3	6473	6473	0	0.0
79.5	5921	5922	1	0.0
80.7	5889	5889	0	0.0
81.9	5821	5822	1	0.0
83.1	5698	5699	1	0.0
84.3	5688	5688	0	0.0
85.5	5581	5580	-1	0.0
86.7	5575	5575	0	0.0
88.0	5492	5492	0	0.0
89.2	5008	5007	-1	0.0
90.4	4987	4987	0	0.0
91.6	4888	4888	0	0.0
92.8	4734	4802	68	1.4
94.0	4671	4734	63	1.3
95.2	4610	4606	-4	-0.1
96.4	4390	4391	1	0.0
97.6	4161	4161	0	0.0
98.8	3941	3985	44	1.1
Min	3941	3985	-170	-1.4
Max	69684	69684	101	1.4
Mean	14539	14538	-1	0.0
Median	9216	9217	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	95.1
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	41373	41373	0	0.0
2.4	33813	33812	-1	0.0
3.6	24792	24792	0	0.0
4.8	23675	23675	0	0.0
6.0	22547	22547	0	0.0
7.2	22185	22185	0	0.0
8.4	17996	17996	0	0.0
9.6	17712	17713	1	0.0
10.8	17646	17646	0	0.0
12.0	16795	16795	0	0.0
13.3	16428	16424	-4	0.0
14.5	16393	16395	2	0.0
15.7	15831	15831	0	0.0
16.9	14522	14522	0	0.0
18.1	14277	14277	0	0.0
19.3	14073	14074	1	0.0
20.5	13396	13396	0	0.0
21.7	13263	13263	0	0.0
22.9	12047	12046	-1	0.0
24.1	11459	11458	-1	0.0
25.3	11329	11329	0	0.0
26.5	10528	10519	-9	-0.1
27.7	10106	10106	0	0.0
28.9	10019	10019	0	0.0
30.1	9726	9724	-2	0.0
31.3	9476	9475	-1	0.0
32.5	9350	9349	-1	0.0
33.7	9269	9243	-26	-0.3
34.9	9193	9190	-3	0.0
36.1	9177	9176	-1	0.0
37.3	9130	9128	-2	0.0
38.6	9034	9034	0	0.0
39.8	8819	8820	1	0.0
41.0	8767	8767	0	0.0
42.2	8678	8677	-1	0.0
43.4	8677	8670	-7	-0.1
44.6	8624	8624	0	0.0
45.8	8596	8597	1	0.0
47.0	8486	8558	72	0.8
48.2	8479	8486	7	0.1
49.4	8452	8479	27	0.3
50.6	8437	8452	15	0.2
51.8	8373	8438	65	0.8
53.0	8363	8373	10	0.1
54.2	8351	8366	15	0.2
55.4	8285	8351	66	0.8
56.6	8221	8285	64	0.8
57.8	8086	8223	137	1.7
59.0	8057	8086	29	0.4
60.2	8008	8002	-6	-0.1
61.4	7899	7873	-26	-0.3
62.7	7876	7835	-41	-0.5
63.9	7835	7702	-133	-1.7
65.1	7707	7702	-5	-0.1
66.3	7703	7638	-65	-0.8
67.5	7639	7634	-5	-0.1
68.7	7588	7588	0	0.0
69.9	7484	7484	0	0.0
71.1	7314	7313	-1	0.0
72.3	7301	7301	0	0.0
73.5	7262	7262	0	0.0
74.7	7159	7158	-1	0.0
75.9	7125	7124	-1	0.0
77.1	7035	7038	3	0.0
78.3	7034	7034	0	0.0
79.5	7018	7017	-1	0.0
80.7	6916	6915	-1	0.0
81.9	6899	6899	0	0.0
83.1	6856	6863	7	0.1
84.3	6709	6857	148	2.2
85.5	6693	6709	16	0.2
86.7	6633	6692	59	0.9
88.0	6589	6633	44	0.7
89.2	6481	6589	108	1.7
90.4	6402	6481	79	1.2
91.6	6363	6393	30	0.5
92.8	6160	6160	0	0.0
94.0	6143	6129	-14	-0.2
95.2	5778	5491	-287	-5.0
96.4	5492	5317	-175	-3.2
97.6	5318	5306	-12	-0.2
98.8	4978	4977	-1	0.0
Min	4978	4977	-287	-5.0
Max	41373	41373	148	2.2
Mean	10582	10584	2	0.0
Median	8445	8466	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	91.5
1.1<=X<10.0		4.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		3.7
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		10.0
X<=-5.0		5.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	22550	22550	0	0.0
2.4	18898	18898	0	0.0
3.6	18028	18028	0	0.0
4.8	17572	17572	0	0.0
6.0	17091	17091	0	0.0
7.2	16976	16976	0	0.0
8.4	14165	14165	0	0.0
9.6	14052	13970	-82	-0.6
10.8	13970	13438	-532	-3.8
12.0	13431	13336	-95	-0.7
13.3	12698	12698	0	0.0
14.5	11821	11820	-1	0.0
15.7	11709	11709	0	0.0
16.9	11669	11668	-1	0.0
18.1	11403	11403	0	0.0
19.3	11217	11217	0	0.0
20.5	10945	10987	42	0.4
21.7	10873	10874	1	0.0
22.9	10599	10599	0	0.0
24.1	10555	10556	1	0.0
25.3	10446	10441	-5	0.0
26.5	10440	10074	-366	-3.5
27.7	10111	10058	-53	-0.5
28.9	9999	9999	0	0.0
30.1	9982	9982	0	0.0
31.3	9855	9952	97	1.0
32.5	9722	9855	133	1.4
33.7	9563	9721	158	1.7
34.9	9541	9563	22	0.2
36.1	9525	9469	-56	-0.6
37.3	9469	9384	-85	-0.9
38.6	9385	9164	-221	-2.4
39.8	9164	9110	-54	-0.6
41.0	9111	9014	-97	-1.1
42.2	9013	9013	0	0.0
43.4	8832	8832	0	0.0
44.6	8806	8784	-22	-0.2
45.8	8630	8659	29	0.3
47.0	8616	8617	1	0.0
48.2	8558	8558	0	0.0
49.4	8471	8471	0	0.0
50.6	8431	8431	0	0.0
51.8	8387	8387	0	0.0
53.0	8311	8311	0	0.0
54.2	8185	8281	96	1.2
55.4	8183	8185	2	0.0
56.6	8175	8174	-1	0.0
57.8	8167	8167	0	0.0
59.0	8163	8158	-5	-0.1
60.2	8136	8141	5	0.1
61.4	8079	8136	57	0.7
62.7	8023	8078	55	0.7
63.9	7987	8023	36	0.5
65.1	7969	7987	18	0.2
66.3	7957	7969	12	0.2
67.5	7933	7957	24	0.3
68.7	7842	7932	90	1.1
69.9	7809	7928	119	1.5
71.1	7804	7842	38	0.5
72.3	7790	7809	19	0.2
73.5	7782	7804	22	0.3
74.7	7770	7789	19	0.2
75.9	7649	7770	121	1.6
77.1	7646	7651	5	0.1
78.3	7614	7648	34	0.4
79.5	7518	7613	95	1.3
80.7	7403	7578	175	2.4
81.9	7371	7518	147	2.0
83.1	7300	7370	70	1.0
84.3	7270	7300	30	0.4
85.5	7196	7270	74	1.0
86.7	7060	7195	135	1.9
88.0	7041	7060	19	0.3
89.2	6999	6999	0	0.0
90.4	6825	6825	0	0.0
91.6	6765	6765	0	0.0
92.8	6727	6727	0	0.0
94.0	6578	6578	0	0.0
95.2	6573	6559	-14	-0.2
96.4	6262	6261	-1	0.0
97.6	6151	6151	0	0.0
98.8	5933	5933	0	0.0
Min	5933	5933	-532	-3.8
Max	22550	22550	175	2.4
Mean	9588	9592	4	0.1
Median	8451	8451	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	82.9
1.1<=X<10.0		12.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		25.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	23988	23988	0	0.0
2.4	16174	16174	0	0.0
3.6	14957	14819	-138	-0.9
4.8	14260	14446	186	1.3
6.0	13812	13806	-6	0.0
7.2	13771	13773	2	0.0
8.4	12977	12891	-86	-0.7
9.6	12547	12368	-179	-1.4
10.8	12369	12322	-47	-0.4
12.0	12345	12258	-87	-0.7
13.3	12128	12113	-15	-0.1
14.5	12113	11917	-196	-1.6
15.7	11918	11887	-31	-0.3
16.9	11887	11792	-95	-0.8
18.1	11701	11533	-168	-1.4
19.3	11670	11530	-140	-1.2
20.5	11533	11423	-110	-1.0
21.7	11530	11349	-181	-1.6
22.9	11423	11340	-83	-0.7
24.1	11349	11277	-72	-0.6
25.3	11347	11266	-81	-0.7
26.5	11281	11207	-74	-0.7
27.7	11266	11142	-124	-1.1
28.9	11218	11069	-149	-1.3
30.1	11208	10999	-209	-1.9
31.3	11142	10990	-152	-1.4
32.5	11069	10974	-95	-0.9
33.7	10990	10868	-122	-1.1
34.9	10974	10852	-122	-1.1
36.1	10868	10829	-39	-0.4
37.3	10853	10819	-34	-0.3
38.6	10829	10794	-35	-0.3
39.8	10819	10778	-41	-0.4
41.0	10793	10741	-52	-0.5
42.2	10768	10727	-41	-0.4
43.4	10727	10687	-40	-0.4
44.6	10686	10684	-2	0.0
45.8	10684	10657	-27	-0.3
47.0	10658	10637	-21	-0.2
48.2	10637	10613	-24	-0.2
49.4	10614	10610	-4	0.0
50.6	10610	10590	-20	-0.2
51.8	10553	10524	-29	-0.3
53.0	10524	10473	-51	-0.5
54.2	10473	10469	-4	0.0
55.4	10470	10463	-7	-0.1
56.6	10463	10417	-46	-0.4
57.8	10419	10400	-19	-0.2
59.0	10400	10391	-9	-0.1
60.2	10391	10373	-18	-0.2
61.4	10365	10365	0	0.0
62.7	10353	10354	1	0.0
63.9	10307	10307	0	0.0
65.1	10212	10239	27	0.3
66.3	10208	10218	10	0.1
67.5	10203	10208	5	0.0
68.7	10115	10203	88	0.9
69.9	10075	10096	21	0.2
71.1	10022	10022	0	0.0
72.3	9978	9978	0	0.0
73.5	9961	9961	0	0.0
74.7	9954	9953	-1	0.0
75.9	9922	9917	-5	-0.1
77.1	9917	9858	-59	-0.6
78.3	9715	9719	4	0.0
79.5	9705	9715	10	0.1
80.7	9677	9705	28	0.3
81.9	9677	9677	0	0.0
83.1	9603	9677	74	0.8
84.3	9446	9603	157	1.7
85.5	9289	9289	0	0.0
86.7	9251	9251	0	0.0
88.0	9231	9230	-1	0.0
89.2	9154	9153	-1	0.0
90.4	9141	9140	-1	0.0
91.6	9038	9038	0	0.0
92.8	8988	8987	-1	0.0
94.0	8804	8804	0	0.0
95.2	8692	8692	0	0.0
96.4	8194	8194	0	0.0
97.6	7860	7860	0	0.0
98.8	7746	7746	0	0.0
Min	7746	7746	-209	-1.9
Max	23988	23988	186	1.7
Mean	10890	10856	-34	-0.3
Median	10612	10600	-12	-0.1

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	84.1
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		13.4
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	15697	15697	0	0.0
2.4	15190	15320	130	0.9
3.6	15173	15046	-127	-0.8
4.8	14802	14755	-47	-0.3
6.0	14723	14725	2	0.0
7.2	14586	14603	17	0.1
8.4	14553	14555	2	0.0
9.6	14551	14482	-69	-0.5
10.8	14481	14460	-21	-0.1
12.0	14442	14452	10	0.1
13.3	14418	14429	11	0.1
14.5	14397	14418	21	0.1
15.7	14385	14368	-17	-0.1
16.9	14370	14233	-137	-1.0
18.1	14347	14135	-212	-1.5
19.3	14249	14109	-140	-1.0
20.5	14131	14085	-46	-0.3
21.7	14126	14051	-75	-0.5
22.9	14108	14037	-71	-0.5
24.1	14085	14013	-72	-0.5
25.3	14042	13798	-244	-1.7
26.5	14015	13772	-243	-1.7
27.7	13804	13728	-76	-0.6
28.9	13781	13718	-63	-0.5
30.1	13732	13696	-36	-0.3
31.3	13702	13686	-16	-0.1
32.5	13681	13632	-49	-0.4
33.7	13642	13578	-64	-0.5
34.9	13601	13382	-219	-1.6
36.1	13353	13185	-168	-1.3
37.3	13281	13171	-110	-0.8
38.6	13187	13095	-92	-0.7
39.8	13170	13061	-109	-0.8
41.0	13095	12913	-182	-1.4
42.2	12915	12826	-89	-0.7
43.4	12848	12754	-94	-0.7
44.6	12754	12690	-64	-0.5
45.8	12709	12669	-40	-0.3
47.0	12670	12605	-65	-0.5
48.2	12414	12406	-8	-0.1
49.4	12132	12124	-8	-0.1
50.6	12126	12087	-39	-0.3
51.8	12073	12040	-33	-0.3
53.0	12066	11973	-93	-0.8
54.2	11997	11930	-67	-0.6
55.4	11951	11881	-70	-0.6
56.6	11927	11829	-98	-0.8
57.8	11881	11783	-98	-0.8
59.0	11829	11771	-58	-0.5
60.2	11783	11751	-32	-0.3
61.4	11771	11692	-79	-0.7
62.7	11701	11647	-54	-0.5
63.9	11627	11627	0	0.0
65.1	11614	11619	5	0.0
66.3	11570	11585	15	0.1
67.5	11555	11570	15	0.1
68.7	11481	11426	-55	-0.5
69.9	11426	11407	-19	-0.2
71.1	11407	11371	-36	-0.3
72.3	11371	11354	-17	-0.1
73.5	11355	11247	-108	-1.0
74.7	11247	11170	-77	-0.7
75.9	11160	11163	3	0.0
77.1	11157	11142	-15	-0.1
78.3	11151	11132	-19	-0.2
79.5	11074	11071	-3	0.0
80.7	11024	11038	14	0.1
81.9	11018	11024	6	0.1
83.1	10990	11020	30	0.3
84.3	10929	10929	0	0.0
85.5	10781	10781	0	0.0
86.7	10743	10743	0	0.0
88.0	10546	10634	88	0.8
89.2	10131	10127	-4	0.0
90.4	10127	9963	-164	-1.6
91.6	10100	9822	-278	-2.8
92.8	9964	9454	-510	-5.1
94.0	9821	9215	-606	-6.2
95.2	9477	9166	-311	-3.3
96.4	9109	9008	-101	-1.1
97.6	8526	8526	0	0.0
98.8	8248	8248	0	0.0
Min	8248	8248	-606	-6.2
Max	15697	15697	130	0.9
Mean	12453	12383	-70	-0.6
Median	12129	12106	-48	-0.4

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		14.6
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		30.0
X<=-5.0		10.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	14038	14038	0	0.0
2.4	13687	13688	1	0.0
3.6	12654	12654	0	0.0
4.8	12511	12511	0	0.0
6.0	12144	12145	1	0.0
7.2	12041	12041	0	0.0
8.4	11687	11832	145	1.2
9.6	11673	11690	17	0.1
10.8	11527	11673	146	1.3
12.0	11508	11498	-10	-0.1
13.3	11293	11293	0	0.0
14.5	11245	11265	20	0.2
15.7	10920	10921	1	0.0
16.9	10829	10818	-11	-0.1
18.1	10818	10810	-8	-0.1
19.3	10818	10788	-30	-0.3
20.5	10622	10783	161	1.5
21.7	10485	10473	-12	-0.1
22.9	10459	10459	0	0.0
24.1	10458	10346	-112	-1.1
25.3	10402	10329	-73	-0.7
26.5	10292	10293	1	0.0
27.7	10257	10252	-5	0.0
28.9	10244	10244	0	0.0
30.1	10235	10238	3	0.0
31.3	10085	10235	150	1.5
32.5	10035	9978	-57	-0.6
33.7	9965	9962	-3	0.0
34.9	9934	9935	1	0.0
36.1	9931	9930	-1	0.0
37.3	9925	9848	-77	-0.8
38.6	9909	9829	-80	-0.8
39.8	9848	9788	-60	-0.6
41.0	9829	9788	-41	-0.4
42.2	9790	9777	-13	-0.1
43.4	9789	9678	-111	-1.1
44.6	9773	9666	-107	-1.1
45.8	9679	9659	-20	-0.2
47.0	9668	9625	-43	-0.4
48.2	9626	9618	-8	-0.1
49.4	9619	9602	-17	-0.2
50.6	9592	9592	0	0.0
51.8	9590	9590	0	0.0
53.0	9520	9513	-7	-0.1
54.2	9509	9509	0	0.0
55.4	9506	9454	-52	-0.5
56.6	9459	9407	-52	-0.5
57.8	9402	9351	-51	-0.5
59.0	9377	9314	-63	-0.7
60.2	9358	9306	-52	-0.6
61.4	9314	9277	-37	-0.4
62.7	9308	9269	-39	-0.4
63.9	9299	9224	-75	-0.8
65.1	9284	9211	-73	-0.8
66.3	9269	9208	-61	-0.7
67.5	9212	9188	-24	-0.3
68.7	9208	9133	-75	-0.8
69.9	9189	9101	-88	-1.0
71.1	9184	9068	-116	-1.3
72.3	9133	9048	-85	-0.9
73.5	9063	8986	-77	-0.8
74.7	8986	8985	-1	0.0
75.9	8985	8937	-48	-0.5
77.1	8938	8937	-1	0.0
78.3	8855	8857	2	0.0
79.5	8760	8833	73	0.8
80.7	8710	8813	103	1.2
81.9	8692	8765	73	0.8
83.1	8683	8709	26	0.3
84.3	8508	8683	175	2.1
85.5	8504	8621	117	1.4
86.7	8460	8507	47	0.6
88.0	8452	8451	-1	0.0
89.2	8371	8419	48	0.6
90.4	8354	8371	17	0.2
91.6	8352	8349	-3	0.0
92.8	8154	8141	-13	-0.2
94.0	7797	7797	0	0.0
95.2	7554	7533	-21	-0.3
96.4	7202	7202	0	0.0
97.6	6841	6840	-1	0.0
98.8	6669	6674	5	0.1
Min	6669	6674	-116	-1.3
Max	14038	14038	175	2.1
Mean	9767	9758	-8	-0.1
Median	9606	9597	-3	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Red Bluff Diversion Dam - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	16458	16458	0	0.0
2.4	15798	15798	0	0.0
3.6	15566	15565	-1	0.0
4.8	15277	15277	0	0.0
6.0	15247	15247	0	0.0
7.2	15214	15215	1	0.0
8.4	15059	15059	0	0.0
9.6	14876	14876	0	0.0
10.8	14642	14642	0	0.0
12.0	13871	13868	-3	0.0
13.3	13484	13250	-234	-1.7
14.5	13262	13192	-70	-0.5
15.7	13191	13160	-31	-0.2
16.9	13061	13062	1	0.0
18.1	13046	13048	2	0.0
19.3	12764	12764	0	0.0
20.5	12661	12721	60	0.5
21.7	12581	12683	102	0.8
22.9	12424	12424	0	0.0
24.1	12393	12393	0	0.0
25.3	12305	12282	-23	-0.2
26.5	12245	12246	1	0.0
27.7	11916	11916	0	0.0
28.9	11732	11732	0	0.0
30.1	11402	11554	152	1.3
31.3	10234	10043	-191	-1.9
32.5	10041	9810	-231	-2.3
33.7	9810	9793	-17	-0.2
34.9	9797	9748	-49	-0.5
36.1	8971	8971	0	0.0
37.3	8806	8835	29	0.3
38.6	8375	8365	-10	-0.1
39.8	7968	7800	-168	-2.1
41.0	7610	7600	-10	-0.1
42.2	7175	7178	3	0.0
43.4	6767	6751	-16	-0.2
44.6	6758	6731	-27	-0.4
45.8	6629	6636	7	0.1
47.0	6383	6523	140	2.2
48.2	6302	6390	88	1.4
49.4	6211	6299	88	1.4
50.6	6183	6184	1	0.0
51.8	6169	6162	-7	-0.1
53.0	6164	6141	-23	-0.4
54.2	6144	6136	-8	-0.1
55.4	6143	6132	-11	-0.2
56.6	6026	6026	0	0.0
57.8	5947	5944	-3	-0.1
59.0	5931	5931	0	0.0
60.2	5907	5918	11	0.2
61.4	5899	5899	0	0.0
62.7	5657	5677	20	0.4
63.9	5625	5657	32	0.6
65.1	5491	5489	-2	0.0
66.3	5467	5467	0	0.0
67.5	5419	5427	8	0.1
68.7	5412	5409	-3	-0.1
69.9	5395	5395	0	0.0
71.1	5379	5344	-35	-0.7
72.3	5338	5338	0	0.0
73.5	5192	5203	11	0.2
74.7	5190	5202	12	0.2
75.9	5164	5188	24	0.5
77.1	5118	5167	49	1.0
78.3	5060	5118	58	1.1
79.5	4999	5060	61	1.2
80.7	4987	5004	17	0.3
81.9	4949	4974	25	0.5
83.1	4946	4924	-22	-0.4
84.3	4924	4912	-12	-0.2
85.5	4912	4892	-20	-0.4
86.7	4891	4889	-2	0.0
88.0	4787	4833	46	1.0
89.2	4697	4785	88	1.9
90.4	4697	4696	-1	0.0
91.6	4515	4448	-67	-1.5
92.8	4448	4434	-14	-0.3
94.0	4434	4432	-2	0.0
95.2	4432	4422	-10	-0.2
96.4	4421	4393	-28	-0.6
97.6	4390	4383	-7	-0.2
98.8	4269	4268	-1	0.0
Min	4269	4268	-234	-2.3
Max	16458	16458	152	2.2
Mean	8335	8332	-3	0.0
Median	6197	6242	0	0.0

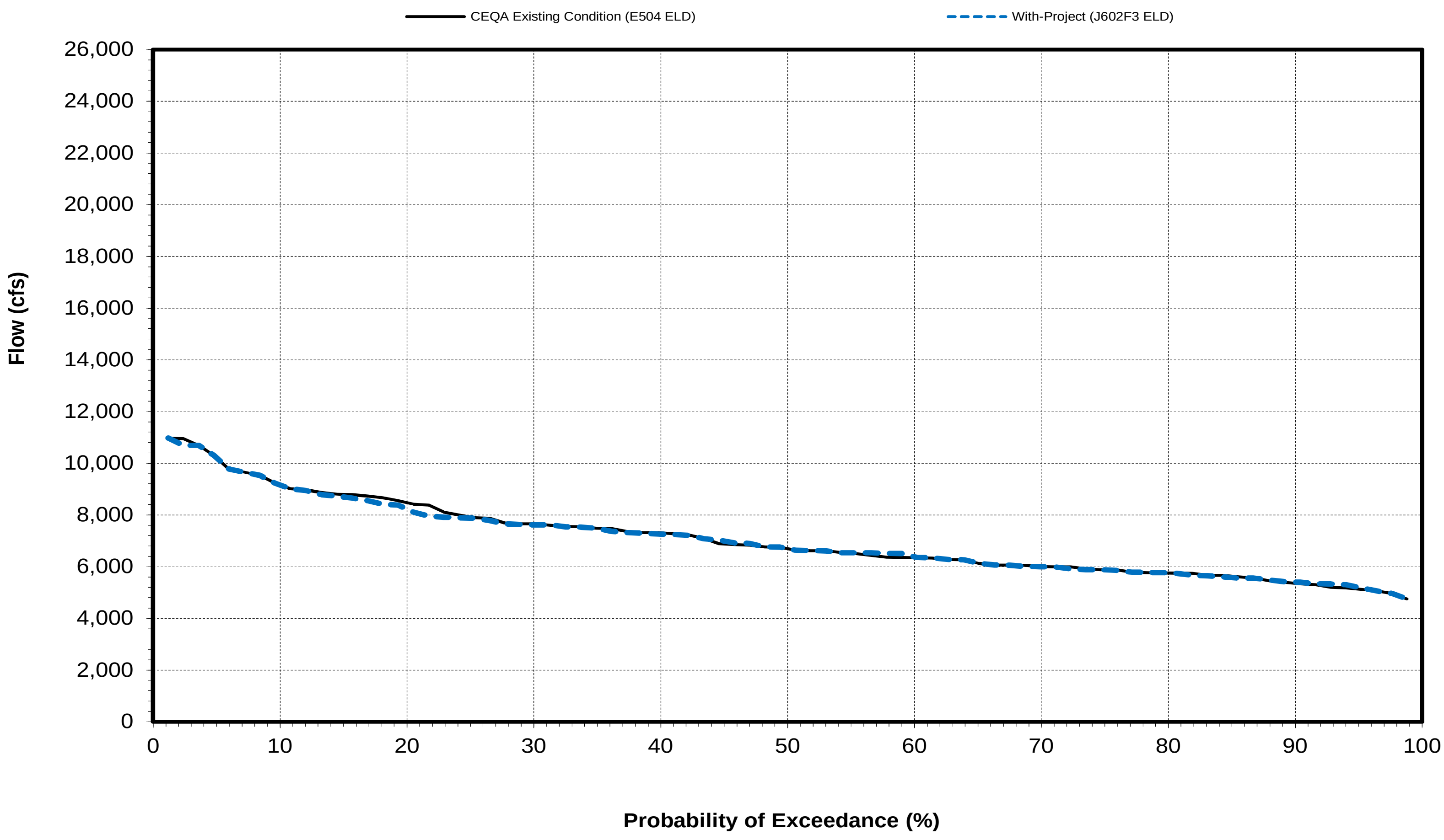
Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	85.4
1.1<=X<10.0		8.5
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

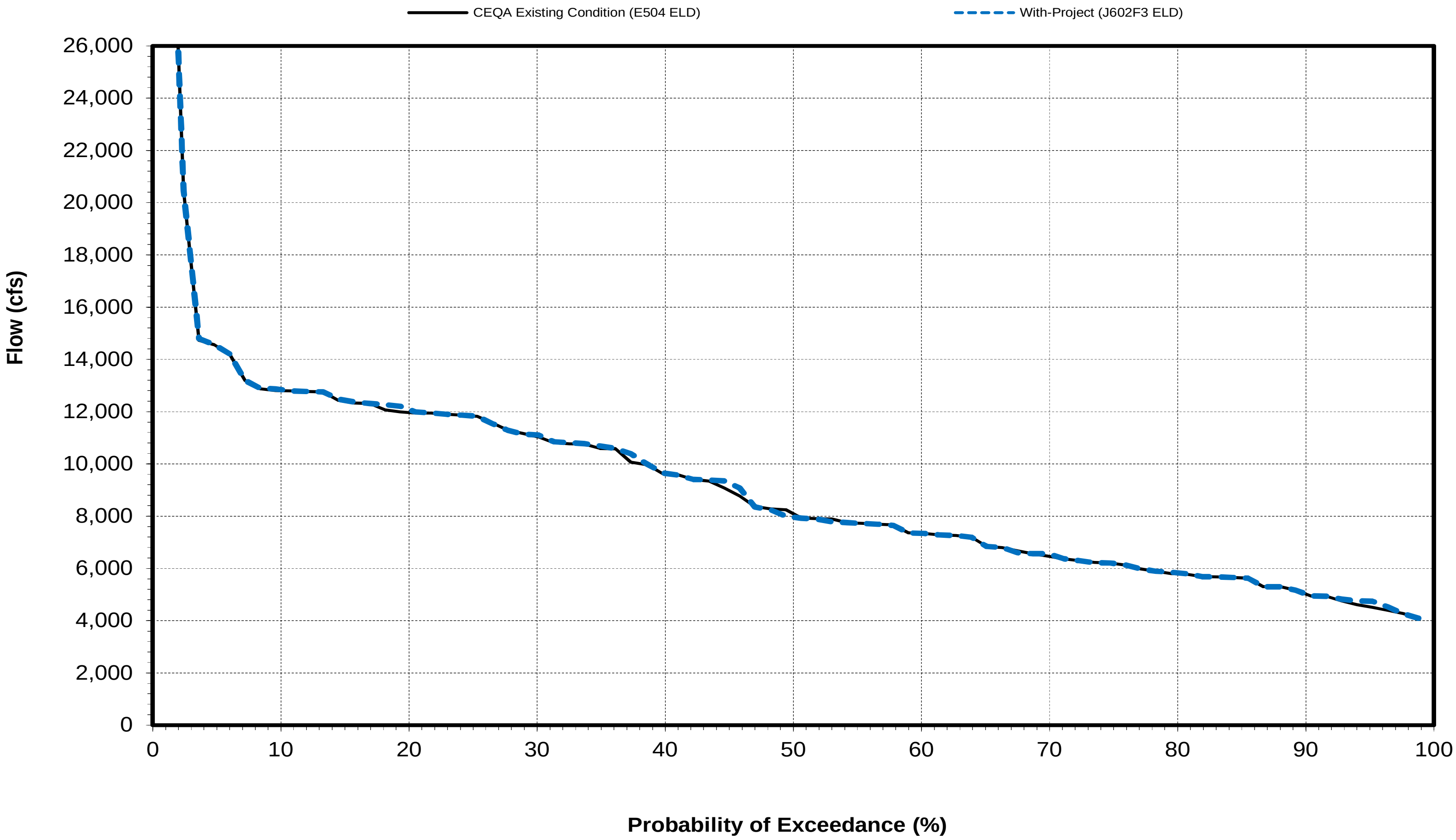
Sacramento River Flow at Red Bluff Diversion Dam **October**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Red Bluff Diversion Dam

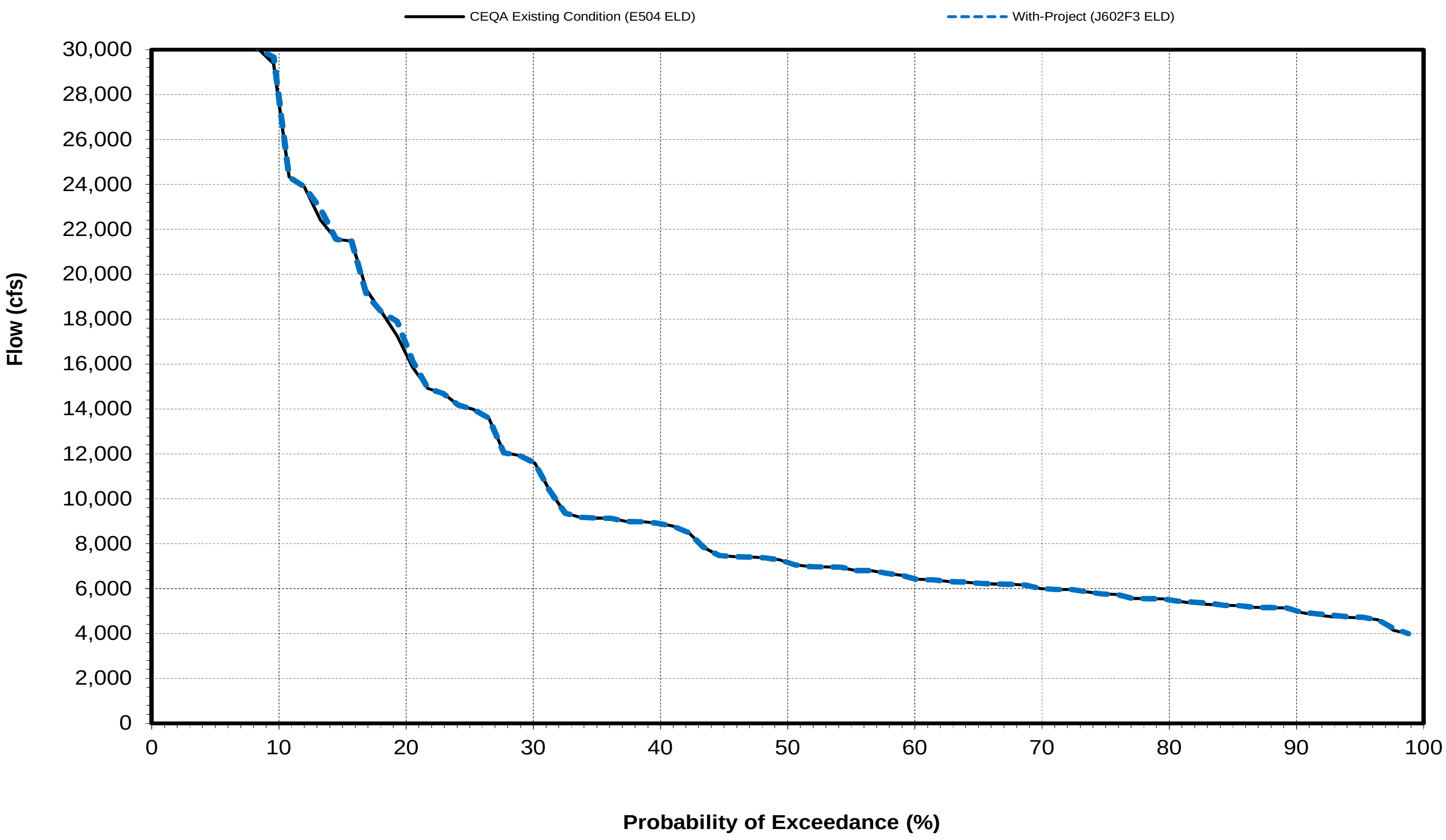
November



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Red Bluff Diversion Dam

December

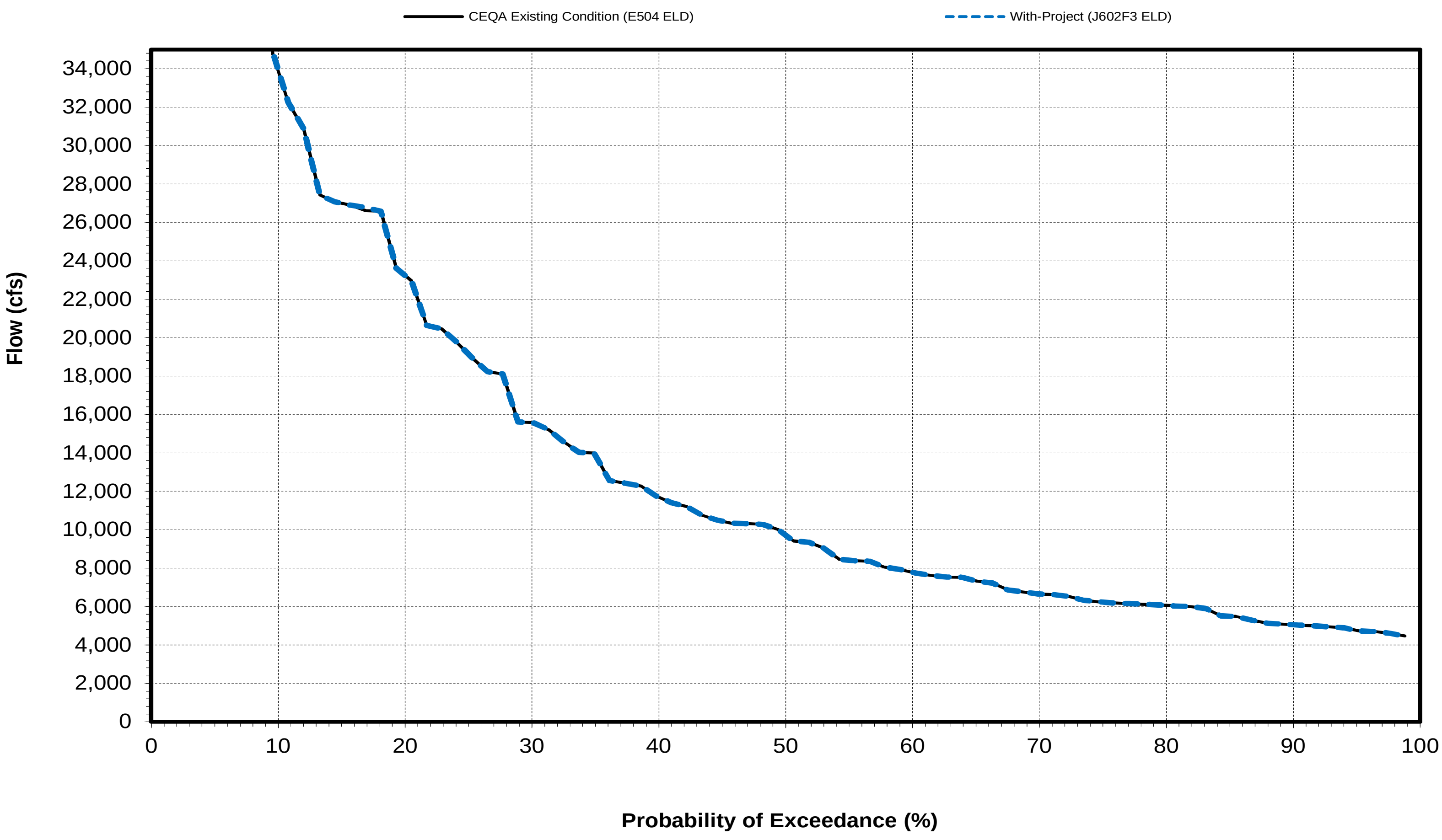


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Red Bluff Diversion Dam

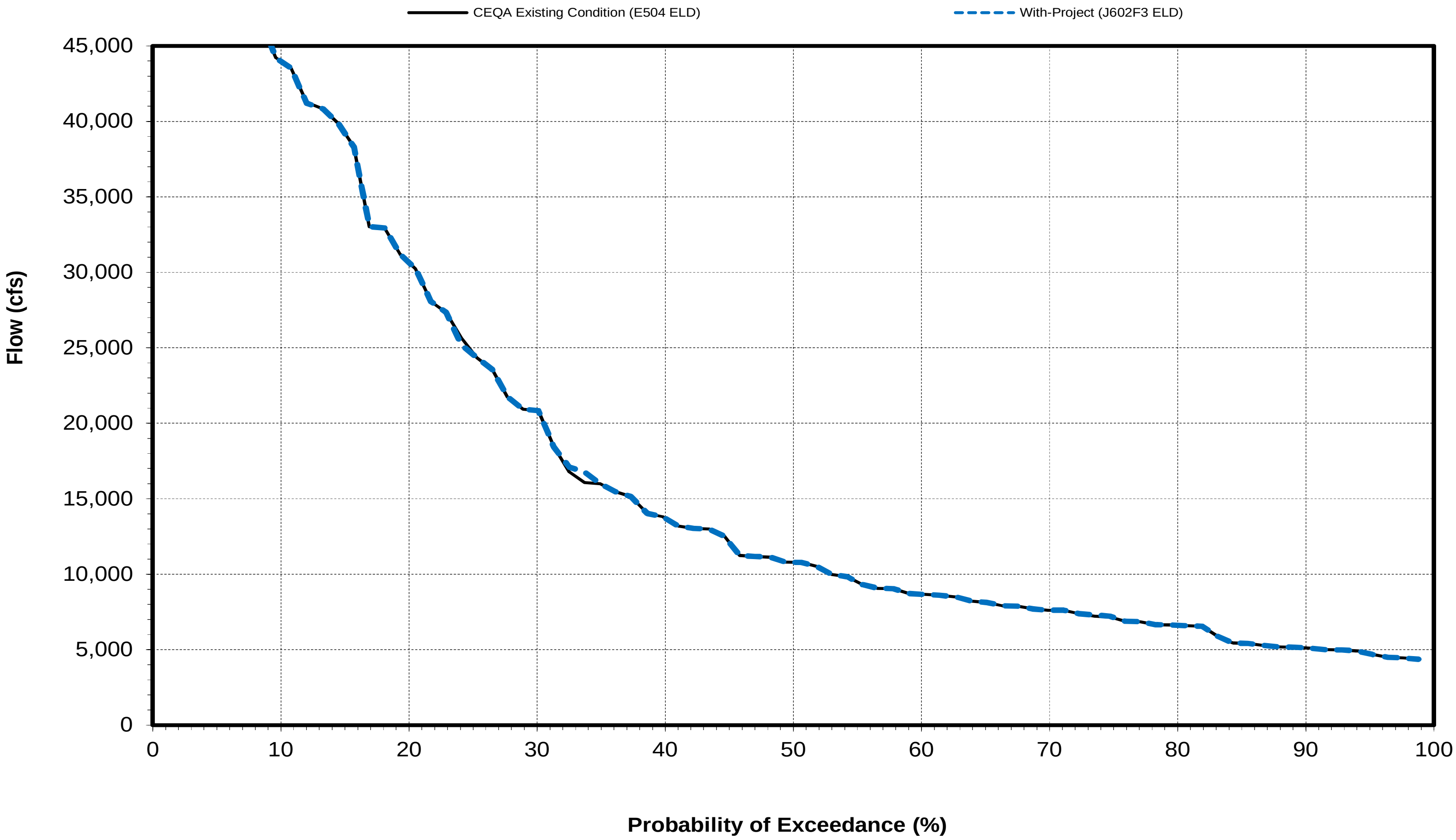
January



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

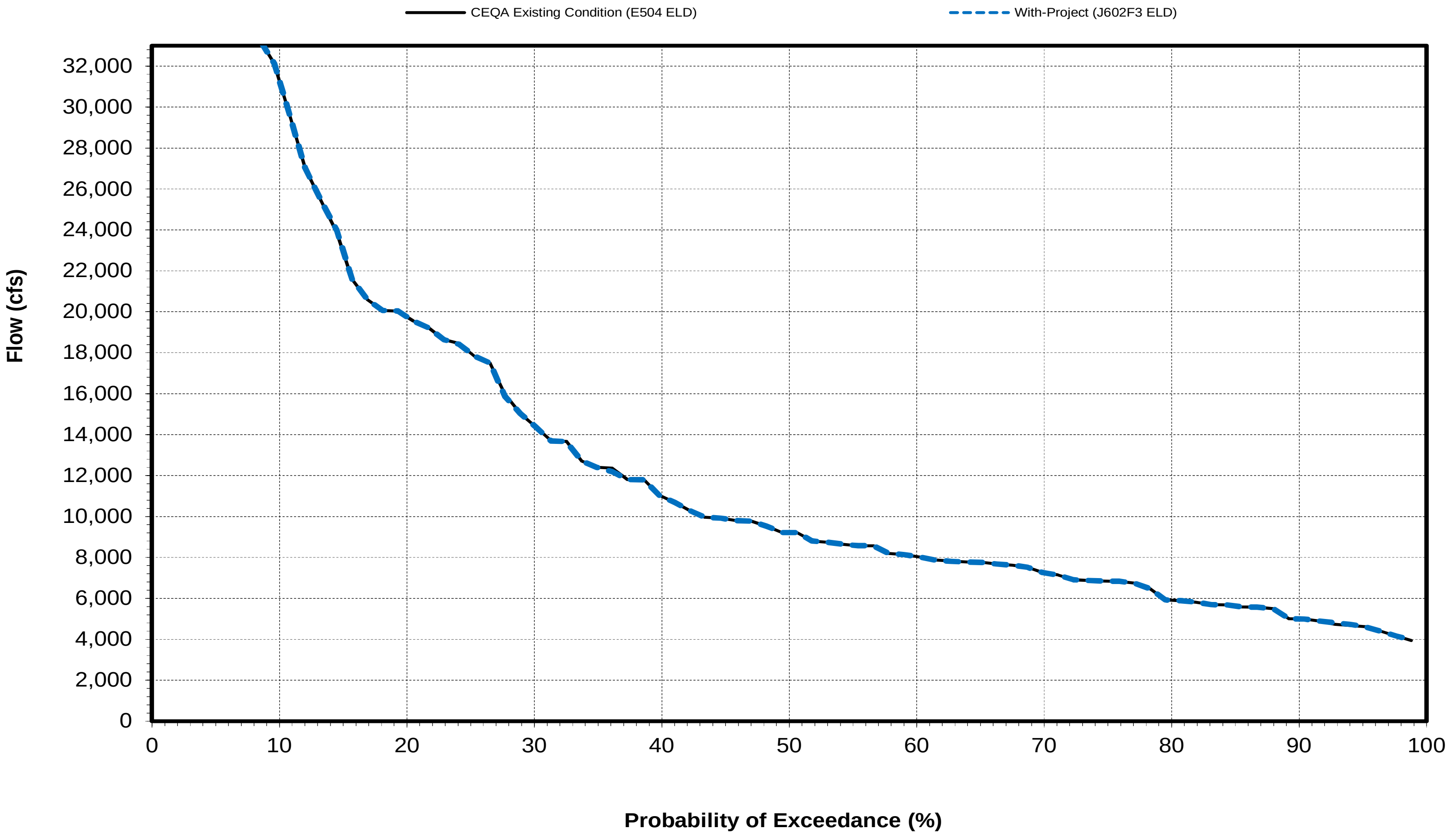
Sacramento River Flow at Red Bluff Diversion Dam **February**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Red Bluff Diversion Dam

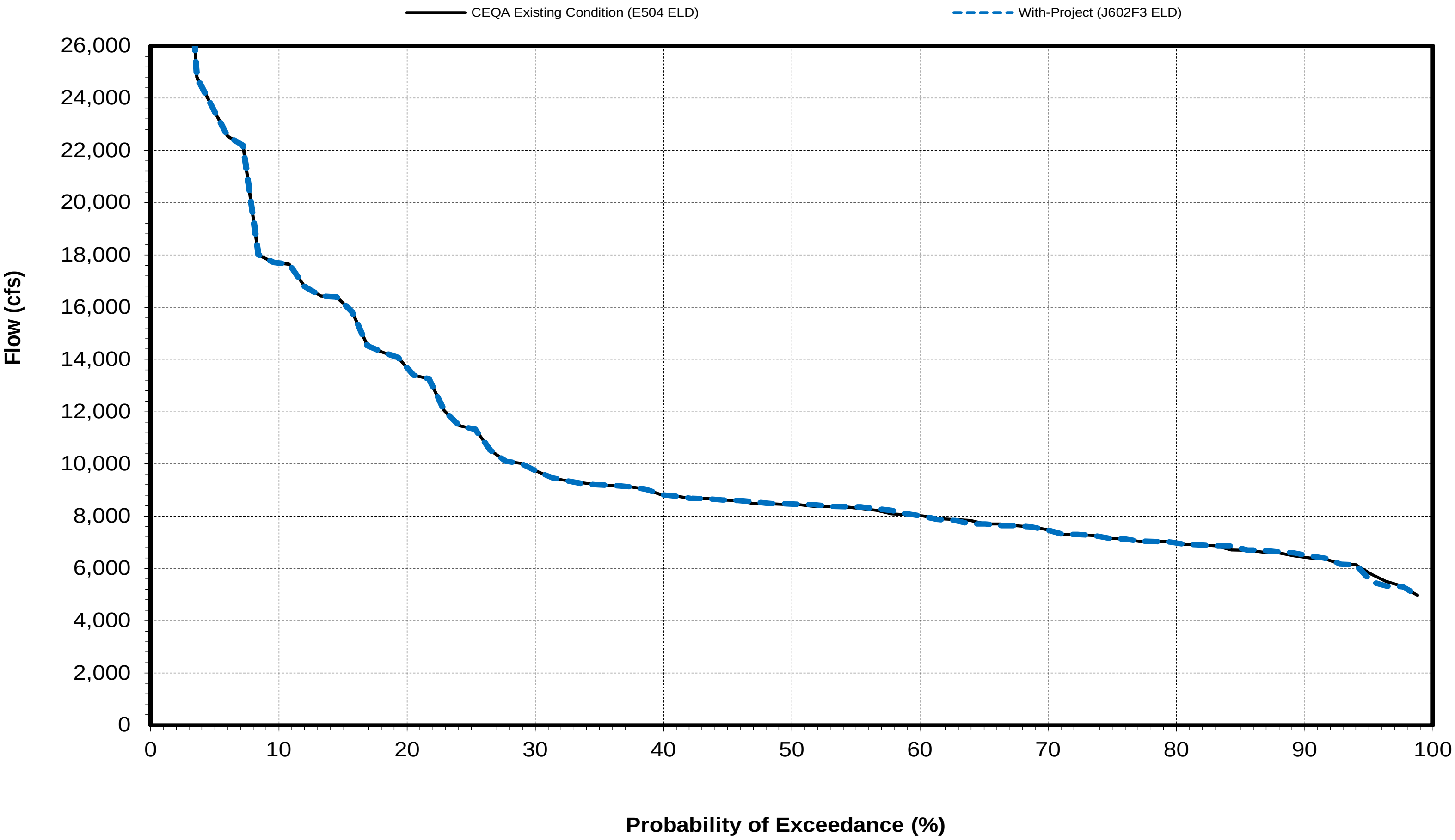
March



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Sacramento River Flow at Red Bluff Diversion Dam

April

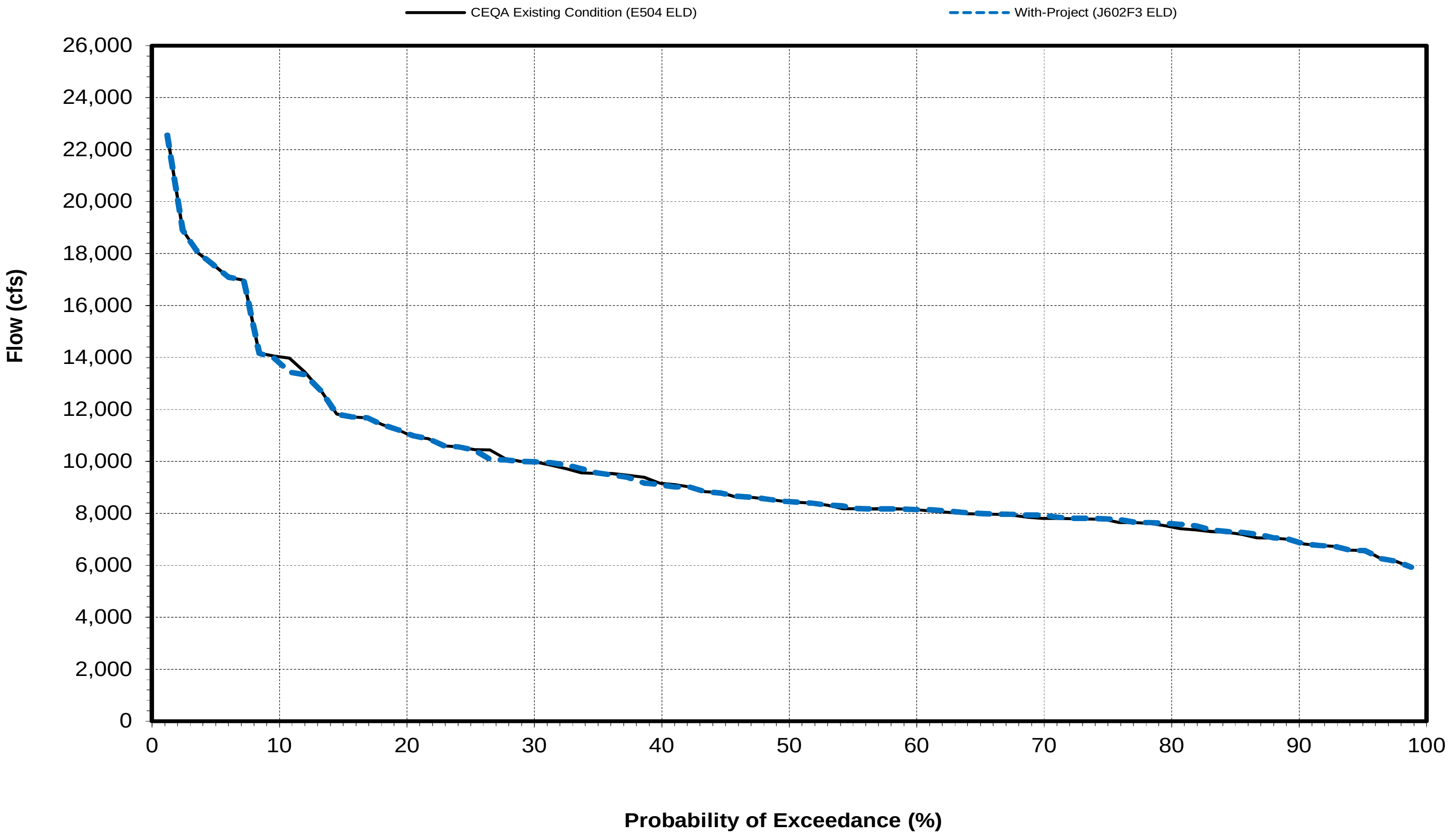


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Red Bluff Diversion Dam

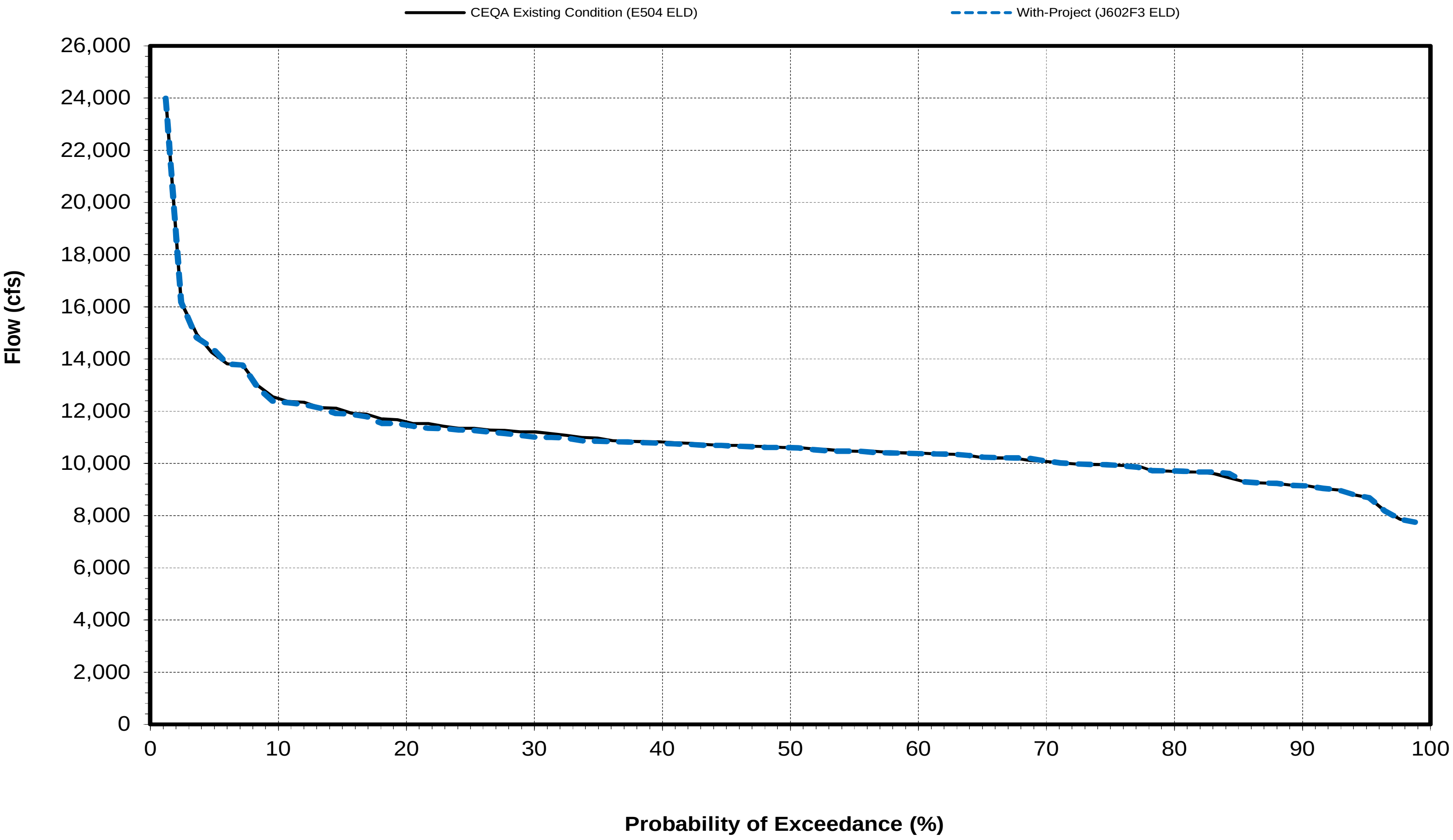
May



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

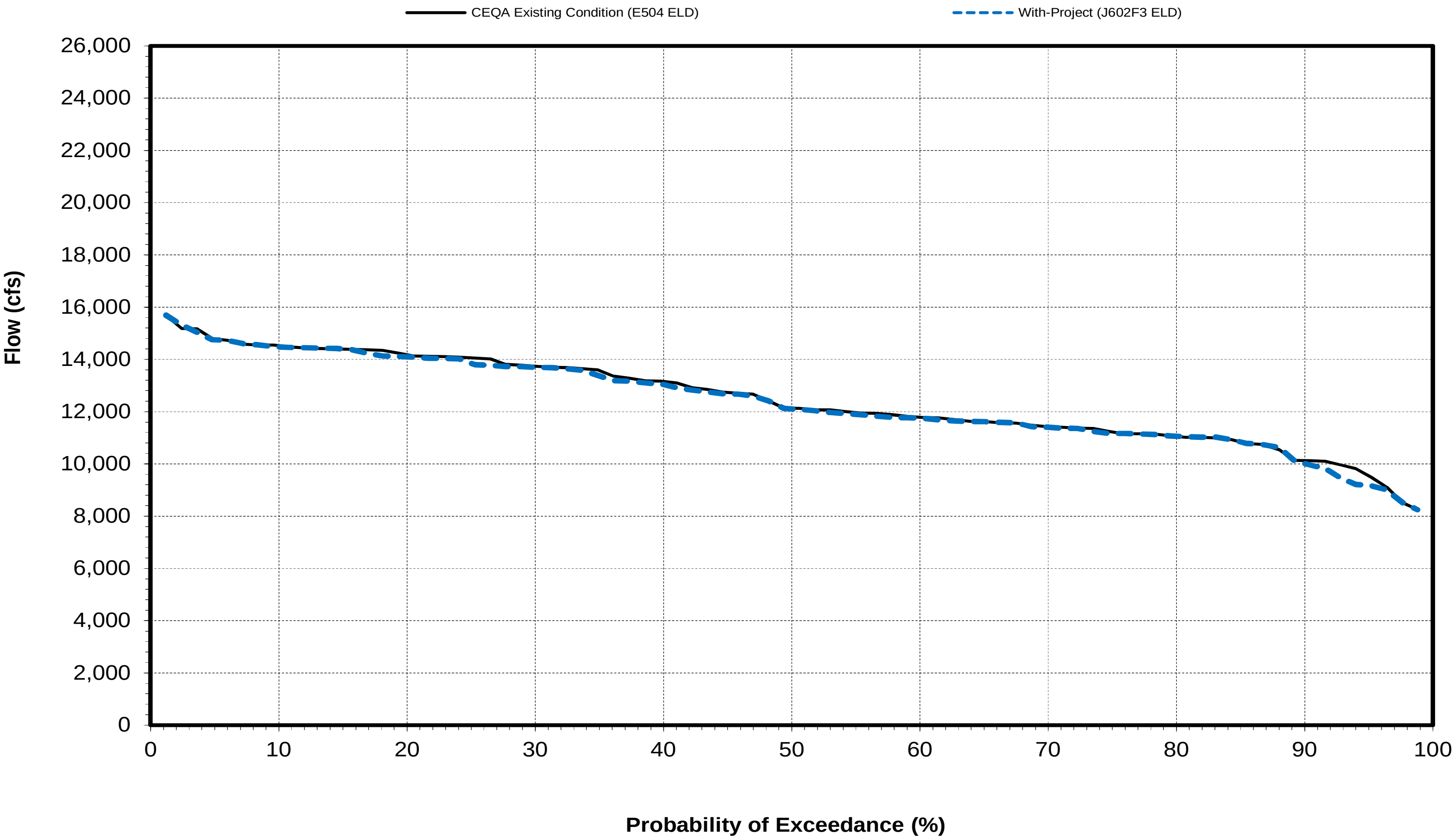
Created: 8/31/2016

Sacramento River Flow at Red Bluff Diversion Dam **June**



Sacramento River Flow at Red Bluff Diversion Dam

July

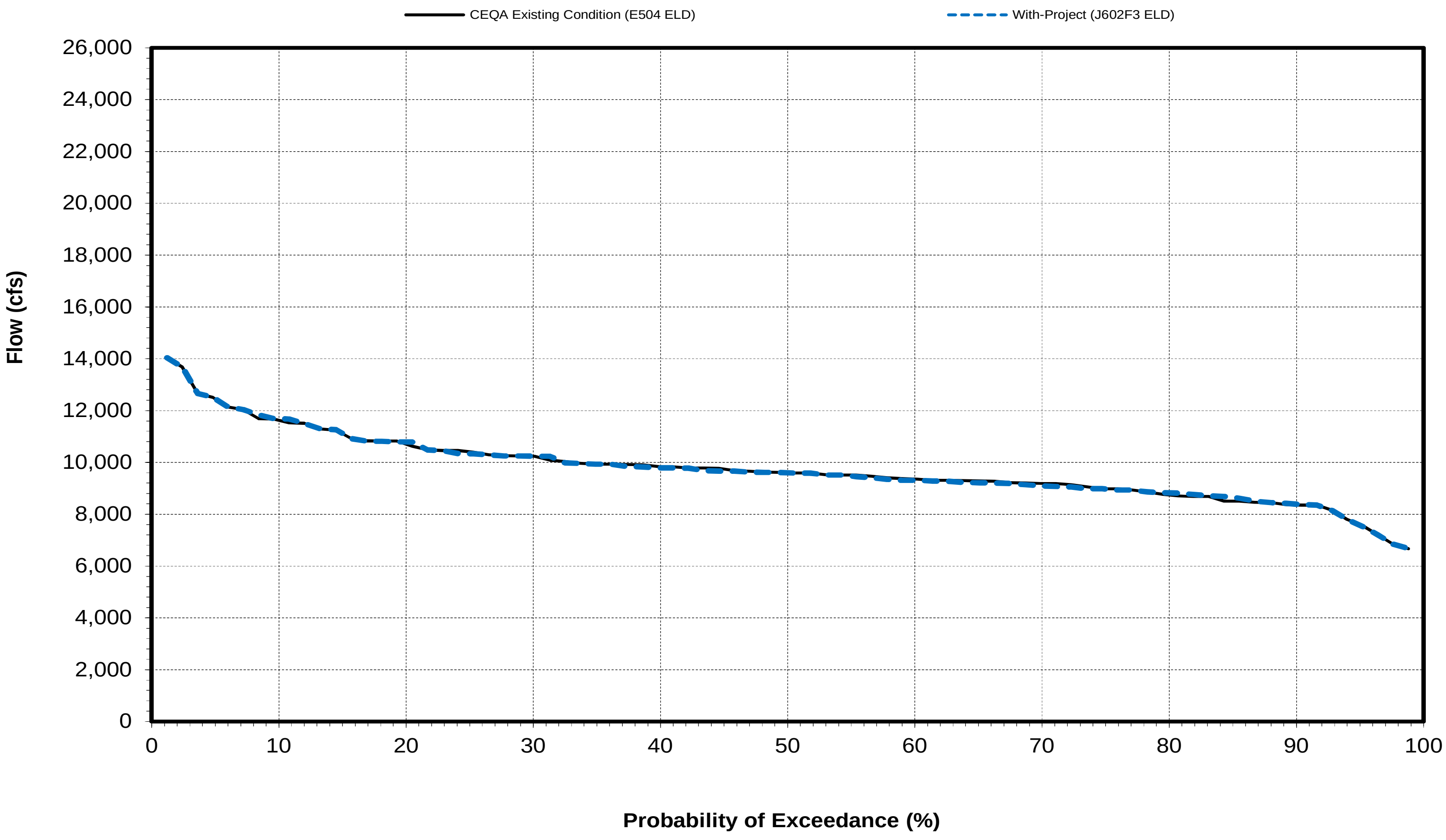


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Red Bluff Diversion Dam

August

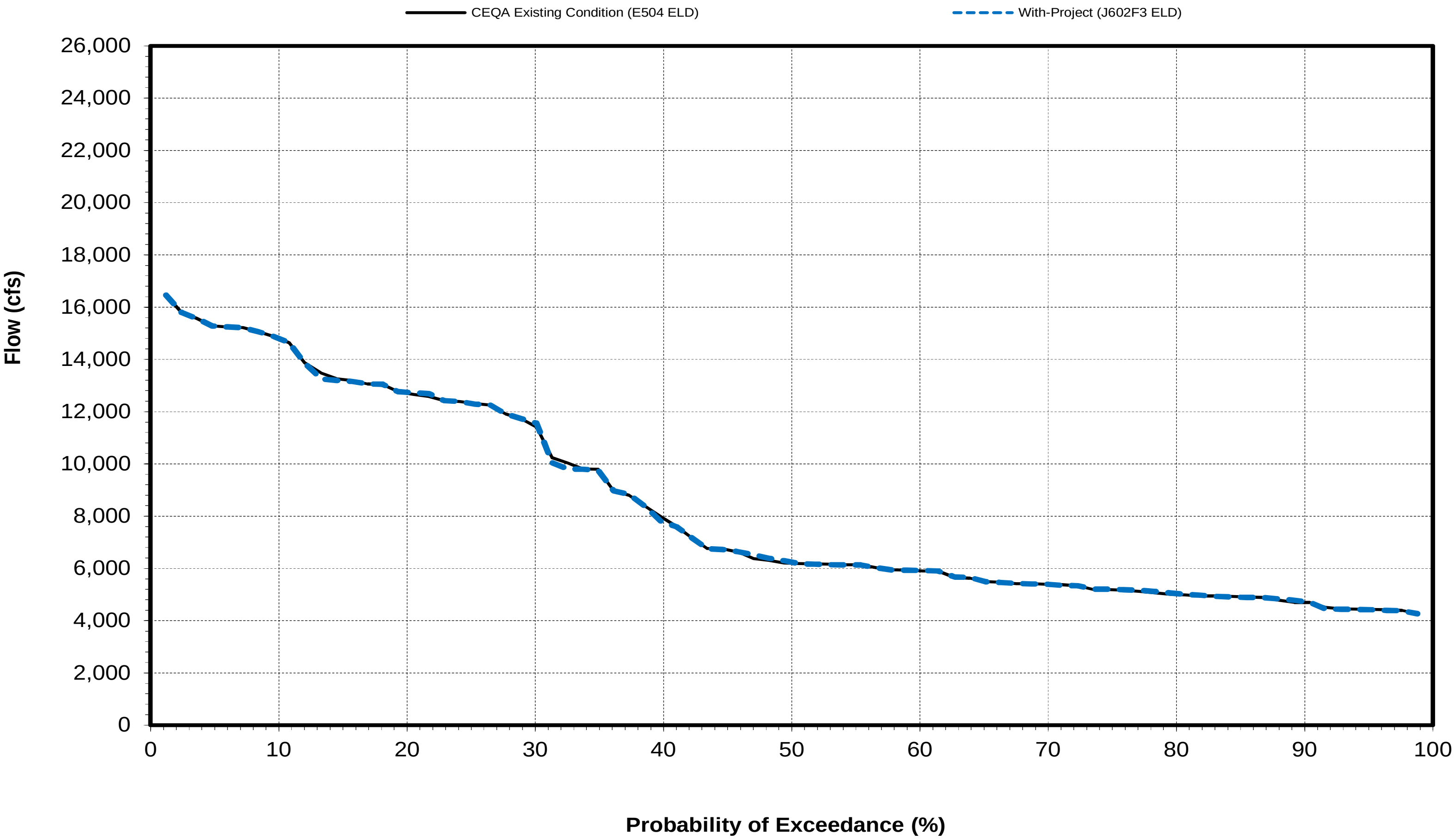


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Red Bluff Diversion Dam

September



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Long-term and Water Year Type Average Sacramento River Flow at Wilkins Slough Under CEQA Existing Condition (E504 ELD) and With-Project (J602F3 ELD Conditions

	Monthly Mean Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[2]												
CEQA Existing Condition (E504 ELD)	6,044	8,986	11,311	13,718	15,306	14,071	8,726	6,923	5,575	6,544	5,446	7,762
With-Project (J602F3 ELD)	6,020	9,012	11,318	13,719	15,312	14,068	8,728	6,926	5,541	6,475	5,441	7,758
Difference	-24	26	7	1	6	-3	2	3	-34	-69	-5	-4
Percent Difference[3]	-0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	-0.6	-1.1	-0.1	-0.1
Water Year Types[1]												
Wet												
CEQA Existing Condition (E504 ELD)	7,272	11,393	17,243	19,104	19,832	18,270	13,424	10,381	6,458	6,458	6,112	12,872
With-Project (J602F3 ELD)	7,159	11,397	17,247	19,106	19,833	18,269	13,423	10,354	6,458	6,444	6,112	12,864
Difference	-113	4	4	2	1	-1	-1	-27	0	-14	0	-8
Percent Difference[3]	-1.6	0.0	0.0	0.0	0.0	0.0	0.0	-0.3	0.0	-0.2	0.0	-0.1
Above Normal												
CEQA Existing Condition (E504 ELD)	5,536	9,281	10,990	16,453	19,081	17,550	10,168	7,472	5,733	7,088	5,288	7,682
With-Project (J602F3 ELD)	5,512	9,340	10,998	16,453	19,081	17,536	10,165	7,549	5,668	7,063	5,254	7,732
Difference	-24	59	8	0	0	-14	-3	77	-65	-25	-34	50
Percent Difference[3]	-0.4	0.6	0.1	0.0	0.0	-0.1	0.0	1.0	-1.1	-0.4	-0.6	0.7
Below Normal												
CEQA Existing Condition (E504 ELD)	5,891	8,208	8,377	12,159	14,413	11,950	7,108	5,549	5,134	6,045	4,918	5,181
With-Project (J602F3 ELD)	5,887	8,199	8,377	12,159	14,413	11,938	7,107	5,550	5,044	6,049	4,895	5,188
Difference	-4	-9	0	0	0	-12	-1	1	-90	4	-23	7
Percent Difference[3]	-0.1	-0.1	0.0	0.0	0.0	-0.1	0.0	0.0	-1.8	0.1	-0.5	0.1
Dry												
CEQA Existing Condition (E504 ELD)	5,309	7,995	8,729	8,870	11,526	11,313	5,303	4,578	5,118	6,970	4,981	4,839
With-Project (J602F3 ELD)	5,337	8,047	8,727	8,870	11,542	11,313	5,315	4,583	5,081	6,809	5,071	4,799
Difference	28	52	-2	0	16	0	12	5	-37	-161	90	-40
Percent Difference[3]	0.5	0.7	0.0	0.0	0.1	0.0	0.2	0.1	-0.7	-2.3	1.8	-0.8
Critical												
CEQA Existing Condition (E504 ELD)	5,174	5,870	6,080	8,404	8,439	8,102	4,128	4,003	4,707	6,129	5,479	4,165
With-Project (J602F3 ELD)	5,243	5,913	6,108	8,405	8,452	8,118	4,128	3,997	4,701	5,950	5,367	4,156
Difference	69	43	28	1	13	16	0	-6	-6	-179	-112	-9
Percent Difference[3]	1.3	0.7	0.5	0.0	0.2	0.2	0.0	-0.1	-0.1	-2.9	-2.0	-0.2

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

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

October

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	13808	13534	-274	-2.0
2.4	11345	11346	1	0.0
3.6	10952	10952	0	0.0
4.8	10850	10851	1	0.0
6.0	9482	9482	0	0.0
7.2	9066	9066	0	0.0
8.4	8193	8162	-31	-0.4
9.6	8086	8085	-1	0.0
10.8	7991	7744	-247	-3.1
12.0	7744	7531	-213	-2.8
13.3	7532	7528	-4	-0.1
14.5	7527	7423	-104	-1.4
15.7	7423	7412	-11	-0.1
16.9	7368	7368	0	0.0
18.1	7351	7153	-198	-2.7
19.3	7121	7074	-47	-0.7
20.5	7074	7007	-67	-0.9
21.7	6904	6903	-1	0.0
22.9	6835	6780	-55	-0.8
24.1	6780	6755	-25	-0.4
25.3	6749	6721	-28	-0.4
26.5	6721	6699	-22	-0.3
27.7	6699	6584	-115	-1.7
28.9	6584	6471	-113	-1.7
30.1	6480	6469	-11	-0.2
31.3	6472	6466	-6	-0.1
32.5	6471	6407	-64	-1.0
33.7	6454	6387	-67	-1.0
34.9	6417	6382	-35	-0.5
36.1	6384	6376	-8	-0.1
37.3	6372	6361	-11	-0.2
38.6	6346	6352	6	0.1
39.8	6305	6310	5	0.1
41.0	6273	6096	-177	-2.8
42.2	6168	6046	-122	-2.0
43.4	6066	6033	-33	-0.5
44.6	6036	6033	-3	0.0
45.8	5883	5883	0	0.0
47.0	5827	5843	16	0.3
48.2	5717	5731	14	0.2
49.4	5536	5727	191	3.5
50.6	5487	5532	45	0.8
51.8	5467	5500	33	0.6
53.0	5441	5475	34	0.6
54.2	5410	5441	31	0.6
55.4	5367	5395	28	0.5
56.6	5334	5367	33	0.6
57.8	5306	5344	38	0.7
59.0	5303	5163	-140	-2.6
60.2	5303	5152	-151	-2.8
61.4	5163	5148	-15	-0.3
62.7	5152	5113	-39	-0.8
63.9	5113	5108	-5	-0.1
65.1	5108	5083	-25	-0.5
66.3	5083	5070	-13	-0.3
67.5	5070	5053	-17	-0.3
68.7	5055	5050	-5	-0.1
69.9	5050	5037	-13	-0.3
71.1	5037	5022	-15	-0.3
72.3	5022	5013	-9	-0.2
73.5	5013	4850	-163	-3.3
74.7	4850	4792	-58	-1.2
75.9	4789	4769	-20	-0.4
77.1	4768	4692	-76	-1.6
78.3	4590	4564	-26	-0.6
79.5	4564	4544	-20	-0.4
80.7	4544	4533	-11	-0.2
81.9	4533	4520	-13	-0.3
83.1	4520	4516	-4	-0.1
84.3	4507	4507	0	0.0
85.5	4450	4450	0	0.0
86.7	4372	4374	2	0.0
88.0	4248	4239	-9	-0.2
89.2	4216	4232	16	0.4
90.4	4174	4196	22	0.5
91.6	4044	4174	130	3.2
92.8	3922	4044	122	3.1
94.0	3873	4014	141	3.6
95.2	3869	3923	54	1.4
96.4	3830	3872	42	1.1
97.6	3769	3769	0	0.0
98.8	3504	3504	0	0.0
Min	3504	3504	-274	-3.3
Max	13808	13534	191	3.6
Mean	6044	6020	-24	-0.3
Median	5512	5630	-9	-0.2

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	75.6
1.1<=X<10.0		7.3
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		17.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	70.0
1.1<=X<10.0		25.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

November

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	21611	21611	0	0.0
2.4	20031	20031	0	0.0
3.6	18500	18512	12	0.1
4.8	17616	17611	-5	0.0
6.0	15255	15261	6	0.0
7.2	14737	14711	-26	-0.2
8.4	14527	14528	1	0.0
9.6	13524	13524	0	0.0
10.8	13372	13365	-7	-0.1
12.0	13097	13111	14	0.1
13.3	13051	13080	29	0.2
14.5	13002	13051	49	0.4
15.7	12958	12991	33	0.3
16.9	12804	12958	154	1.2
18.1	12707	12706	-1	0.0
19.3	12511	12511	0	0.0
20.5	12237	12231	-6	0.0
21.7	11978	11978	0	0.0
22.9	11753	11749	-4	0.0
24.1	11525	11620	95	0.8
25.3	11430	11525	95	0.8
26.5	11093	11348	255	2.3
27.7	11069	11237	168	1.5
28.9	11052	11045	-7	-0.1
30.1	10928	11023	95	0.9
31.3	10815	10954	139	1.3
32.5	10632	10814	182	1.7
33.7	10492	10492	0	0.0
34.9	10450	10449	-1	0.0
36.1	10411	10405	-6	-0.1
37.3	10238	10256	18	0.2
38.6	10178	10238	60	0.6
39.8	10150	10151	1	0.0
41.0	10145	10131	-14	-0.1
42.2	10131	10067	-64	-0.6
43.4	9969	9951	-18	-0.2
44.6	9520	9528	8	0.1
45.8	9316	9399	83	0.9
47.0	8942	9317	375	4.2
48.2	8779	8944	165	1.9
49.4	8444	8444	0	0.0
50.6	8281	8277	-4	0.0
51.8	8002	7912	-90	-1.1
53.0	7911	7861	-50	-0.6
54.2	7880	7790	-90	-1.1
55.4	7861	7743	-118	-1.5
56.6	7628	7627	-1	0.0
57.8	7556	7548	-8	-0.1
59.0	7153	7154	1	0.0
60.2	7141	7141	0	0.0
61.4	7045	7050	5	0.1
62.7	6841	6841	0	0.0
63.9	6661	6653	-8	-0.1
65.1	6520	6521	1	0.0
66.3	6497	6491	-6	-0.1
67.5	6462	6476	14	0.2
68.7	6141	6073	-68	-1.1
69.9	5883	5885	2	0.0
71.1	5877	5877	0	0.0
72.3	5743	5743	0	0.0
73.5	5614	5719	105	1.9
74.7	5598	5649	51	0.9
75.9	5541	5543	2	0.0
77.1	5465	5470	5	0.1
78.3	5415	5400	-15	-0.3
79.5	5387	5386	-1	0.0
80.7	5119	5119	0	0.0
81.9	5102	5102	0	0.0
83.1	4921	4922	1	0.0
84.3	4742	4741	-1	0.0
85.5	4586	4586	0	0.0
86.7	4529	4529	0	0.0
88.0	4510	4510	0	0.0
89.2	4425	4425	0	0.0
90.4	4347	4349	2	0.0
91.6	4119	4311	192	4.7
92.8	4032	4106	74	1.8
94.0	4020	4070	50	1.2
95.2	3992	4032	40	1.0
96.4	3941	4020	79	2.0
97.6	3854	3948	94	2.4
98.8	3534	3534	0	0.0
Min	3534	3534	-118	-1.5
Max	21611	21611	375	4.7
Mean	8986	9012	26	0.3
Median	8363	8361	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	79.3
1.1<=X<10.0		15.9
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		4.9
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		25.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

December

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	22617	22617	0	0.0
2.4	22187	22157	-30	-0.1
3.6	21725	21729	4	0.0
4.8	21443	21443	0	0.0
6.0	21426	21430	4	0.0
7.2	21203	21203	0	0.0
8.4	21144	21161	17	0.1
9.6	21118	21104	-14	-0.1
10.8	20887	20887	0	0.0
12.0	20833	20852	19	0.1
13.3	20733	20833	100	0.5
14.5	20670	20670	0	0.0
15.7	20523	20523	0	0.0
16.9	20138	20280	142	0.7
18.1	19427	19426	-1	0.0
19.3	19225	19298	73	0.4
20.5	19054	19000	-54	-0.3
21.7	18795	18795	0	0.0
22.9	18384	18384	0	0.0
24.1	18158	18158	0	0.0
25.3	16558	16561	3	0.0
26.5	16196	16195	-1	0.0
27.7	16070	16070	0	0.0
28.9	15623	15596	-27	-0.2
30.1	15161	15152	-9	-0.1
31.3	14101	14101	0	0.0
32.5	13436	13431	-5	0.0
33.7	12918	12910	-8	-0.1
34.9	12883	12858	-25	-0.2
36.1	12823	12824	1	0.0
37.3	12648	12650	2	0.0
38.6	12047	12047	0	0.0
39.8	12042	12040	-2	0.0
41.0	11820	11820	0	0.0
42.2	11733	11733	0	0.0
43.4	11055	11056	1	0.0
44.6	10908	10908	0	0.0
45.8	9424	9424	0	0.0
47.0	9405	9405	0	0.0
48.2	9046	9028	-18	-0.2
49.4	8998	8999	1	0.0
50.6	8709	8709	0	0.0
51.8	8573	8573	0	0.0
53.0	8094	8093	-1	0.0
54.2	8013	8035	22	0.3
55.4	7956	7965	9	0.1
56.6	7777	7777	0	0.0
57.8	7755	7750	-5	-0.1
59.0	7525	7526	1	0.0
60.2	7501	7502	1	0.0
61.4	7470	7470	0	0.0
62.7	7110	7111	1	0.0
63.9	6672	6675	3	0.0
65.1	6663	6663	0	0.0
66.3	6396	6396	0	0.0
67.5	6363	6362	-1	0.0
68.7	6268	6268	0	0.0
69.9	6252	6252	0	0.0
71.1	6146	6147	1	0.0
72.3	6146	6146	0	0.0
73.5	5984	5984	0	0.0
74.7	5977	5976	-1	0.0
75.9	5894	5896	2	0.0
77.1	5773	5773	0	0.0
78.3	5748	5733	-15	-0.3
79.5	5738	5728	-10	-0.2
80.7	5728	5721	-7	-0.1
81.9	5622	5716	94	1.7
83.1	5584	5584	0	0.0
84.3	5529	5531	2	0.0
85.5	5446	5443	-3	-0.1
86.7	5314	5314	0	0.0
88.0	5269	5269	0	0.0
89.2	5078	5255	177	3.5
90.4	5042	5042	0	0.0
91.6	5010	5011	1	0.0
92.8	4711	4711	0	0.0
94.0	4616	4616	0	0.0
95.2	4586	4580	-6	-0.1
96.4	4538	4538	0	0.0
97.6	4412	4410	-2	0.0
98.8	3959	4035	76	1.9
Min	3959	4035	-54	-0.3
Max	22617	22617	177	3.5
Mean	11311	11318	6	0.1
Median	8854	8854	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	96.3
1.1<=X<10.0		3.7
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	85.0
1.1<=X<10.0		15.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

January

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	23794	23794	0	0.0
2.4	23069	23069	0	0.0
3.6	23035	23037	2	0.0
4.8	23006	23001	-5	0.0
6.0	22730	22733	3	0.0
7.2	22612	22612	0	0.0
8.4	22577	22577	0	0.0
9.6	22432	22466	34	0.2
10.8	21737	21737	0	0.0
12.0	21617	21617	0	0.0
13.3	21590	21592	2	0.0
14.5	21520	21519	-1	0.0
15.7	21425	21428	3	0.0
16.9	21330	21330	0	0.0
18.1	21237	21232	-5	0.0
19.3	21199	21199	0	0.0
20.5	21113	21113	0	0.0
21.7	21064	21064	0	0.0
22.9	20846	20838	-8	0.0
24.1	20776	20776	0	0.0
25.3	20652	20652	0	0.0
26.5	20426	20426	0	0.0
27.7	20129	20127	-2	0.0
28.9	19691	19689	-2	0.0
30.1	19252	19284	32	0.2
31.3	18839	18839	0	0.0
32.5	18368	18369	1	0.0
33.7	18246	18246	0	0.0
34.9	18205	18205	0	0.0
36.1	18002	18002	0	0.0
37.3	17839	17839	0	0.0
38.6	17762	17763	1	0.0
39.8	17001	17002	1	0.0
41.0	16363	16355	-8	0.0
42.2	15646	15640	-6	0.0
43.4	15480	15481	1	0.0
44.6	15451	15451	0	0.0
45.8	12865	12865	0	0.0
47.0	12625	12633	8	0.1
48.2	12207	12208	1	0.0
49.4	11333	11333	0	0.0
50.6	11309	11309	0	0.0
51.8	11074	11073	-1	0.0
53.0	11041	11041	0	0.0
54.2	10785	10785	0	0.0
55.4	10765	10765	0	0.0
56.6	10725	10721	-4	0.0
57.8	10654	10655	1	0.0
59.0	10257	10247	-10	-0.1
60.2	10187	10207	20	0.2
61.4	9775	9776	1	0.0
62.7	9527	9527	0	0.0
63.9	9287	9289	2	0.0
65.1	9260	9268	8	0.1
66.3	8987	8987	0	0.0
67.5	8591	8591	0	0.0
68.7	8429	8437	8	0.1
69.9	8357	8357	0	0.0
71.1	8068	8065	-3	0.0
72.3	7874	7874	0	0.0
73.5	7741	7741	0	0.0
74.7	7689	7694	5	0.1
75.9	7654	7657	3	0.0
77.1	7591	7607	16	0.2
78.3	7549	7549	0	0.0
79.5	7290	7291	1	0.0
80.7	7272	7272	0	0.0
81.9	7017	7016	-1	0.0
83.1	6882	6874	-8	-0.1
84.3	6878	6868	-10	-0.1
85.5	6850	6850	0	0.0
86.7	6845	6849	4	0.1
88.0	6228	6229	1	0.0
89.2	6224	6224	0	0.0
90.4	6027	6023	-4	-0.1
91.6	6019	6019	0	0.0
92.8	6007	6006	-1	0.0
94.0	5716	5711	-5	-0.1
95.2	5546	5546	0	0.0
96.4	5476	5476	0	0.0
97.6	5295	5295	0	0.0
98.8	5029	5029	0	0.0
Min	5029	5029	-10	-0.1
Max	23794	23794	34	0.2
Mean	13718	13719	1	0.0
Median	11321	11321	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	100.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

February

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	24347	24347	0	0.0
2.4	24271	24267	-4	0.0
3.6	23759	23762	3	0.0
4.8	23244	23244	0	0.0
6.0	23025	23035	10	0.0
7.2	22992	23025	33	0.1
8.4	22879	22880	1	0.0
9.6	22638	22637	-1	0.0
10.8	22463	22463	0	0.0
12.0	22400	22400	0	0.0
13.3	22264	22264	0	0.0
14.5	22199	22198	-1	0.0
15.7	22087	22086	-1	0.0
16.9	21521	21520	-1	0.0
18.1	21503	21504	1	0.0
19.3	21415	21409	-6	0.0
20.5	21376	21372	-4	0.0
21.7	21349	21349	0	0.0
22.9	21288	21284	-4	0.0
24.1	21241	21241	0	0.0
25.3	21201	21198	-3	0.0
26.5	20900	20900	0	0.0
27.7	20825	20826	1	0.0
28.9	20764	20764	0	0.0
30.1	20734	20734	0	0.0
31.3	20698	20698	0	0.0
32.5	20579	20579	0	0.0
33.7	20444	20444	0	0.0
34.9	20141	20141	0	0.0
36.1	20088	20088	0	0.0
37.3	19828	20081	253	1.3
38.6	19742	19742	0	0.0
39.8	19741	19741	0	0.0
41.0	19715	19715	0	0.0
42.2	19356	19357	1	0.0
43.4	19037	19037	0	0.0
44.6	18431	18431	0	0.0
45.8	18043	18044	1	0.0
47.0	17672	17672	0	0.0
48.2	17358	17359	1	0.0
49.4	17097	17098	1	0.0
50.6	16189	16189	0	0.0
51.8	15974	15974	0	0.0
53.0	15338	15339	1	0.0
54.2	13921	13922	1	0.0
55.4	13882	13882	0	0.0
56.6	13765	13765	0	0.0
57.8	13500	13520	20	0.1
59.0	13469	13469	0	0.0
60.2	12630	12632	2	0.0
61.4	12558	12558	0	0.0
62.7	12425	12425	0	0.0
63.9	11712	11715	3	0.0
65.1	11513	11521	8	0.1
66.3	11477	11478	1	0.0
67.5	11344	11346	2	0.0
68.7	11237	11238	1	0.0
69.9	10979	10983	4	0.0
71.1	10811	10810	-1	0.0
72.3	10219	10222	3	0.0
73.5	9996	9996	0	0.0
74.7	9284	9284	0	0.0
75.9	8763	8881	118	1.3
77.1	8745	8764	19	0.2
78.3	8185	8184	-1	0.0
79.5	7787	7788	1	0.0
80.7	7574	7574	0	0.0
81.9	7568	7568	0	0.0
83.1	7281	7281	0	0.0
84.3	7177	7177	0	0.0
85.5	6807	6807	0	0.0
86.7	6732	6730	-2	0.0
88.0	6477	6477	0	0.0
89.2	6434	6439	5	0.1
90.4	6398	6396	-2	0.0
91.6	6065	6074	9	0.1
92.8	5988	5988	0	0.0
94.0	5432	5432	0	0.0
95.2	5015	5016	1	0.0
96.4	4937	4937	0	0.0
97.6	4757	4758	1	0.0
98.8	4117	4117	0	0.0
Min	4117	4117	-6	0.0
Max	24347	24347	253	1.3
Mean	15306	15312	6	0.0
Median	16643	16644	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	97.6
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	95.0
1.1<=X<10.0		5.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

March

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	24109	24110	1	0.0
2.4	23714	23714	0	0.0
3.6	23228	23228	0	0.0
4.8	22668	22668	0	0.0
6.0	22240	22240	0	0.0
7.2	21949	21949	0	0.0
8.4	21862	21862	0	0.0
9.6	21554	21555	1	0.0
10.8	21548	21548	0	0.0
12.0	21328	21325	-3	0.0
13.3	21310	21310	0	0.0
14.5	20993	20993	0	0.0
15.7	20725	20725	0	0.0
16.9	20664	20667	3	0.0
18.1	20596	20596	0	0.0
19.3	20282	20282	0	0.0
20.5	20210	20210	0	0.0
21.7	20055	20079	24	0.1
22.9	20050	20039	-11	-0.1
24.1	19634	19635	1	0.0
25.3	19606	19606	0	0.0
26.5	19540	19541	1	0.0
27.7	19455	19456	1	0.0
28.9	19340	19340	0	0.0
30.1	18512	18513	1	0.0
31.3	18022	18022	0	0.0
32.5	17784	17757	-27	-0.2
33.7	17690	17690	0	0.0
34.9	17631	17462	-169	-1.0
36.1	17088	17088	0	0.0
37.3	17002	17002	0	0.0
38.6	16647	16630	-17	-0.1
39.8	15882	15882	0	0.0
41.0	15875	15871	-4	0.0
42.2	15828	15832	4	0.0
43.4	15585	15567	-18	-0.1
44.6	15560	15560	0	0.0
45.8	15500	15495	-5	0.0
47.0	14934	14934	0	0.0
48.2	14597	14597	0	0.0
49.4	14573	14569	-4	0.0
50.6	13885	13750	-135	-1.0
51.8	13552	13556	4	0.0
53.0	13506	13506	0	0.0
54.2	12995	12995	0	0.0
55.4	12634	12634	0	0.0
56.6	12579	12580	1	0.0
57.8	12523	12524	1	0.0
59.0	11839	11839	0	0.0
60.2	11301	11301	0	0.0
61.4	11130	11128	-2	0.0
62.7	10218	10218	0	0.0
63.9	10132	10132	0	0.0
65.1	9959	9959	0	0.0
66.3	9838	9838	0	0.0
67.5	9666	9666	0	0.0
68.7	9627	9627	0	0.0
69.9	9586	9586	0	0.0
71.1	9438	9438	0	0.0
72.3	9379	9381	2	0.0
73.5	9379	9379	0	0.0
74.7	8917	8907	-10	-0.1
75.9	8856	8847	-9	-0.1
77.1	8813	8814	1	0.0
78.3	8744	8744	0	0.0
79.5	8701	8700	-1	0.0
80.7	8051	8050	-1	0.0
81.9	7887	7887	0	0.0
83.1	7755	7757	2	0.0
84.3	7530	7531	1	0.0
85.5	7519	7521	2	0.0
86.7	7278	7278	0	0.0
88.0	6571	6571	0	0.0
89.2	6158	6153	-5	-0.1
90.4	5701	5701	0	0.0
91.6	5622	5622	0	0.0
92.8	5617	5619	2	0.0
94.0	5570	5570	0	0.0
95.2	5477	5477	0	0.0
96.4	5239	5341	102	1.9
97.6	5217	5244	27	0.5
98.8	4039	4083	44	1.1
Min	4039	4083	-169	-1.0
Max	24109	24110	102	1.9
Mean	14071	14068	-2	0.0
Median	14229	14160	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	97.6
1.1<=X<10.0		2.4
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		10.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

April

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	21503	21503	0	0.0
2.4	21100	21100	0	0.0
3.6	20909	20909	0	0.0
4.8	20456	20456	0	0.0
6.0	20286	20287	1	0.0
7.2	18947	18946	-1	0.0
8.4	18785	18785	0	0.0
9.6	18680	18681	1	0.0
10.8	18592	18592	0	0.0
12.0	17944	17945	1	0.0
13.3	17711	17710	-1	0.0
14.5	17629	17629	0	0.0
15.7	17457	17447	-10	-0.1
16.9	17395	17397	2	0.0
18.1	17203	17203	0	0.0
19.3	16914	16914	0	0.0
20.5	16306	16305	-1	0.0
21.7	15000	15000	0	0.0
22.9	14080	14080	0	0.0
24.1	13338	13338	0	0.0
25.3	13267	13258	-9	-0.1
26.5	12907	12908	1	0.0
27.7	10959	10955	-4	0.0
28.9	9493	9467	-26	-0.3
30.1	9150	9151	1	0.0
31.3	8858	8859	1	0.0
32.5	8748	8748	0	0.0
33.7	8548	8540	-8	-0.1
34.9	7837	7838	1	0.0
36.1	7739	7738	-1	0.0
37.3	6542	6542	0	0.0
38.6	6506	6504	-2	0.0
39.8	6494	6492	-2	0.0
41.0	6271	6271	0	0.0
42.2	6076	6077	1	0.0
43.4	5930	5922	-8	-0.1
44.6	5804	5790	-14	-0.2
45.8	5545	5545	0	0.0
47.0	5528	5528	0	0.0
48.2	5515	5515	0	0.0
49.4	5482	5482	0	0.0
50.6	5459	5459	0	0.0
51.8	5439	5439	0	0.0
53.0	5427	5427	0	0.0
54.2	5420	5420	0	0.0
55.4	5368	5368	0	0.0
56.6	5340	5351	11	0.2
57.8	5333	5340	7	0.1
59.0	5308	5308	0	0.0
60.2	5283	5283	0	0.0
61.4	5276	5276	0	0.0
62.7	5244	5244	0	0.0
63.9	5232	5232	0	0.0
65.1	5195	5195	0	0.0
66.3	5164	5163	-1	0.0
67.5	5161	5161	0	0.0
68.7	5146	5146	0	0.0
69.9	5140	5140	0	0.0
71.1	5109	5109	0	0.0
72.3	5082	5082	0	0.0
73.5	5039	5039	0	0.0
74.7	4998	4997	-1	0.0
75.9	4896	4896	0	0.0
77.1	4851	4833	-18	-0.4
78.3	4759	4764	5	0.1
79.5	4585	4585	0	0.0
80.7	4579	4578	-1	0.0
81.9	4565	4367	-198	-4.3
83.1	4367	4358	-9	-0.2
84.3	4358	4356	-2	0.0
85.5	4220	4300	80	1.9
86.7	4134	4220	86	2.1
88.0	3879	4134	255	6.6
89.2	3856	3879	23	0.6
90.4	3792	3792	0	0.0
91.6	3712	3712	0	0.0
92.8	3635	3635	0	0.0
94.0	3633	3633	0	0.0
95.2	3586	3586	0	0.0
96.4	3581	3581	0	0.0
97.6	3535	3535	0	0.0
98.8	3394	3394	0	0.0
Min	3394	3394	-198	-4.3
Max	21503	21503	255	6.6
Mean	8726	8728	2	0.1
Median	5471	5471	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	95.1
1.1<=X<10.0		3.7
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		1.2
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		15.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		5.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

May

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD)	With-Project (J602F3 ELD)	Absolute Difference (cfs)	Relative Difference (%)
	Monthly Mean Flow (cfs)	Monthly Mean Flow (cfs)		
1.2	19520	19519	-1	0.0
2.4	18692	18692	0	0.0
3.6	18577	18577	0	0.0
4.8	17681	17682	1	0.0
6.0	17165	17165	0	0.0
7.2	16783	16783	0	0.0
8.4	15447	15447	0	0.0
9.6	15258	15265	7	0.0
10.8	13002	13003	1	0.0
12.0	12564	12563	-1	0.0
13.3	12169	11801	-368	-3.0
14.5	11801	11480	-321	-2.7
15.7	11480	11453	-27	-0.2
16.9	11240	11239	-1	0.0
18.1	10267	10268	1	0.0
19.3	9111	9111	0	0.0
20.5	8974	8972	-2	0.0
21.7	8604	8604	0	0.0
22.9	8347	8422	75	0.9
24.1	7995	8390	395	4.9
25.3	7787	7788	1	0.0
26.5	7610	7613	3	0.0
27.7	7267	7268	1	0.0
28.9	7150	7128	-22	-0.3
30.1	6653	6653	0	0.0
31.3	6012	5847	-165	-2.7
32.5	5846	5768	-78	-1.3
33.7	5804	5625	-179	-3.1
34.9	5487	5481	-6	-0.1
36.1	5453	5453	0	0.0
37.3	5450	5450	0	0.0
38.6	5432	5432	0	0.0
39.8	5385	5385	0	0.0
41.0	5315	5315	0	0.0
42.2	5254	5272	18	0.3
43.4	5228	5254	26	0.5
44.6	5215	5228	13	0.2
45.8	5196	5196	0	0.0
47.0	5186	5186	0	0.0
48.2	5176	5176	0	0.0
49.4	5171	5171	0	0.0
50.6	5167	5167	0	0.0
51.8	5130	5130	0	0.0
53.0	5129	5129	0	0.0
54.2	5108	5108	0	0.0
55.4	5104	5101	-3	-0.1
56.6	5101	5093	-8	-0.2
57.8	5090	5090	0	0.0
59.0	5077	5077	0	0.0
60.2	5050	5050	0	0.0
61.4	4956	4956	0	0.0
62.7	4941	4941	0	0.0
63.9	4799	4921	122	2.5
65.1	4772	4799	27	0.6
66.3	4733	4733	0	0.0
67.5	4665	4715	50	1.1
68.7	4657	4665	8	0.2
69.9	4611	4657	46	1.0
71.1	4593	4611	18	0.4
72.3	4570	4593	23	0.5
73.5	4559	4570	11	0.2
74.7	4421	4559	138	3.1
75.9	4362	4362	0	0.0
77.1	4324	4324	0	0.0
78.3	4290	4290	0	0.0
79.5	4181	4278	97	2.3
80.7	4168	4168	0	0.0
81.9	4163	4163	0	0.0
83.1	4145	4145	0	0.0
84.3	4128	4143	15	0.4
85.5	4098	4128	30	0.7
86.7	3792	4098	306	8.1
88.0	3778	3792	14	0.4
89.2	3707	3707	0	0.0
90.4	3683	3683	0	0.0
91.6	3659	3659	0	0.0
92.8	3604	3604	0	0.0
94.0	3583	3583	0	0.0
95.2	3569	3569	0	0.0
96.4	3561	3567	6	0.2
97.6	3522	3522	0	0.0
98.8	3377	3377	0	0.0
Min	3377	3377	-368	-3.1
Max	19520	19519	395	8.1
Mean	6923	6926	3	0.2
Median	5169	5169	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	86.6
1.1<=X<10.0		7.3
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		6.1
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	90.0
1.1<=X<10.0		10.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

June

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	18896	18896	0	0.0
2.4	15275	15276	1	0.0
3.6	10713	10667	-46	-0.4
4.8	8445	8441	-4	0.0
6.0	8167	8168	1	0.0
7.2	7794	7657	-137	-1.8
8.4	7600	7601	1	0.0
9.6	7313	7515	202	2.8
10.8	7312	7313	1	0.0
12.0	7058	7059	1	0.0
13.3	6417	6419	2	0.0
14.5	6347	6341	-6	-0.1
15.7	6341	6312	-29	-0.5
16.9	6313	6053	-260	-4.1
18.1	6069	5987	-82	-1.4
19.3	5801	5729	-72	-1.2
20.5	5731	5577	-154	-2.7
21.7	5617	5507	-110	-2.0
22.9	5577	5502	-75	-1.3
24.1	5522	5441	-81	-1.5
25.3	5507	5424	-83	-1.5
26.5	5502	5409	-93	-1.7
27.7	5441	5342	-99	-1.8
28.9	5424	5332	-92	-1.7
30.1	5409	5316	-93	-1.7
31.3	5342	5307	-35	-0.7
32.5	5332	5302	-30	-0.6
33.7	5316	5281	-35	-0.7
34.9	5307	5268	-39	-0.7
36.1	5302	5265	-37	-0.7
37.3	5268	5247	-21	-0.4
38.6	5265	5236	-29	-0.6
39.8	5247	5235	-12	-0.2
41.0	5236	5214	-22	-0.4
42.2	5235	5206	-29	-0.6
43.4	5214	5204	-10	-0.2
44.6	5206	5196	-10	-0.2
45.8	5204	5186	-18	-0.3
47.0	5196	5179	-17	-0.3
48.2	5186	5173	-13	-0.3
49.4	5185	5159	-26	-0.5
50.6	5173	5155	-18	-0.3
51.8	5159	5145	-14	-0.3
53.0	5155	5145	-10	-0.2
54.2	5145	5144	-1	0.0
55.4	5145	5132	-13	-0.3
56.6	5144	5132	-12	-0.2
57.8	5132	5131	-1	0.0
59.0	5132	5128	-4	-0.1
60.2	5131	5124	-7	-0.1
61.4	5128	5110	-18	-0.4
62.7	5124	5098	-26	-0.5
63.9	5110	5092	-18	-0.4
65.1	5098	5082	-16	-0.3
66.3	5092	5073	-19	-0.4
67.5	5082	5072	-10	-0.2
68.7	5073	4793	-280	-5.5
69.9	5056	4782	-274	-5.4
71.1	4917	4777	-140	-2.8
72.3	4793	4751	-42	-0.9
73.5	4782	4742	-40	-0.8
74.7	4777	4703	-74	-1.5
75.9	4751	4657	-94	-2.0
77.1	4697	4636	-61	-1.3
78.3	4657	4626	-31	-0.7
79.5	4626	4593	-33	-0.7
80.7	4591	4591	0	0.0
81.9	4369	4379	10	0.2
83.1	4278	4245	-33	-0.8
84.3	4245	4238	-7	-0.2
85.5	4240	4141	-99	-2.3
86.7	4238	4095	-143	-3.4
88.0	4141	4085	-56	-1.4
89.2	3768	4073	305	8.1
90.4	3661	3768	107	2.9
91.6	3606	3661	55	1.5
92.8	3598	3606	8	0.2
94.0	3585	3598	13	0.4
95.2	3579	3579	0	0.0
96.4	3535	3535	0	0.0
97.6	3524	3524	0	0.0
98.8	3507	3507	0	0.0
Min	3507	3507	-280	-5.5
Max	18896	18896	305	8.1
Mean	5575	5541	-34	-0.6
Median	5179	5157	-19	-0.4

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	68.3
1.1<=X<10.0		4.9
X>=5.0		1.2
X>=10.0		0.0
-10.0<X<=-1.1		26.8
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	60.0
1.1<=X<10.0		15.0
X>=5.0		5.0
X>=10.0		0.0
-10.0<X<=-1.1		25.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

July

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	10737	10737	0	0.0
2.4	10508	10508	0	0.0
3.6	9470	9420	-50	-0.5
4.8	8779	8744	-35	-0.4
6.0	8742	8654	-88	-1.0
7.2	8601	8652	51	0.6
8.4	8523	8645	122	1.4
9.6	8517	8532	15	0.2
10.8	8436	8431	-5	-0.1
12.0	8388	8368	-20	-0.2
13.3	8310	8344	34	0.4
14.5	8304	8308	4	0.0
15.7	8290	8196	-94	-1.1
16.9	8248	8178	-70	-0.8
18.1	8186	8152	-34	-0.4
19.3	8150	7843	-307	-3.8
20.5	8117	7809	-308	-3.8
21.7	7918	7795	-123	-1.6
22.9	7862	7786	-76	-1.0
24.1	7809	7710	-99	-1.3
25.3	7792	7707	-85	-1.1
26.5	7763	7584	-179	-2.3
27.7	7618	7544	-74	-1.0
28.9	7568	7532	-36	-0.5
30.1	7552	7445	-107	-1.4
31.3	7539	7424	-115	-1.5
32.5	7527	7396	-131	-1.7
33.7	7450	7384	-66	-0.9
34.9	7395	7276	-119	-1.6
36.1	7384	7209	-175	-2.4
37.3	7259	7165	-94	-1.3
38.6	7217	7117	-100	-1.4
39.8	7173	7114	-59	-0.8
41.0	7115	6972	-143	-2.0
42.2	6994	6935	-59	-0.8
43.4	6759	6759	0	0.0
44.6	6723	6723	0	0.0
45.8	6671	6672	1	0.0
47.0	6660	6660	0	0.0
48.2	6645	6645	0	0.0
49.4	6566	6567	1	0.0
50.6	6501	6493	-8	-0.1
51.8	6421	6419	-2	0.0
53.0	6402	6394	-8	-0.1
54.2	6348	6198	-150	-2.4
55.4	6042	5990	-52	-0.9
56.6	5987	5878	-109	-1.8
57.8	5809	5777	-32	-0.6
59.0	5742	5719	-23	-0.4
60.2	5719	5682	-37	-0.6
61.4	5705	5667	-38	-0.7
62.7	5555	5575	20	0.4
63.9	5537	5492	-45	-0.8
65.1	5434	5434	0	0.0
66.3	5388	5391	3	0.1
67.5	5381	5356	-25	-0.5
68.7	5366	5263	-103	-1.9
69.9	5183	5181	-2	0.0
71.1	5180	5172	-8	-0.2
72.3	5172	5148	-24	-0.5
73.5	5171	5142	-29	-0.6
74.7	5149	5129	-20	-0.4
75.9	5142	5129	-13	-0.3
77.1	5129	5111	-18	-0.4
78.3	5129	5107	-22	-0.4
79.5	5111	5104	-7	-0.1
80.7	5107	5102	-5	-0.1
81.9	5104	5089	-15	-0.3
83.1	5102	5080	-22	-0.4
84.3	5089	4932	-157	-3.1
85.5	5080	4891	-189	-3.7
86.7	4935	4885	-50	-1.0
88.0	4885	4795	-90	-1.8
89.2	4843	4594	-249	-5.1
90.4	4836	4564	-272	-5.6
91.6	4793	4455	-338	-7.1
92.8	4572	4113	-459	-10.0
94.0	4367	4092	-275	-6.3
95.2	4075	4052	-23	-0.6
96.4	4008	3872	-136	-3.4
97.6	3541	3541	0	0.0
98.8	3308	3308	0	0.0
Min	3308	3308	-459	-10.0
Max	10737	10737	122	1.4
Mean	6544	6475	-69	-1.2
Median	6534	6530	-36	-0.6

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	65.9
1.1<=X<10.0		1.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		31.7
X<=-5.0		6.1
X<=-10.0		1.2
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-1.2**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	55.0
1.1<=X<10.0		0.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		40.0
X<=-5.0		25.0
X<=-10.0		5.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**-5.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

August

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	10548	10548	0	0.0
2.4	9078	9078	0	0.0
3.6	8737	8737	0	0.0
4.8	8367	8367	0	0.0
6.0	8239	8239	0	0.0
7.2	7925	7868	-57	-0.7
8.4	7309	7328	19	0.3
9.6	7300	7285	-15	-0.2
10.8	7187	7281	94	1.3
12.0	7161	7187	26	0.4
13.3	7135	7160	25	0.4
14.5	6956	7137	181	2.6
15.7	6859	6859	0	0.0
16.9	6730	6831	101	1.5
18.1	6686	6687	1	0.0
19.3	6553	6338	-215	-3.3
20.5	6366	6201	-165	-2.6
21.7	6355	6183	-172	-2.7
22.9	6200	6152	-48	-0.8
24.1	6151	5961	-190	-3.1
25.3	6006	5696	-310	-5.2
26.5	5980	5683	-297	-5.0
27.7	5709	5675	-34	-0.6
28.9	5695	5672	-23	-0.4
30.1	5574	5525	-49	-0.9
31.3	5542	5496	-46	-0.8
32.5	5505	5495	-10	-0.2
33.7	5430	5430	0	0.0
34.9	5308	5304	-4	-0.1
36.1	5286	5286	0	0.0
37.3	5129	5129	0	0.0
38.6	5122	5122	0	0.0
39.8	5088	5120	32	0.6
41.0	5087	5087	0	0.0
42.2	5082	5083	1	0.0
43.4	5070	5070	0	0.0
44.6	5066	5066	0	0.0
45.8	5062	5062	0	0.0
47.0	5061	5061	0	0.0
48.2	5055	5055	0	0.0
49.4	5054	5054	0	0.0
50.6	5033	5033	0	0.0
51.8	5030	5030	0	0.0
53.0	5029	5029	0	0.0
54.2	5029	5029	0	0.0
55.4	5029	5029	0	0.0
56.6	5024	5024	0	0.0
57.8	5023	5023	0	0.0
59.0	5019	5019	0	0.0
60.2	5018	5018	0	0.0
61.4	5017	5017	0	0.0
62.7	5016	5016	0	0.0
63.9	5012	5012	0	0.0
65.1	5012	5012	0	0.0
66.3	5012	5012	0	0.0
67.5	5011	5011	0	0.0
68.7	5010	5010	0	0.0
69.9	5008	5008	0	0.0
71.1	4974	4908	-66	-1.3
72.3	4897	4841	-56	-1.1
73.5	4855	4789	-66	-1.4
74.7	4640	4640	0	0.0
75.9	4636	4636	0	0.0
77.1	4626	4626	0	0.0
78.3	4555	4602	47	1.0
79.5	4533	4555	22	0.5
80.7	4528	4542	14	0.3
81.9	4510	4533	23	0.5
83.1	4510	4510	0	0.0
84.3	4214	4510	296	7.0
85.5	4102	4175	73	1.8
86.7	4052	4038	-14	-0.3
88.0	4038	4017	-21	-0.5
89.2	4017	4013	-4	-0.1
90.4	4013	4009	-4	-0.1
91.6	4009	4009	0	0.0
92.8	3952	3982	30	0.8
94.0	3682	3951	269	7.3
95.2	3645	3662	17	0.5
96.4	3517	3645	128	3.6
97.6	3509	3517	8	0.2
98.8	3505	3505	0	0.0
Min	3505	3505	-310	-5.2
Max	10548	10548	296	7.3
Mean	5446	5441	-6	0.0
Median	5044	5044	0	0.0

Entire 82-Year Simulation Period

(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	80.5
1.1<=X<10.0		8.5
X>=5.0		2.4
X>=10.0		0.0
-10.0<X<=-1.1		11.0
X<=-5.0		2.4
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	80.0
1.1<=X<10.0		20.0
X>=5.0		10.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough - Probability of Exceedance

September

Percent Exceedance Probability (%)	CEQA Existing Condition (E504 ELD) Monthly Mean Flow (cfs)	With-Project (J602F3 ELD) Monthly Mean Flow (cfs)	Absolute Difference (cfs)	Relative Difference (%)
1.2	15000	15000	0	0.0
2.4	15000	15000	0	0.0
3.6	15000	15000	0	0.0
4.8	15000	15000	0	0.0
6.0	15000	15000	0	0.0
7.2	15000	15000	0	0.0
8.4	15000	15000	0	0.0
9.6	14154	14154	0	0.0
10.8	13414	13414	0	0.0
12.0	13226	13226	0	0.0
13.3	13169	13169	0	0.0
14.5	12794	12791	-3	0.0
15.7	12737	12738	1	0.0
16.9	12673	12626	-47	-0.4
18.1	12637	12406	-231	-1.8
19.3	12406	12348	-58	-0.5
20.5	12203	12263	60	0.5
21.7	12201	12259	58	0.5
22.9	12175	12204	29	0.2
24.1	12160	12175	15	0.1
25.3	11858	11858	0	0.0
26.5	11825	11825	0	0.0
27.7	11735	11735	0	0.0
28.9	11728	11703	-25	-0.2
30.1	10932	10934	2	0.0
31.3	10066	10214	148	1.5
32.5	10021	10020	-1	0.0
33.7	9886	9886	0	0.0
34.9	9643	9176	-467	-4.8
36.1	7945	7935	-10	-0.1
37.3	7876	7902	26	0.3
38.6	7483	7321	-162	-2.2
39.8	7288	7288	0	0.0
41.0	6955	6943	-12	-0.2
42.2	6617	6618	1	0.0
43.4	6546	6539	-7	-0.1
44.6	6471	6475	4	0.1
45.8	6209	6174	-35	-0.6
47.0	6191	6160	-31	-0.5
48.2	5797	6083	286	4.9
49.4	5640	5647	7	0.1
50.6	5373	5637	264	4.9
51.8	5369	5374	5	0.1
53.0	5330	5374	44	0.8
54.2	5303	5333	30	0.6
55.4	5295	5332	37	0.7
56.6	5233	5307	74	1.4
57.8	5185	5241	56	1.1
59.0	5168	5179	11	0.2
60.2	5148	5143	-5	-0.1
61.4	5143	5080	-63	-1.2
62.7	5096	5066	-30	-0.6
63.9	5071	5064	-7	-0.1
65.1	5066	5051	-15	-0.3
66.3	5064	5035	-29	-0.6
67.5	5051	5029	-22	-0.4
68.7	5031	5025	-6	-0.1
69.9	5025	4779	-246	-4.9
71.1	5019	4666	-353	-7.0
72.3	4666	4596	-70	-1.5
73.5	4596	4575	-21	-0.5
74.7	4554	4554	0	0.0
75.9	4539	4539	0	0.0
77.1	4526	4526	0	0.0
78.3	4517	4517	0	0.0
79.5	4513	4513	0	0.0
80.7	4337	4329	-8	-0.2
81.9	4200	4199	-1	0.0
83.1	4075	4167	92	2.3
84.3	4061	4061	0	0.0
85.5	4023	4039	16	0.4
86.7	4016	4023	7	0.2
88.0	4007	4019	12	0.3
89.2	4006	4007	1	0.0
90.4	3854	4006	152	3.9
91.6	3800	3865	65	1.7
92.8	3746	3796	50	1.3
94.0	3713	3747	34	0.9
95.2	3668	3668	0	0.0
96.4	3539	3591	52	1.5
97.6	3505	3505	0	0.0
98.8	3360	3360	0	0.0
Min	3360	3360	-467	-7.0
Max	15000	15000	286	4.9
Mean	7762	7758	-4	0.0
Median	5507	5642	0	0.0

Entire 82-Year Simulation Period

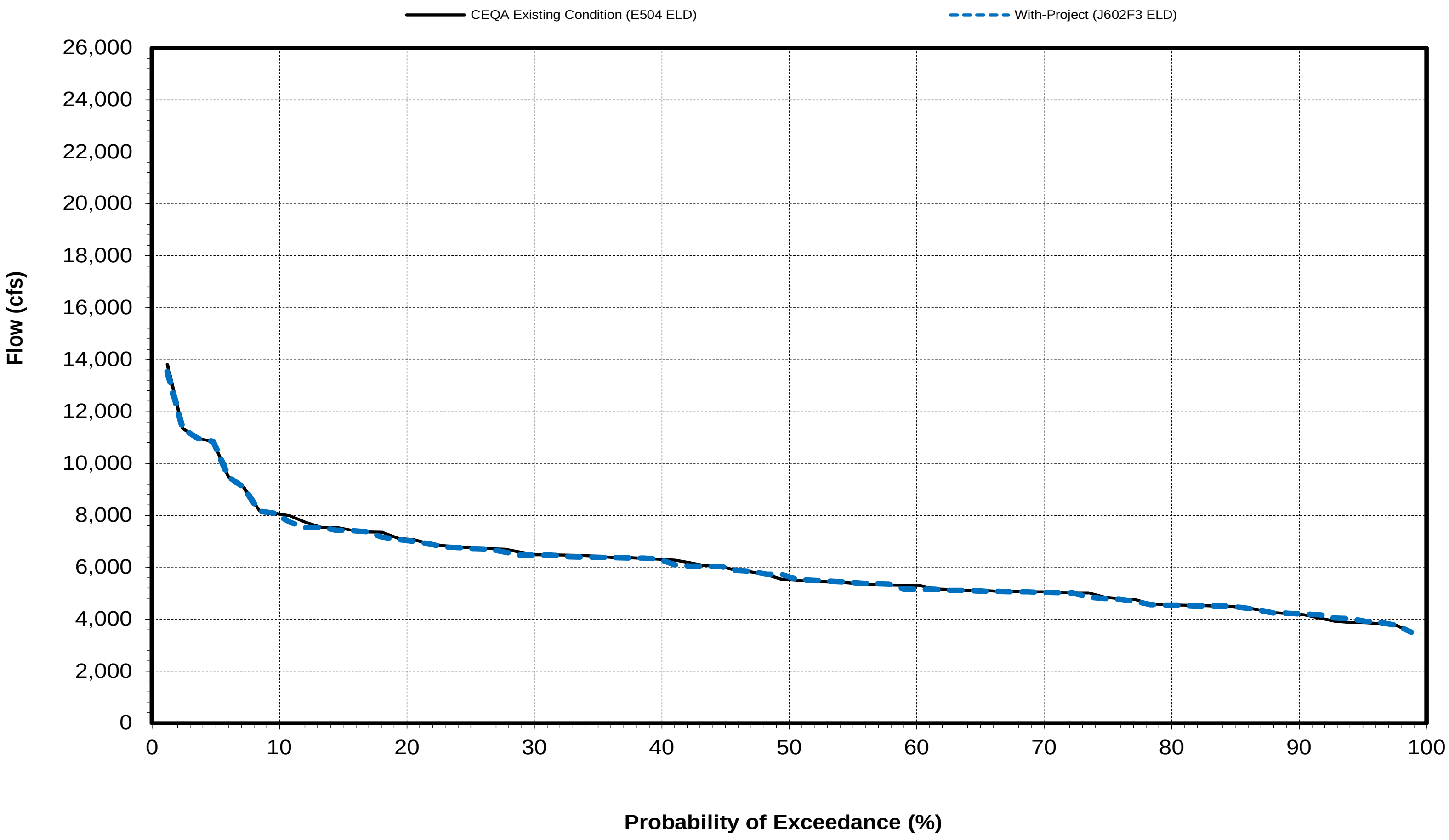
(-1.1<X<1.1)	Percent of Time (Percentage of the 82 Years)	79.3
1.1<=X<10.0		12.2
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		8.5
X<=-5.0		1.2
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Low Flow Conditions (Upper 25% of Distribution)

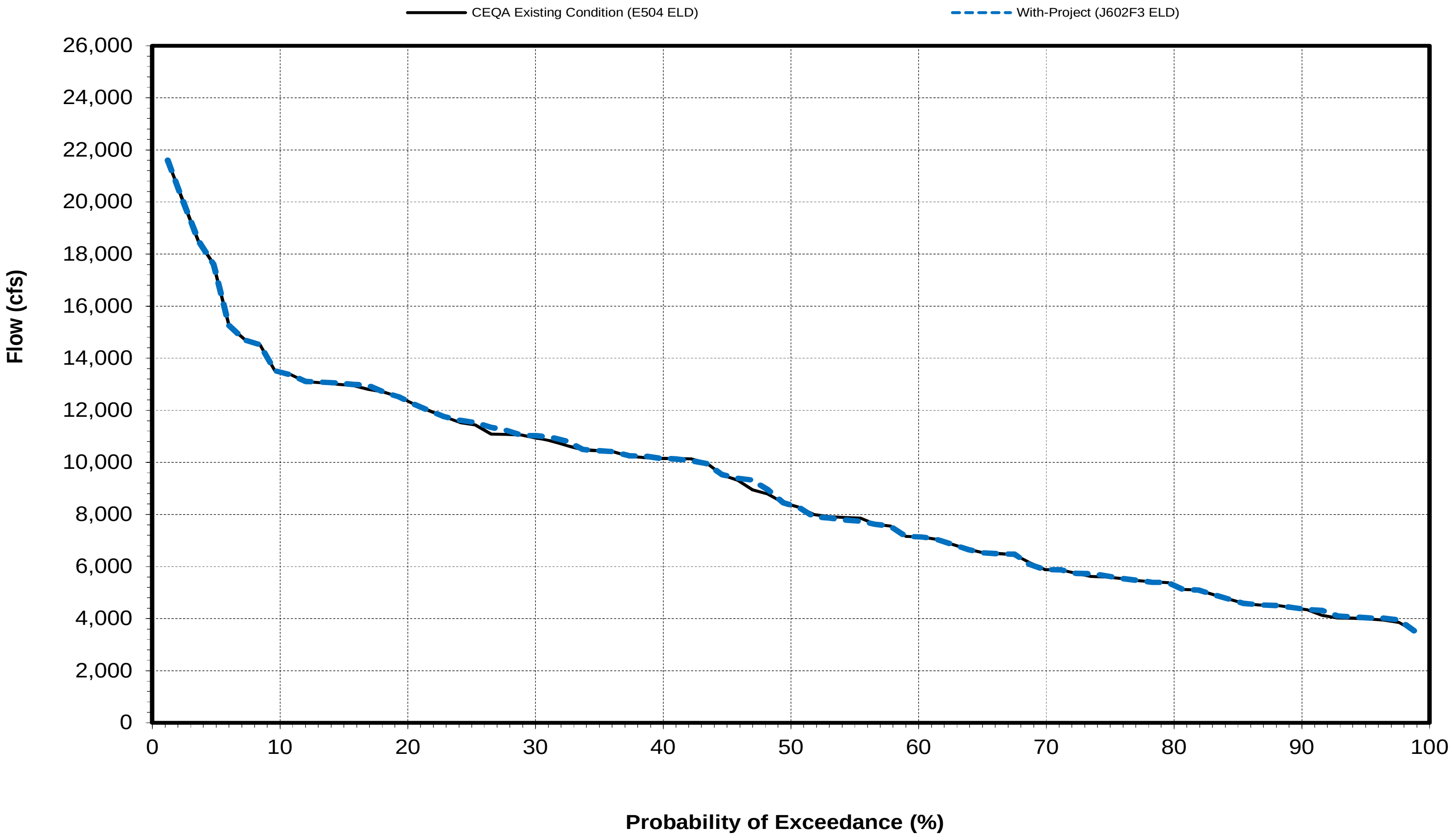
(-1.1<X<1.1)	Percent of Time (Percentage of the 20 Years)	75.0
1.1<=X<10.0		25.0
X>=5.0		0.0
X>=10.0		0.0
-10.0<X<=-1.1		0.0
X<=-5.0		0.0
X<=-10.0		0.0
Net Change in 10% Exceedance	Percent of Time -- Increases of 10% or more minus decreases of 10% or more	**0.0**

Sacramento River Flow at Wilkins Slough

October



Sacramento River Flow at Wilkins Slough **November**

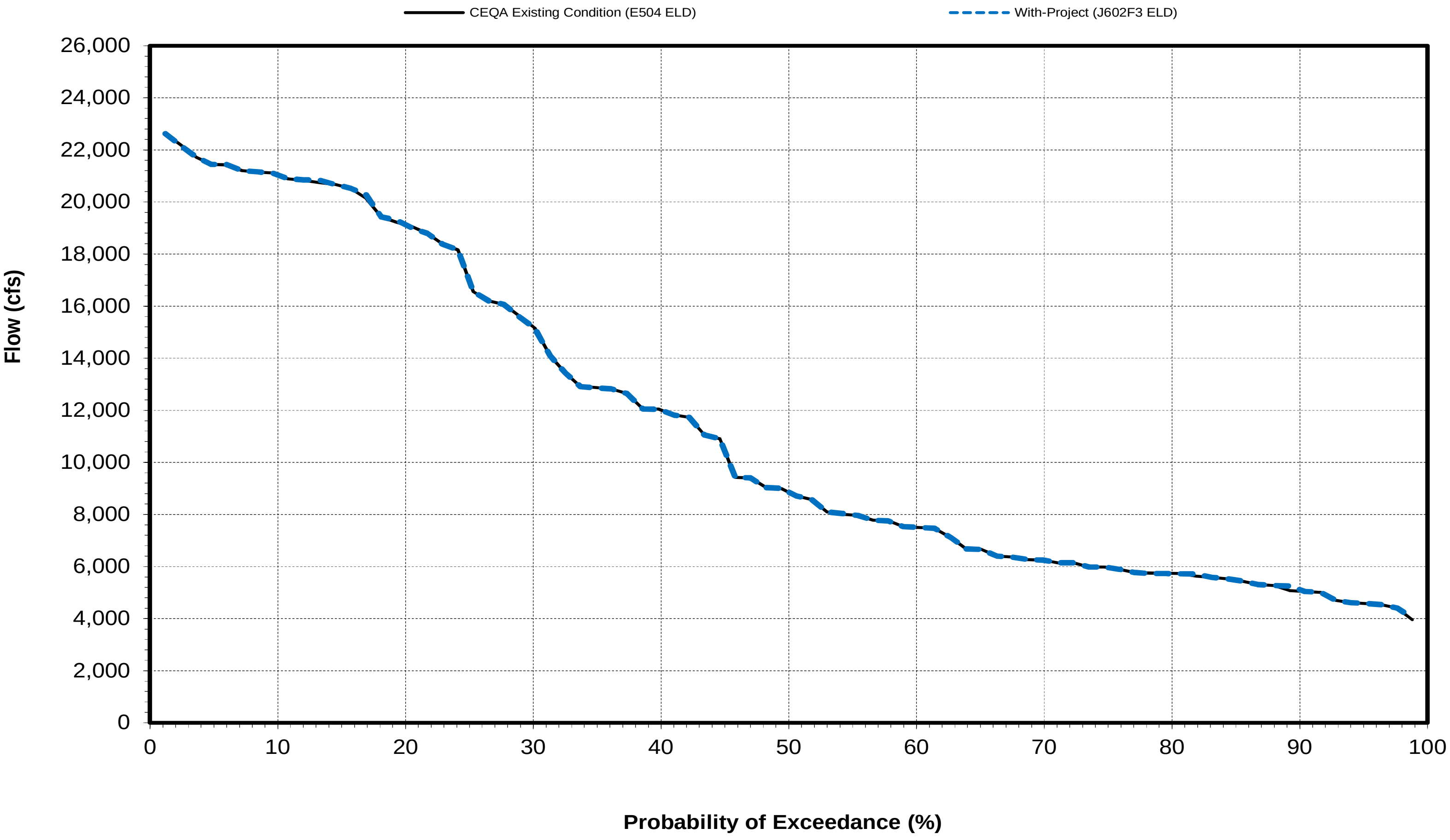


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Wilkins Slough

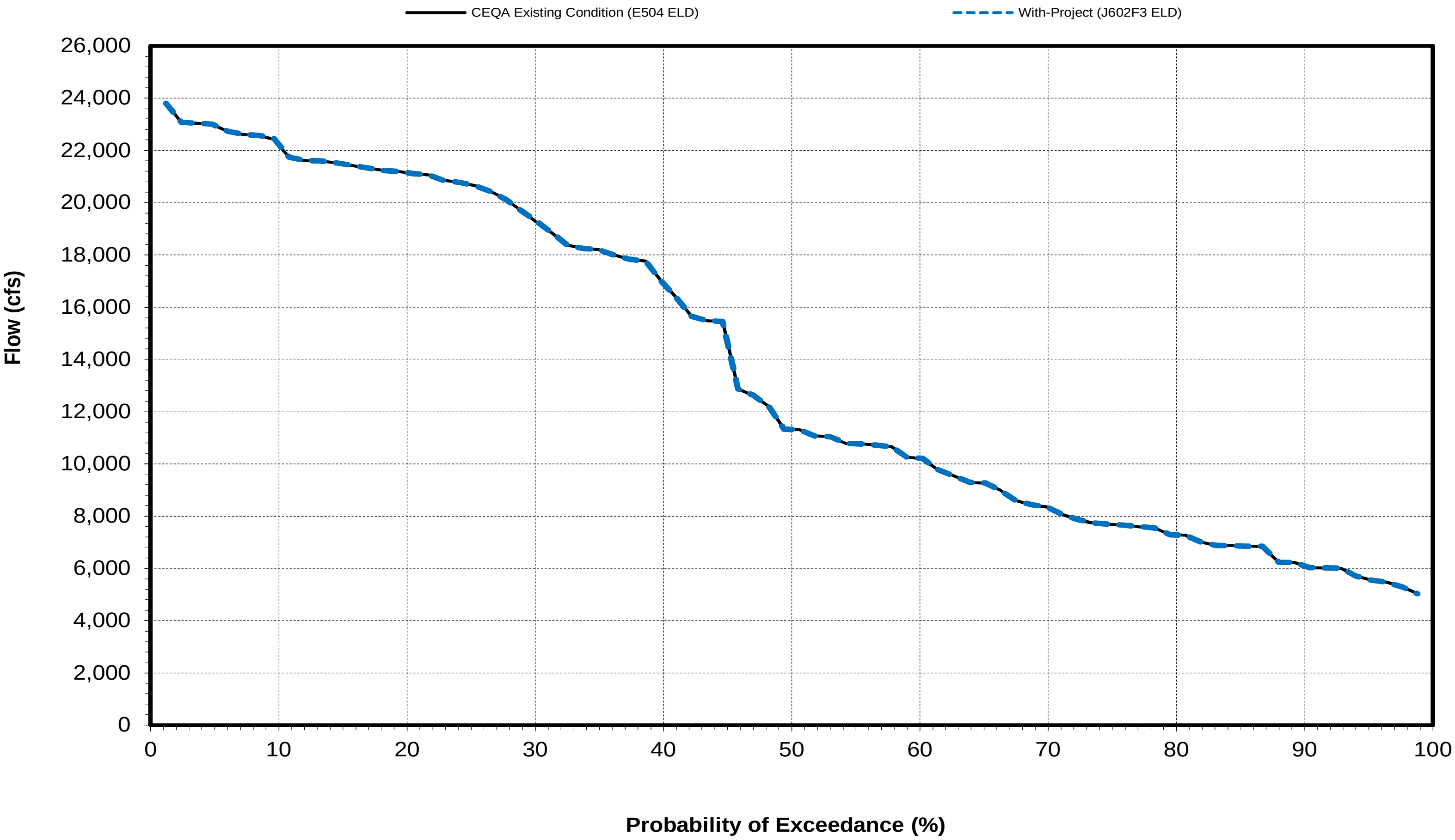
December



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Wilkins Slough **January**

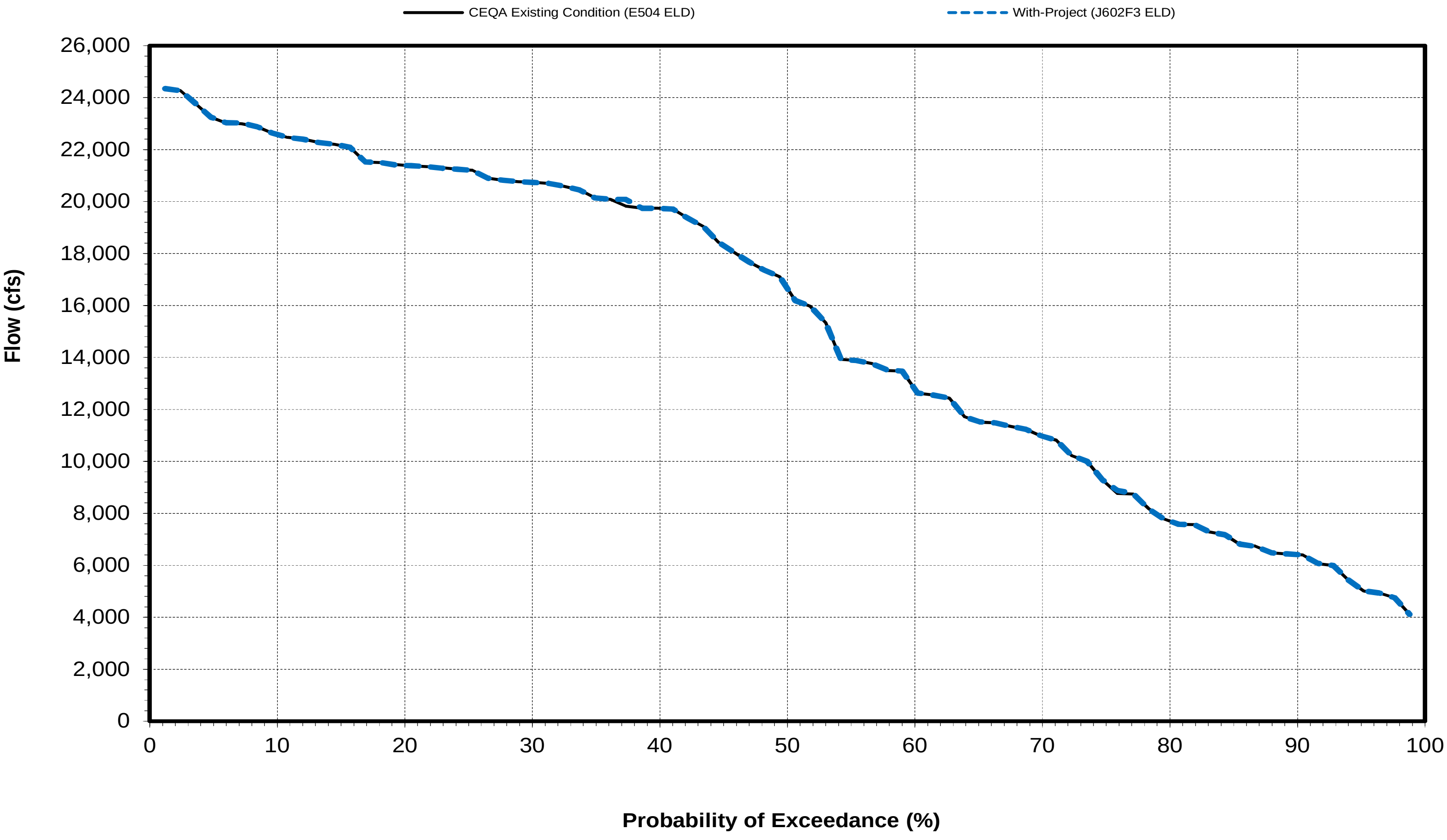


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Wilkins Slough

February

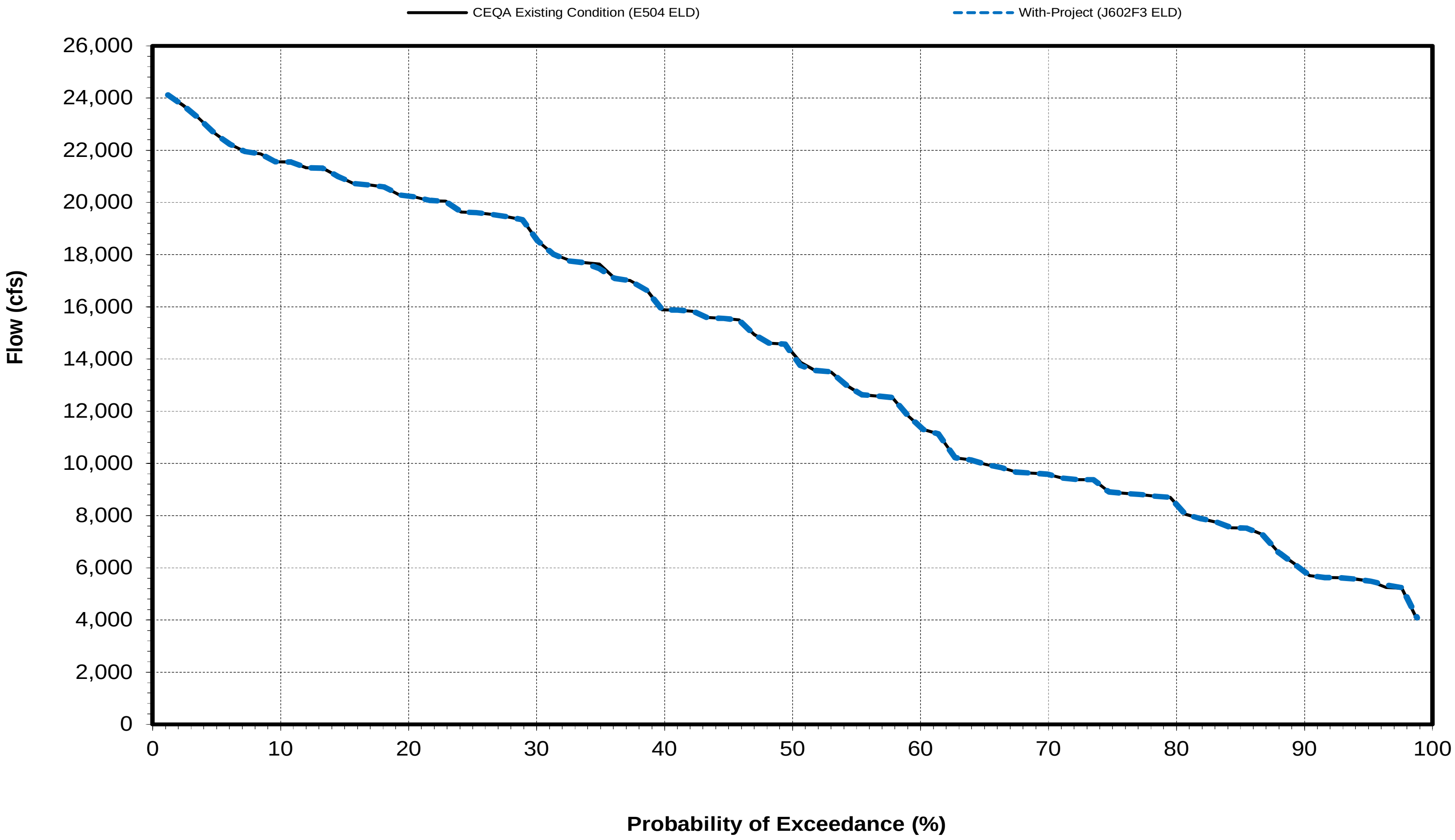


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Wilkins Slough

March

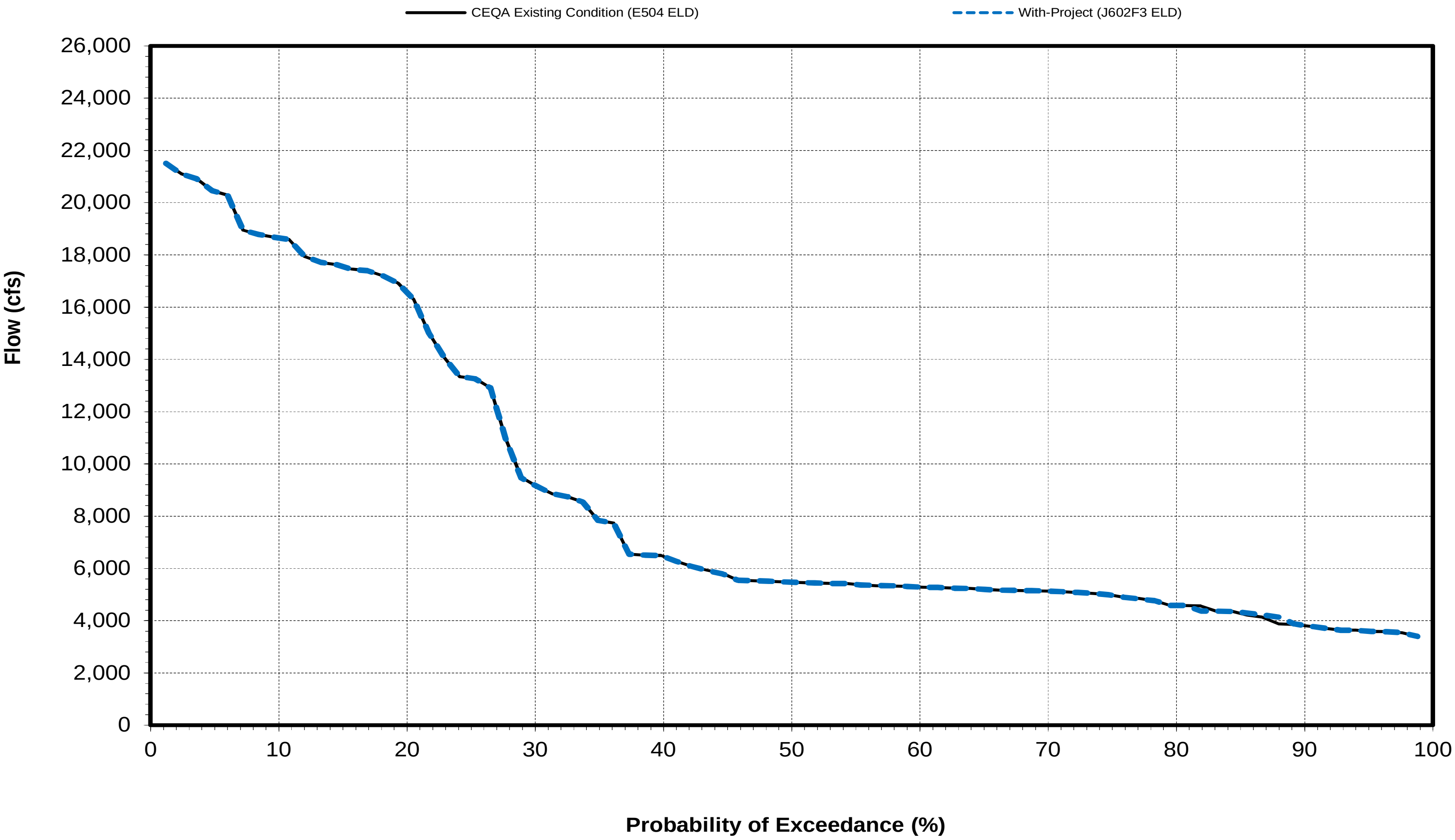


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Wilkins Slough

April

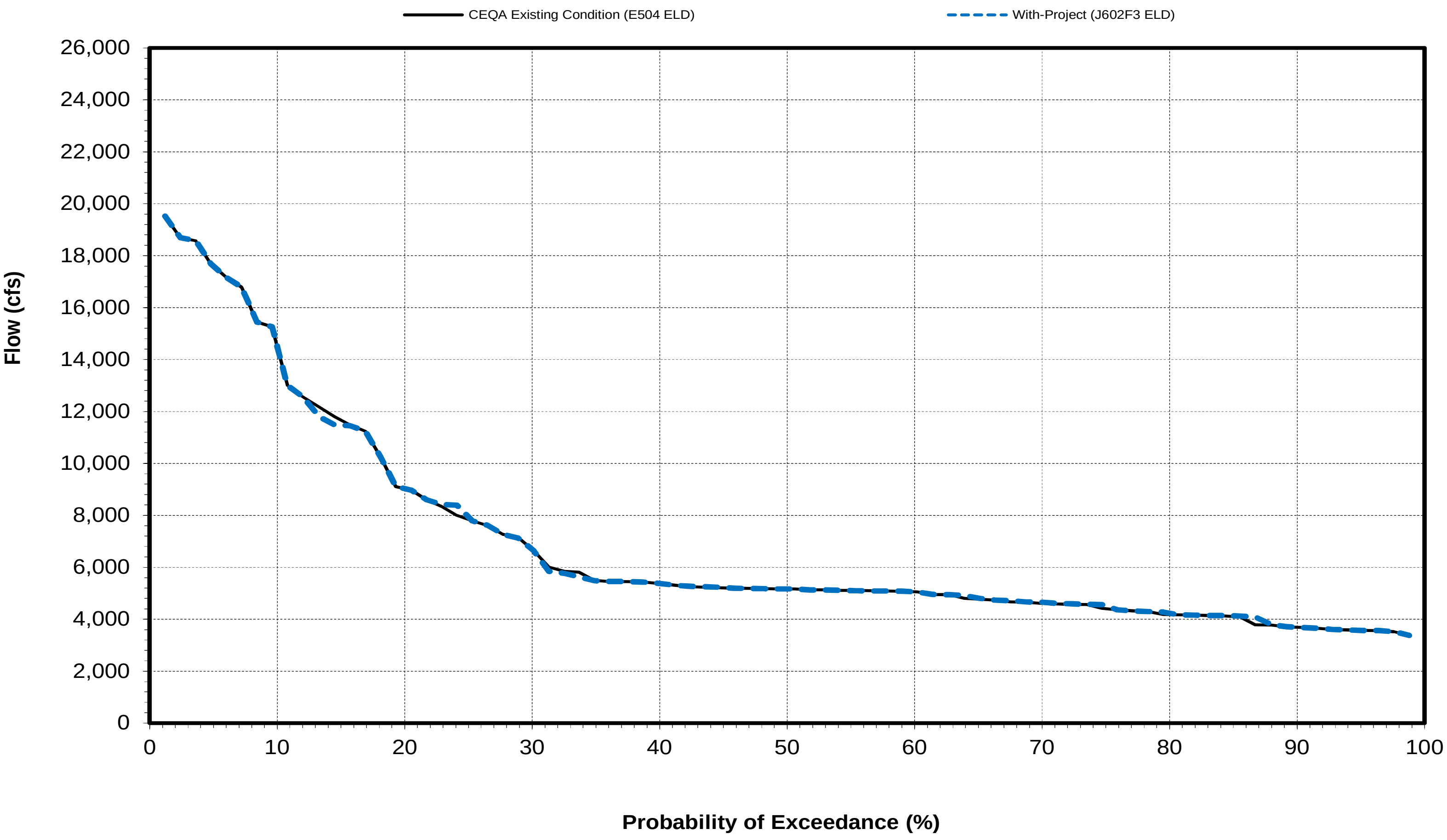


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Wilkins Slough

May

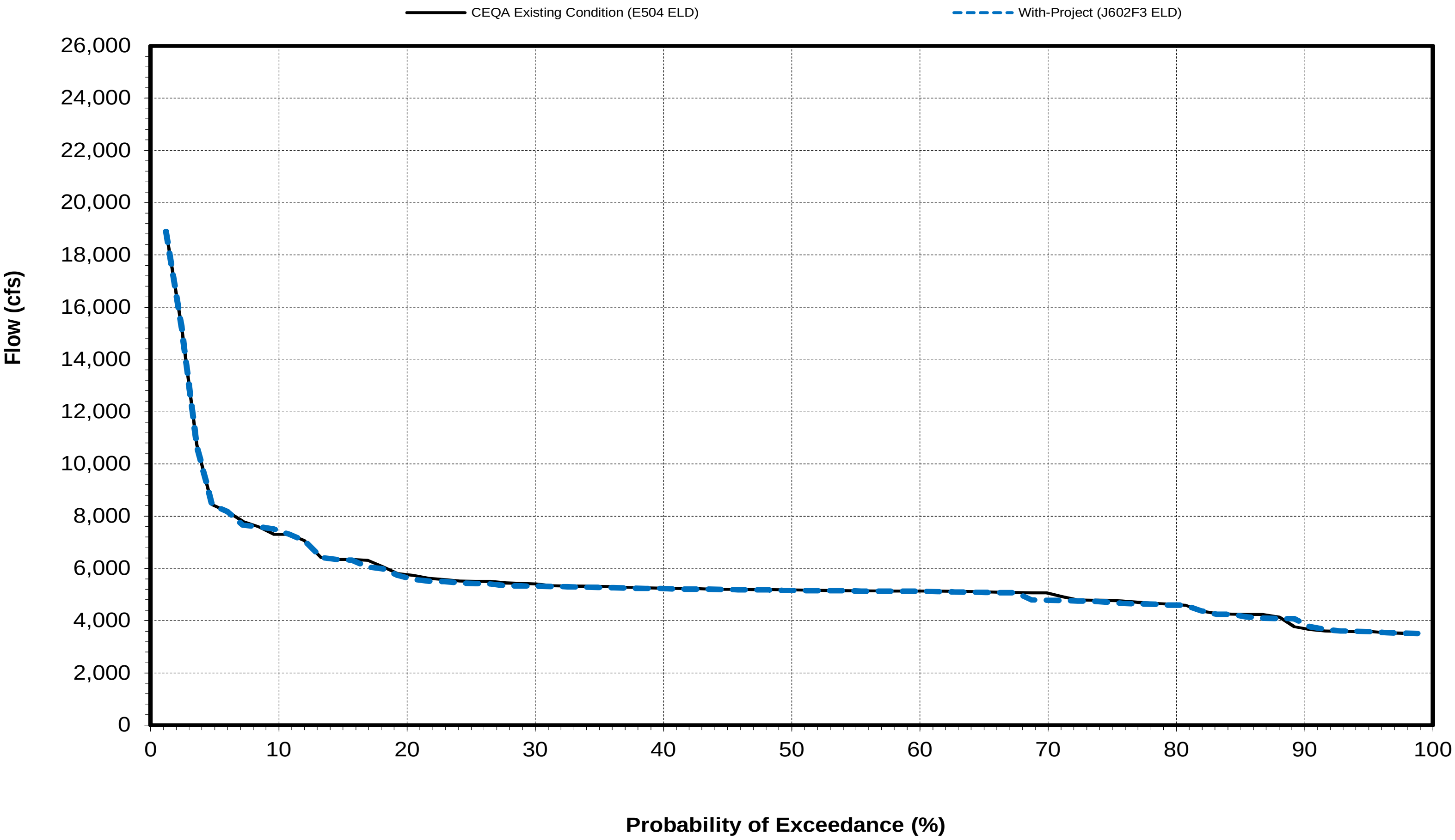


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Wilkins Slough

June

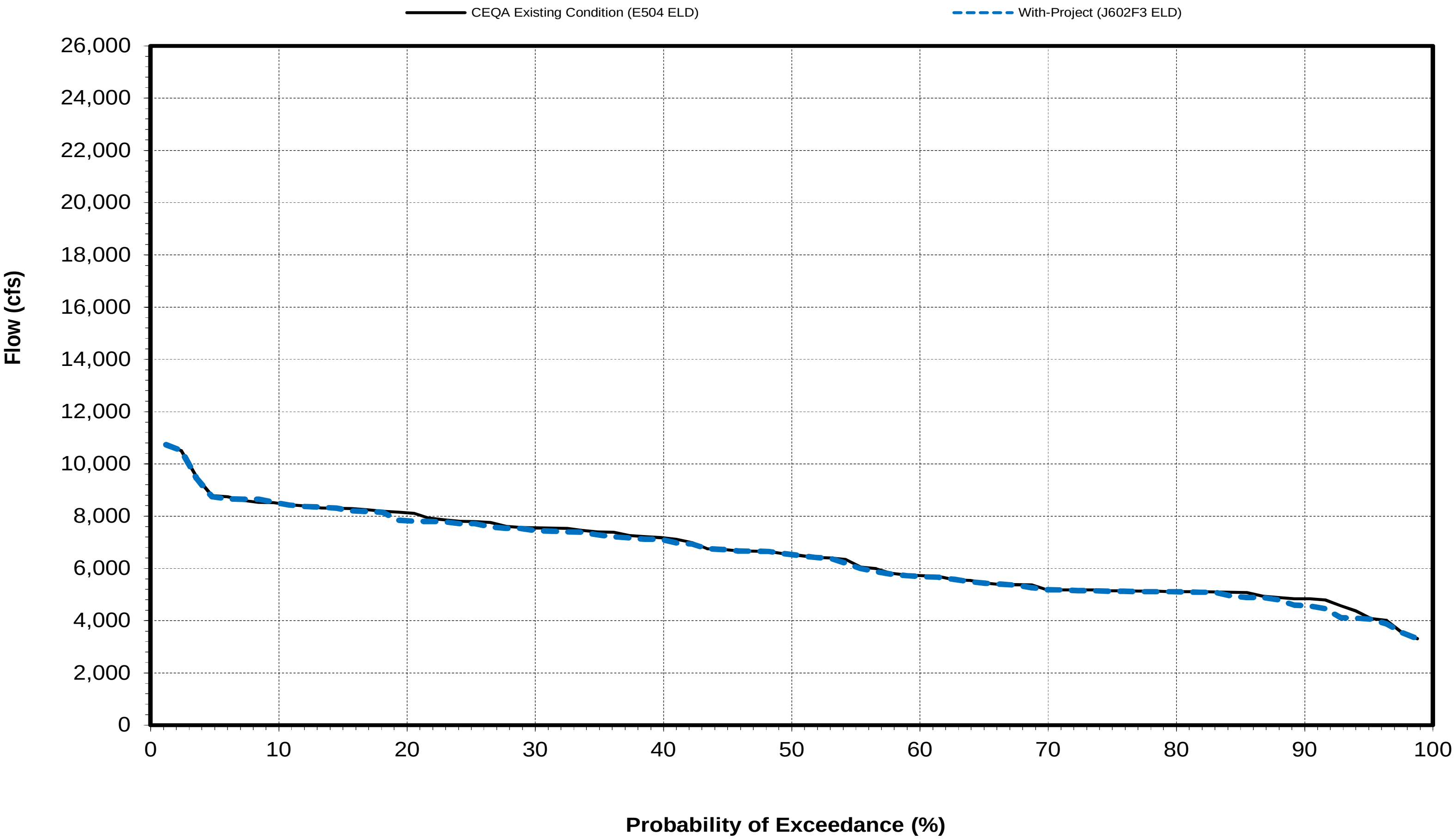


Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Wilkins Slough

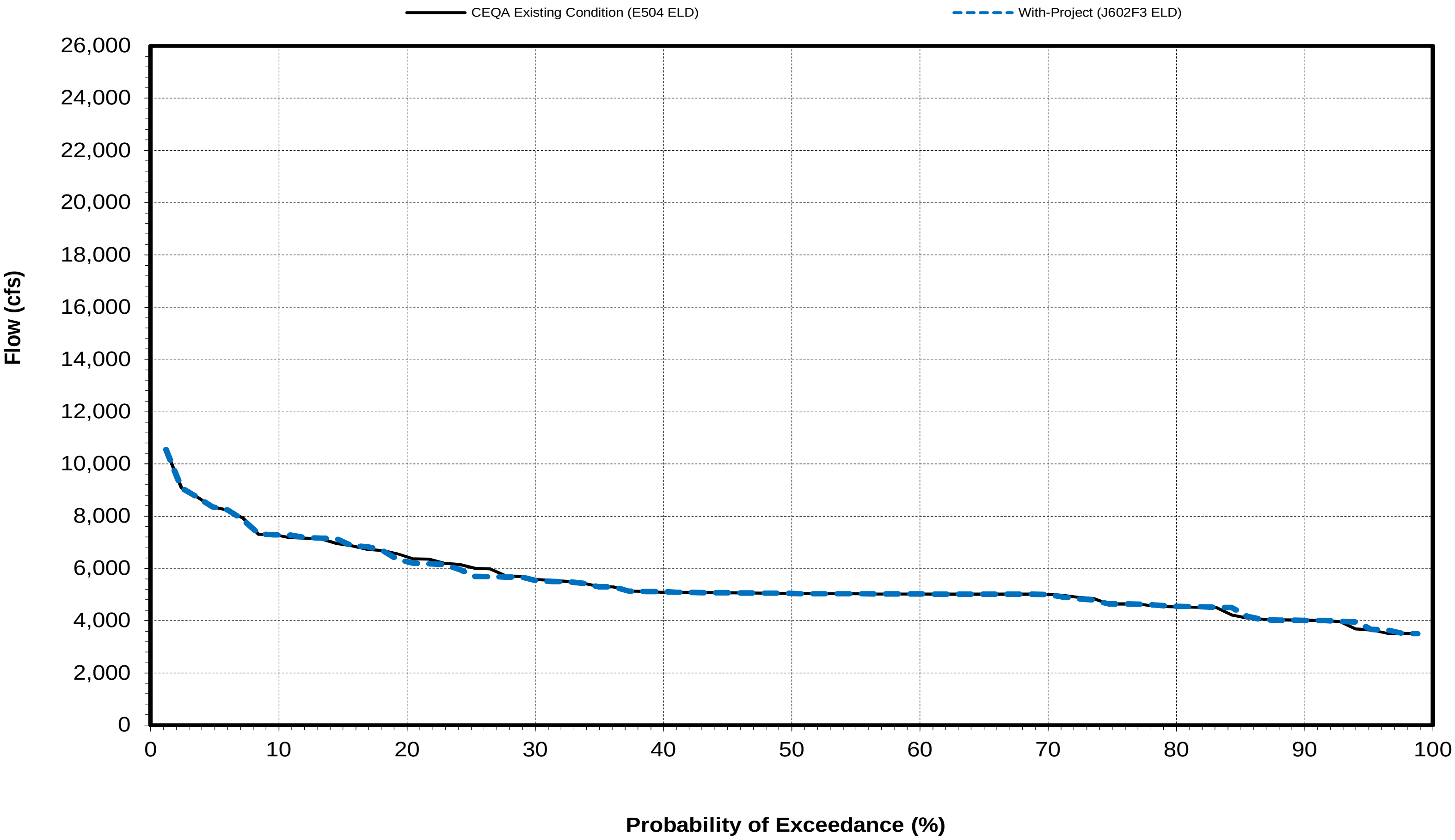
July



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

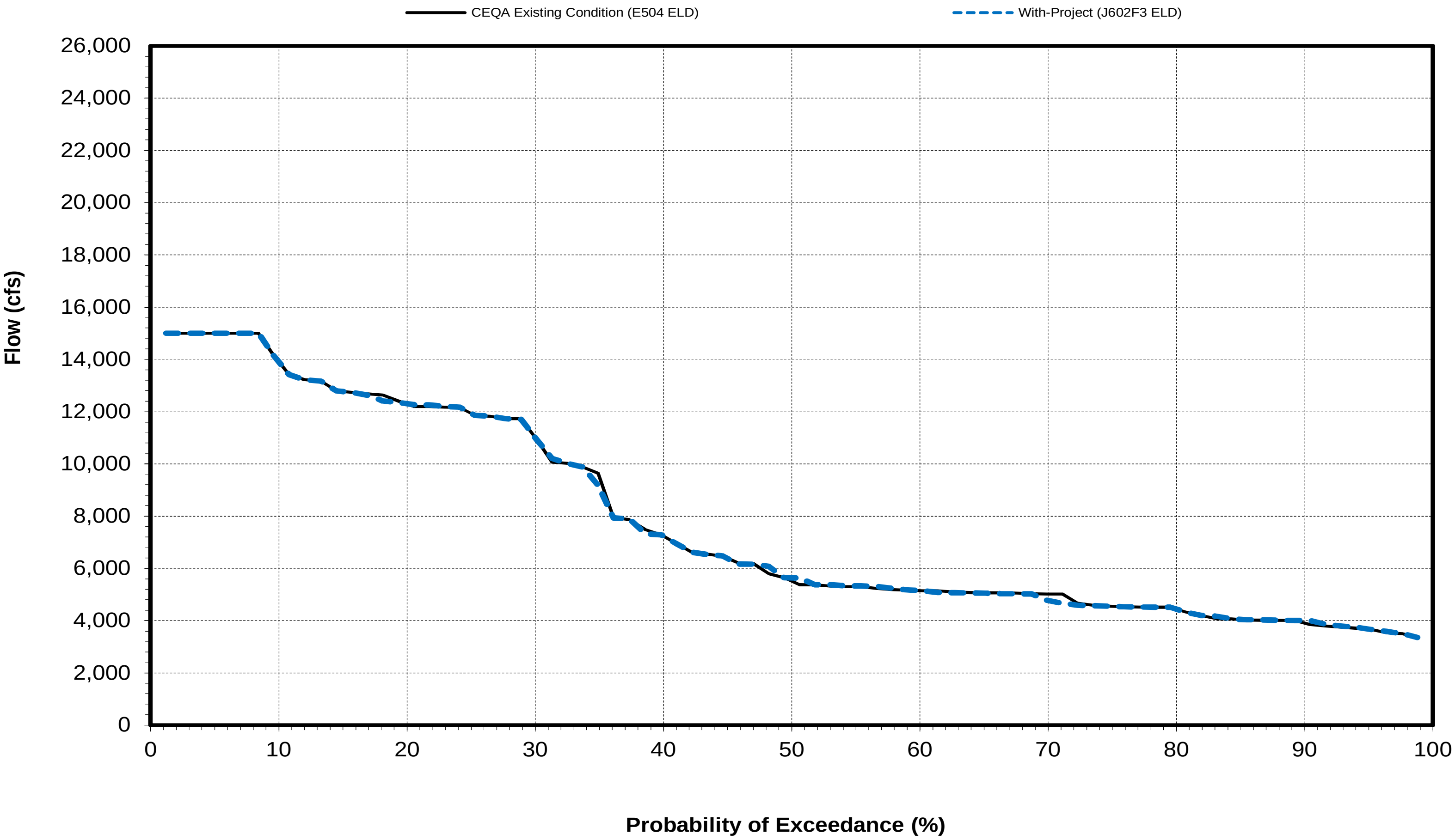
Sacramento River Flow at Wilkins Slough **August**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Sacramento River Flow at Wilkins Slough **September**



Folsom_WCM: Comparison E504ELD-J602F3ELD (With-Project (J602F3 ELD) vs CEQA Existing Condition (E504 ELD))

Created: 8/31/2016

Appendix F: Cultural Resources

Folsom Dam Water Control Manual Project Section 106 Consultation Record with Native American Tribes and Interested Parties*
*May not include all communication for project.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
2/21/2014	Outgoing Email	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Steven Hutchason, Grayson Coney	Proposed meeting dates in March on 3/19, 3/25, or 3/31 for meeting to discuss the Corps' Section 106 undertakings at Folsom: Water Control Manual, Dam Raise. Proposed general agenda to provide information on the projects, project schedules, the Corps' plan to comply with Section 106, and hear the tribes' concerns, areas of interest, how they want to be involved.
2/24/2014	Incoming Email	UAIC	Marcos Guerrero	Response from Mr. Guerrero that 3/31/14 would be best for a meeting with the UAIC, but all dates presently available.
2/24/2014	Outgoing Email	UAIC	Marcos Guerrero	Acknowledgement of email received 2/24/14, will follow up once additional information and responses received.
2/26/2014	Outgoing Email	SSBMI, TAM, WR	Andrew Godsey, Daniel Fonseca, Steven Hutchason, Grayson Coney	Follow up to email sent 2/24/14 to ask tribes who have not responded for their availability on 3/19, 3/25, or 3/31. Asked for a response in order to schedule a meeting by the end of the week (2/28/14).
2/28/2014	Outgoing Meeting Invitation	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Steven Hutchason, Grayson Coney	Meeting invitation sent to tribes to request a meeting on 3/19/14 at DWR offices to discuss Corps Section 106 undertakings at Folsom (Water Control Manual and Dam Raise).
2/28/2014	Incoming Email	UAIC	Marcos Guerrero	Mr. Guerrero accepted meeting invitation for 3/19/14.
3/4/2014	Incoming Email	UAIC	Melodi McAdams	Ms. McAdams accepted meeting invitation for 3/19/14.
3/13/2014	Outgoing Meeting Invitation	UAIC, SSBMI, WR, TAM	Marcos Guerrero, Jason Camp, Andrew Godsey, Daniel Fonseca, Steven Hutchason, Grayson Coney	Meeting update for meeting invitation sent 2/28/14, stating that United Auburn has RSVPed, and that if other tribal representatives are not available to get in touch with Melissa Montag to schedule another date and time for a meeting.
3/13/2014	Incoming Email	SSBMI	Andrew Godsey	Mr. Godsey accepted meeting invitation for 3/19/14.
3/19/2014	Incoming Email	WR	Steven Hutchason	Mr. Hutchason accepted meeting invitation for 3/19/14.
3/19/2014	Meeting	UIAC, SSBMI, WR	Marcos Guerrero, Jason Camp, Andrew Godsey, Kara Perry, Steven Hutchason	Meeting held with Native American tribal representatives, the Bureau of Reclamation, California Department of Water Resources to discuss the Corps' Section 106 undertakings at Folsom (Water Control Manual and Dam Raise).

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
3/20/2014	Outgoing Email	UIAC, SSBMI, WR	Marcos Guerrero, Jason Camp, Andrew Godsey, Kara Perry, Steven Hutchason	Forwarded Reclamation Sedimentation Survey from 2005 for Folsom Lake and Dam, as requested during 3/19/14 meeting.
1/13/2015	Outgoing Letter	Strawberry Valley Rancheria (SVR), California Valley Miwok Tribe, Ione Band of Miwok Indians (IBMI), UAIC, Yocha Dehe Wintun Nation, Tsi-Akim Maidu, Colfax-Todds Consolidated Tribe, Jackson Rancheria Band of Miwuk Indians, Mechoopda Indian Tribe of Chico Rancheria (Mechoopda), El Dorado Miwok Tribe, SSBMI, WR, Buena Vista Rancheria (BVR), Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, Enterprise Rancheria of Maidu Indians (ERMI), Mooretown Rancheria of Maidu Indians, Nashville-El Dorado Miwok, Cortina Wintun Environmental Protection Agency	Cathy Bishop, Silvia Burley, Anthony Burris, Jason Camp, Cynthia Clarke, Grayson Coney, Pamela Cubbler, Adam Dalton, Michael DeSpain, Rose Enos, Kesner Flores, Nicholas Fonseca, Daniel Fonseca, Andrew Franklin, Reno Franklin, Andrew Godsey, Marcos Guerrero, Steven Hutchason, Leland Kinter, Roselynn Lwenya, Judith Marks, Marshall McKay, Yvonne Miller, Ambar Mohammed, Eileen Moon, Glenda Nelson, April Wallace Moore, Rhonda Pope, Dennis Ramirez, Don Ryberg, Guy Taylor, Cosme Valdez, Gene Whitehouse, Charlie Wright, Randy Yonemura	Letters sent to Native American Tribes invited them to open forum meetings scheduled for 1/26/15 and 2/2/15 at locations in downtown Sacramento and Folsom. Letters included project descriptions for Folsom Dam Raise and Water Control Manual Update projects, information on partners on project, project purpose and description, maps of preliminary APEs.

Date	Type of Contact	Organization	Person Contacted	Contents of Communication
1/14/2015	Outgoing Email	SVR, UAIC, TAM, Mechoopda, IBMI, SSBMI, ERMI, WR, BVR	Cathy Bishop, Jason Camp, Grayson Coney, Michael DeSpain, Randy Yonemura, Kesner Flores, Yvonne Miller, Daniel Fonseca, Andrew Godsey, Kara Perry, Cynthia Franco, Reno Franklin, Marcos Guerrero, Steven Hutchason, Roselynn Lwenya, Rhonda Pope	Email transmittal to available email addresses of 1/13/15 letter.
1/14/2015	Incoming Email		Kesner Flores, IBMI	Emails to Mr. Flores and IBMI main email address were returned as undeliverable.
1/16/2015	Incoming Voice Mail	Mechoopda	Mike DeSpain	Left message to refer comments on the projects to UAIC, SSBMI, and BVR.
1/23/2015	Outgoing Email	Mechoopda	Mike DeSpain	In reply to voice message left on 1/16/15, acknowledged that the Corps has also sent information on the projects to UAIC, SSBMI, and BVR and that the tribe has referred comments on those projects to those tribes.
1/26/2015	Open Forum for Tribes	UAIC	Marcos Guerrero, Jason Camp, Donald Rey	Open forum included maps and project information, staff from Department of Water Resources, Bureau of Reclamation, Corps environmental and cultural resources. Three representatives from UAIC were present. They asked questions about the project scope, expressed concerns that the Corps had begun survey and inventory efforts without consulting or notifying the tribes, that the Corps was not operating in a way that was reasonable and in good faith, and expressed concerns that there could be areas of concern within the project and survey areas. Ms. Melissa Montag stated that surveys were undertaken as part of efforts to begin identification of historic properties, that the Corps will continue to work with the tribes within efforts to comply with Section 106, proposed a meeting in the field in March.

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SACRAMENTO DISTRICT
1325 J STREET
SACRAMENTO CA 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

JAN 13 2015

TO NATIVE AMERICAN TRIBES:

The U.S. Army Corps of Engineers, Sacramento District (Corps) and the Central Valley Flood Protection Board (CVFPB) will be holding two open forums to provide information on the Folsom Dam Raise (Dam Raise) and Folsom Dam Water Control Manual Update (Manual Update) and to solicit input from the Native American tribes. The Dam Raise was most recently authorized in the 2004 Energy and Water Development Appropriations Act, Public Law (PL) 108-137, and the Manual Update was authorized in the Water Resources Development Act of 1999, PL 106-53. The Corps and CVFPB are preparing two separate draft Supplemental Environmental Impact Statement/ Environmental Impact Reports (SEIS/SEIR), one for the Dam Raise and one for the Manual Update, to evaluate potential impacts as a result of the independent projects. The Corps will serve as lead agency for compliance with the National Environmental Policy Act (NEPA) and the National Historic Preservation Act of 1966, as amended (NHPA), and CVFPB will serve as lead agency for compliance with the California Environmental Quality Act (CEQA). For the Dam Raise the U.S. Bureau of Reclamation (Reclamation) is an involved party and for the Manual Update Reclamation is a cooperating agency. The Sacramento Area Flood Control Agency is a responsible agency for both projects.

Pursuant to 36 CFR § 800.3(f)(2), the implementing regulations of Section 106 of the NHPA, the Corps has identified you as a Native American tribe that may be interested in consulting on the Dam Raise and the Manual Update. These forums will only be open to Native American tribes.

Folsom Dam and Lake is a multipurpose project operated by Reclamation as a part of the Central Valley Project. The Corps is responsible for prescribing operations pertaining to use of the storage allocated for flood risk management. The dam provides flood risk management benefits to the city of Sacramento and its surrounding areas by regulating runoff from approximately 1,860 square miles of drainage area.

The purpose of the Dam Raise is flood risk management and ecosystem restoration. The Dam Raise is authorized for 4 components: 1) emergency spillway gate modifications; 2) raising the right and left wings of the main dam, Mormon Island Auxiliary Dam (MIAD), and the reservoir dikes (1-8) by 3.5 feet; 3) temperature control shutter automation and reconfiguration; and 4) downstream ecosystem restoration of Bushy Lake and Woodlake. The current Dam Raise analysis will address the flood damage reduction components, the emergency spillway gate modifications and the 3.5 foot raise, which are being prioritized for construction. The Dam Raise project will address the proposed structural modifications to the Folsom Dam, MIAD, and the dikes only. Any changes in operation as a result of the construction of these projects, downstream ecosystem restoration, temperature control shutter automation, and reconfiguration components of the Dam Raise will be addressed in the future. A preliminary area of potential effects (APE) for the Dam Raise is shown in Enclosure 1.

The Folsom Dam Joint Federal Project, currently under construction, consists of a new auxiliary spillway with a crest elevation 50 feet lower in elevation than the current gated spillways on the main dam. In order to fully realize the benefits of the new auxiliary spillway, the current Folsom Dam and Lake Water Control Manual must be updated. The Manual Update will identify, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Lake to reduce flood risk to the Sacramento area by utilizing the new auxiliary spillway and by incorporating an improved understanding of the American River watershed upstream of Folsom Dam. The findings of the evaluation will be used to help define the Dam's new flood operations plan, with the intention of meeting flood risk management objectives and dam safety requirements in a manner that conserves as much water as possible and maximizes all authorized Folsom Dam project uses to the extent practicable. The Manual Update will not cover operational activities of Folsom Dam and Lake that Reclamation is responsible for. A preliminary APE for the Manual Update is shown in Enclosure 2.

In accordance with Section 106 of the NHPA, the Corps is required to take into account the effects of their undertakings on historic properties. This includes the identification of historic properties, finding of effect, and the resolution of adverse effects through the process identified in 36 CFR § 800. As part of our efforts to identify historic properties and consider the views of Native American tribes, we are inviting you to attend the open forums and consult on the Dam Raise and Manual Update projects. Your input on the above topics and any associated items that are important to you will be used to:

- Further determine the scope of the analysis in the SEIS/SEIR documents and in the efforts to identify historic properties.

- Provide input on the range of alternatives to be evaluated in the SEIS/SEIR.

- Obtain local knowledge or information to assist in the environmental analysis and assessment of adverse effects on historic properties.

Project team staff will be on hand to accept comments and address questions regarding the projects. You will be given the opportunity to provide written and verbal comments at the open forums.

Written comments and suggestions about the Dam Raise and Manual Update may be submitted to Melissa Montag, Corps Cultural, Recreational, & Social Assessment Section. For e-mailed comments, please include "Folsom Dam Raise" or "Folsom Manual Update" in the subject line, attach comments in MS Word format, and include the commenter's U.S. Postal Service mailing address. Questions about the projects and the SEIS/SEIR should be addressed to:

Melissa Montag,
CESPK-PD-RC
1325 J St, Sacramento,
CA 95814
Phone: 916-557-7907
Fax: 916-557-7856
e-mail: Melissa.L.Montag@usace.army.mil

The open forums will be held at the following locations:

Sacramento Library Galleria
828 I Street, Sacramento, CA
January 26th, 2015
5pm to 7pm

Folsom Community Center
52 Natoma Street, Folsom, CA
February 2nd, 2015
5pm to 7pm

For more information please visit the Folsom Dam Raise website at http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomDamRaise.aspx or the Folsom Dam Manual Update website at http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomWaterControlManualUpdate.aspx.

Sincerely,

Alicia E. Kirchner for
Chief, Planning Division

cc: (w/enclosures)
Cathy Bishop, Chairperson, Strawberry Valley Rancheria, 1540 Strader Avenue, Sacramento, CA 95815
Silvia Burley, Chairperson, California Valley Miwok Tribe, 10601 N. Escondido PL, Stockton, CA 95212-9231

Anthony Burris, Ione Band of Miwok Indians, P.O. Box 699, Plymouth, CA 95699
Jason Camp, Tribal Historic Preservation Officer, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, CA 95603
Cynthia Clarke, Yocha Dehe Wintun Nation, P.O. Box 18, Brooks, CA 95606
Grayson Coney, Tsi-Akim Maidu, P.O. Box 1316, Colfax, CA 95713
Pamela Cubbler, Colfax-Todds Valley Consolidated Tribe, P.O. Box 734, Foresthill, CA 95631
Adam Dalton, Chairperson, Jackson Rancheria Band of Miwuk Indians, P.O. Box 1090, Jackson, CA 95642
Michael D. DeSpain, Director of OEPP, Mechoopda Indian Tribe of Chico Rancheria, 125 Mission Ranch Boulevard, Chico, CA 95926
El Dorado Miwok Tribe, P.O. Box 711, El Dorado, CA 95623
Rose Enos, 15310 Bancroft Road, Auburn, CA 95603
Kesner Flores, P.O. Box 1047, Wheatland, CA 95692
Nicolas Fonseca, Chairperson, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682-1340
Daniel Fonseca, Tribal Historic Preservation Officer, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682
Andrew Franklin, Chairperson, Wilton Rancheria, 9728 Kent Street, Elk Grove, CA 95624
Reno Franklin, Tribal Historic Preservation Officer, Enterprise Rancheria of Maidu Indians, 2133 Monte Vista Avenue, Oroville, CA 95966
Andrew Godsey, Assistant Director, Cultural Resources Department, Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs, CA 95682
Marcos Guerrero, Cultural Resources Manager, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, CA 95603
Steven Hutchason, Executive Director of Environmental Resources, Wilton Rancheria, 9728 Kent Street, Elk Grove, CA 95624
Leland Kinter, Yocha Dehe Wintun Nation, P.O. Box 18, Brooks, CA 95606
Roselynn Lwenya, Tribal Historic Preservation Officer, Buena Vista Rancheria, 1418 20th Street, Suite 200, Sacramento, CA 95811
Judith Marks, Colfax-Todds Valley Consolidated Tribe, 1068 Silverton Circle, Lincoln, CA 95648
Marshall McKay, Yocha Dehe Wintun Nation, P.O. Box 18, Brooks, CA 95606
Yvonne Miller, Chairperson, Ione Band of Miwok Indians, P.O. Box 699, Plymouth, CA 95669-0699
Ambar Mohammed, Cachil DeHe Band of Wintun Indians of the Colusa Indian Community of the Colusa Rancheria, 3730 State Highway 45 # B, Colusa, CA 95932
Eileen Moon, Vice Chairperson, Tsi-Akim Maidu, 1239 East Main Street, Grass Valley, CA 95945

Glenda Nelson, Chairperson, Enterprise Rancheria of Maidu Indians, 2133 Monte Vista Avenue, Oroville, CA 95966
April Wallace Moore, 19630 Placer Hills Road, Colfax, CA 95713
Rhonda Morningstar Pope, Chairperson, Buena Vista Rancheria, 1418 20th Street, Suite 200, Sacramento, CA 95811
Dennis Ramirez, Chairperson, Mechoopda Indian Tribe of Chico Rancheria, 125 Mission Ranch Boulevard, Chico, CA 95926
Don Ryberg, Chairman, Tsi-Akim Maidu, 1239 East Main Street, Grass Valley, CA 95945
Guy Taylor, Representative, Mooretown Rancheria of Maidu Indians, 31 Alverde Drive, Oroville, CA 95966
Cosme Valdez, Interim Chief Executive Officer, Nashville-El Dorado Miwok, P.O. Box 580986, Elk Grove, CA 95758
Gene Whitehouse, Chairperson, United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, CA 95603
Charlie Wright, Chairperson, Cortina Wintun Environmental Protection Agency, P.O. Box 1630, Williams, CA 95987
Randy Yonemura, 4305 39th Avenue, Sacramento, CA 95824

United States Department of the Interior

BUREAU OF RECLAMATION
Mid-Pacific Regional Office
2800 Cottage Way
Sacramento, CA 95825-1898

IN REPLY REFER TO:

APR 17 2017

MP-153
ENV-3.00

CERTIFIED – RETURN RECEIPT REQUESTED

Mark T. Ziminske
Chief, Environmental Resources Branch
U.S. Army Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922

Subject: National Historic Preservation Act (NHPA) Section 106 Designation of Lead Federal Agency for the Folsom Dam and Lake Water Control Manual Update (Project #15-CCAO-033)

Dear Mr. Ziminske:

The U.S. Army Corps of Engineers (Corps) and the Bureau of Reclamation are proposing to update the Folsom Dam and Lake Water Control Manual (WCM) to implement new operational criteria to meet flood risk management objectives for the new Folsom Dam Safety/Flood Reduction Project (Joint Federal Project) at Folsom Dam. While Reclamation is responsible for daily operation of the dam, the Corps' Sacramento District is responsible for developing and prescribing flood risk management operations for the Folsom Dam Project. A change in operation of Folsom Dam and Lake, Federal facilities, are subject to compliance with Title 54 U.S.C. §306108, commonly known as Section 106 of the NHPA, and the implementing regulations at 36 CFR Part 800. As the Corps and Reclamation both have responsibilities under Section 106, Reclamation is designating the Corps as lead Federal agency for compliance with Section 106, pursuant to 36 CFR § 800.2(a)(2). As lead Federal agency, the Corps will act on our behalf, fulfilling the collective responsibilities of both agencies for Section 106 consultations regarding updating the WCM.

As lead agency, the Corps will coordinate and consult with Reclamation throughout the Section 106 process. The process would include: identifying and consulting with required and interested parties; defining the area of potential effects; establishing the scope of identification efforts; determining eligibility of cultural resources for listing on the National Register of Historic Places; making a finding of effect; and developing agreement documents, as required under 36 CFR Part 800. Reclamation will retain responsibility for issuing permission to access Reclamation lands and Archaeological Resource Protection Act permits, if required, for purposes of conducting cultural resources studies. Should Reclamation and the Corps fail to agree on a finding of effect, the agencies may invite the Advisory Council on Historic Preservation to assist in coming to agreement, or Reclamation may proceed individually to meet Section 106 responsibilities.

Reclamation requests that the Corps accepts Federal lead agency status for Section 106 compliance for updating the WCM. If you have any questions or concerns about this designation of Lead Agency, please contact Mr. Scott Williams, Archaeologist, at 916-978-5042 or sawilliams@usbr.gov.

Sincerely,

Anastasia T. Leigh
Regional Environmental Officer

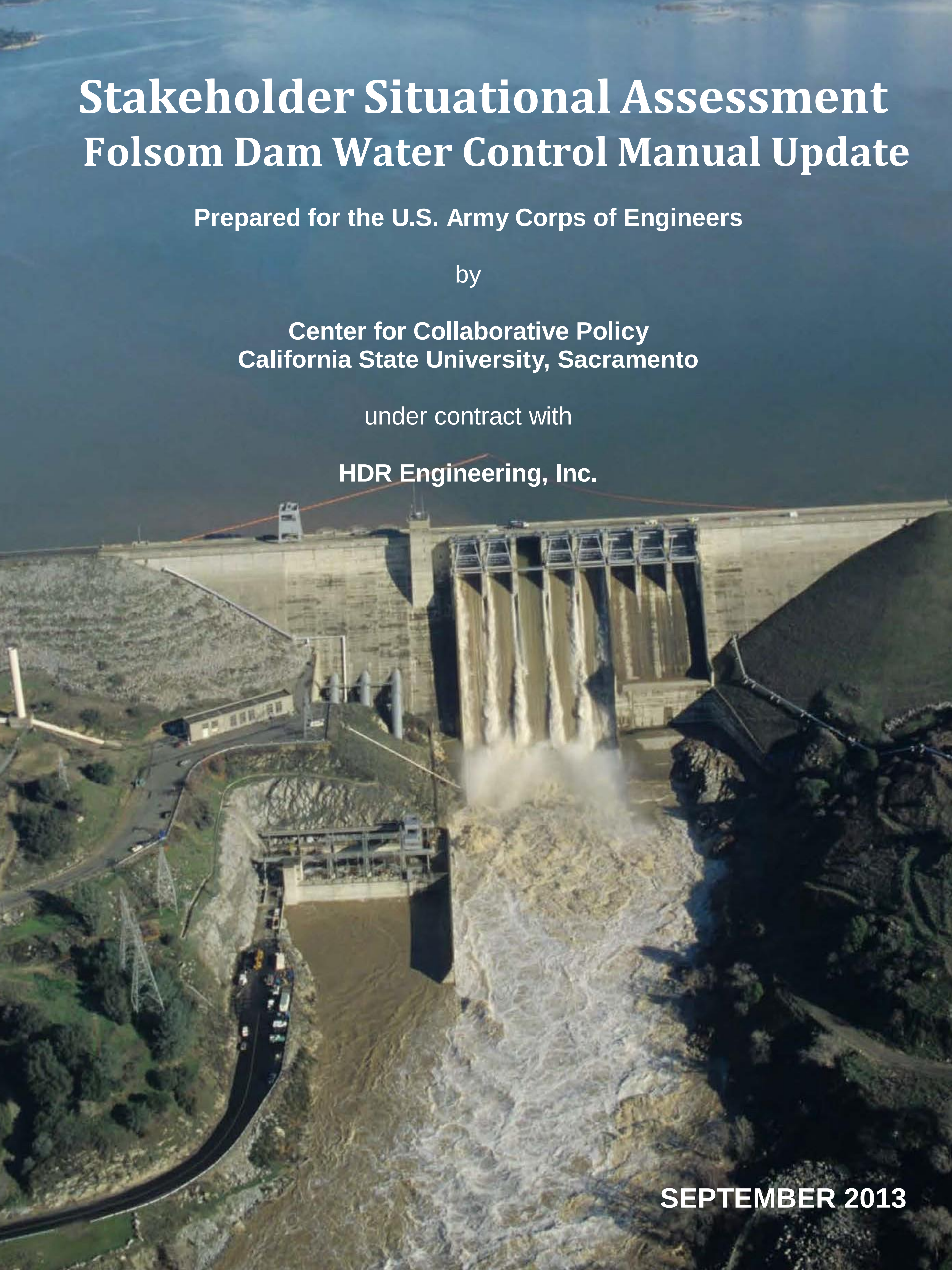
cc: Ms. Julianne Polanco
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street, Suite 100
Sacramento, CA 95816

Mr. Drew Lessard
Manager
Central California Area Office
Bureau of Reclamation
7794 Folsom Dam Road
Folsom, CA 95630

Ms. Melissa Montag
Historian
U.S. Army Corps of Engineers
Cultural, Recreation & Social Assessment Section (CESPK-PD-RC)
1325 J Street
Sacramento, CA 95814-2922

Appendix G: Public Involvement, Part 1

Stakeholder Situational Assessment



Stakeholder Situational Assessment
Folsom Dam Water Control Manual Update

Prepared for the U.S. Army Corps of Engineers

by

Center for Collaborative Policy
California State University, Sacramento

under contract with

HDR Engineering, Inc.

SEPTEMBER 2013

Front Cover: Folsom Dam and Reservoir 1997

Stakeholder Situational Assessment
Folsom Dam Water Control Manual Update

Table of Contents

1. USACE Briefing Memorandum on Folsom Dam Water Control Manual Update, July 2012
2. Stakeholder Organizations and User Groups
3. Power Point Presentation from September 2012 Stakeholder Meetings
4. Power Point Presentation from February and March 2013 Stakeholder Meetings

Note Regarding Appendices 3 and 4: The information in these presentations was current as of the date listed. As the project progresses, information may evolve and change over time. For more current information, see http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomDamAuxiliarySpillway.aspx. Readers can access material on Folsom Dam Water Control Manual Update on the lower right side of the page.

Stakeholder Situational Assessment

Folsom Dam Water Control Manual Update

Introduction

Situated at the confluence of two large rivers - the American and Sacramento - the populated areas in and near the City of Sacramento have lived with the realities of floods and flood risk since the 1850's. Of course, tribal populations lived with the sometimes fierce rhythms of these rivers long before the settlers arrived. In recent history, the record flood of 1986 exposed the area's vulnerability when Folsom Reservoir exceeded its normal flood control storage capacity and several levees nearly collapsed under the strain of the storm.

The 1986 flood raised concerns over the adequacy of the existing flood management system and the safety of Folsom Dam, leading to a series of important actions over the past 25 years on the part of Congress and local, regional, state and federal agencies. The U.S. Army Corps of Engineers (USACE), U.S. Bureau of Reclamation (Reclamation), Sacramento Area Flood Control Agency (SAFCA), and the Central Valley Flood Protection Board through the California Department of Water Resources (CVFPB/DWR) have worked in partnership on these actions.

In addition to levee strengthening, one of the most important actions to reduce Sacramento area's flood risk will be the completion of the Folsom Dam Joint Federal Project (JFP). The JFP, authorized by Congress, is currently under construction and is anticipated to be built by the fall of 2017. One of the current limitations of Folsom Dam is that sufficient flood waters cannot be released at lower elevations due to the positioning of the dam gates, thus preventing the earlier and safe evacuation of flood waters. The JFP, consisting of a six submerged tainter gate structure and an auxiliary spillway, will address that problem by allowing more flood water to be safely released at a lower elevation and earlier in a storm event. This increased release efficiency effectively creates more storage capacity in Folsom Reservoir to hold flood waters throughout a storm.

In order to realize the full benefits of this new auxiliary spillway and gate structure, an updated Water Control Manual (Manual Update) needs to be developed. The Water Control Manual is the document that stipulates the flood control operations of Folsom Dam, and has provided the rules and criteria for operating the Dam since 1956.

The Manual Update effort, led by USACE with Reclamation as its federal partner, and assisted by its state and local cost-sharing partners (CVFPB/ DWR; SAFCA) will develop, evaluate, and recommend changes to the flood management operations of Folsom Dam and Reservoir in order to reduce flood risk to the Sacramento area.

In addition to the new spillway and gate structure, this ongoing effort will also evaluate other operational considerations to achieve an improved level of flood risk reduction while decreasing the volume of flood control space required in Folsom Reservoir at any one time. These additional considerations include various upstream watershed conditions (incidental upstream storage and degree of basin saturation); storm forecasting technologies; the status of the downstream levees; and aspects of the proposed Dam raise project, which is scheduled to be constructed by 2019.

Important factors in the development of the Manual Update include dam safety requirements; Endangered Species Act (ESA); fish and wildlife needs; water quality requirements; water supply and water rights permit terms; power generation and recreational needs.

For more background information on the Manual Update, see Appendix 1 for USACE's July 2012 Briefing Memorandum on Folsom Dam Water Control Manual Update.

Why Do a Stakeholder Situational Assessment?

In addition to its critical flood control function, Folsom Dam and Reservoir serve a number of other purposes including municipal and industrial water supply, agricultural irrigation supply, hydropower generation, fish and wildlife protection, water quality, and recreation at Folsom Lake. Thus, any changes in the operation of Folsom Dam to increase flood protection could also have the possibility of affecting the other purposes of the Dam as well as the stakeholders who have a "stake" in those purposes.

This Stakeholder Situation Assessment, and more importantly the foundational conversations held among stakeholders and the four government agencies developing the Manual Update, provide an important starting point to:

- Improve the Manual Update through stakeholder feedback;
- Anticipate and collaboratively resolve stakeholder concerns and problems;
- Develop information that could lead to mutual gain for the stakeholder groups as well as the government agencies working on the Manual Update; and
- Create the conditions for a timely and smooth federal approval of the proposed Manual Update modifications.

To lay the foundation for future stakeholder engagement in the Manual Update, this Stakeholder Situation Assessment will:

1. Identify organizations, groups, government entities and other interested parties who believe they could be adversely or positively affected by a revised Folsom Dam Water Control Manual;
2. Provide a summary of stakeholders' views, perspectives, concerns and needs;
3. Describe common interests as well as potential tensions among the stakeholders groups to better inform the Update; and
4. Recommend a process for meaningfully engaging stakeholder groups with the work of USACE, its partner and cost-sharing sponsors throughout the Manual Update process.

Who are the Stakeholders?

The first step in any stakeholder situation assessment is the identification of those groups and organizations - external to the responsible government entities - that have an active interest in a project and / or believe they could be adversely affected by a project.

Given the multi-purpose nature of Folsom Dam and the considerable attention given to the flood risk reduction issues in Sacramento, the major stakeholder groupings listed in the box below were easy to identify. What took more attention was the identification of the multiple organizations within each stakeholder grouping along with the individuals who could best represent those organizations in the Manual Update discussions. The six major stakeholder groupings in the box represent a total of 67 organizations/ sub-divisions /user groups and 100 individuals representing these interests. For a listing of the organizations and user groups associated with each of the following interest groups, see Appendix 2.

Major Stakeholder Groupings for Stakeholder Situation Assessment

(The notation following each grouping represents the number of organizations or user groups associated with that grouping. Some organizations are dual purpose and are included in more than one grouping.)

Regional Flood Management Entities *(9)*
Folsom Lake, Lake Natoma, and Lower American River Recreation Interests *(15)*
Regional Environmental Interests *(14)*
In-Basin Water Purveyors/ Suppliers *(18)*
Central Valley Project (CVP) and State Water Project (SWP) Contractors *(15)*
Electric Power Utilities and their Associations *(5)*

The other stakeholder groupings identified as having an interest in the operation of Folsom Dam include the metropolitan business community, the regional emergency response agencies, the downstream interests in the lower Sacramento River and North Delta region, and the regional tribes. USACE has its own separate process for engaging tribes and tribal governments. The other four groups have important concerns about and perspectives on flood risks in Sacramento, but not necessarily relating the fine points of how the Dam is operated. As described later in this report, these groups will be invited to participate in the quarterly all-stakeholder discussion sessions throughout the Manual Update Process.

How was the Stakeholder Situational Assessment Done?

The information for this Assessment came from a series of meetings, conversations and other communications with the stakeholders from the six major categories -- Regional Flood Management Organizations; Folsom Lake, Lake Natoma, and Lower American River Recreation Interests; Regional Environmental Interests; In-Basin Water Purveyors; Central Valley Project (CVP) and State Water Project (SWP) Contractors; and Electric Power Utilities and their Associations.

In September 2012, USACE, in concert with Reclamation, SAFCA and CVFPB/DWR, convened a series of facilitated conversation with each of the six groups identified above. The purpose of these separate discussions was to engage the stakeholders in the policy and technical work of the Manual Update; understand stakeholders' interests, views and concerns; and ask the stakeholders how best to involve them in the future work of the Manual Update . This effort consisted of five (three-hour) discussions. The Central Valley Project (CVP), State Water Project (SWP) Contractors, and Electric Power Utilities and their Associations were combined into one meeting.

The September 2012 series of meetings produced two products:

- The identification of each group's interests and issues, which was then sent to all the individuals in each grouping multiple times for corrections, additions and approvals.

- The development of a draft stakeholder engagement plan based on the level of involvement requested by the stakeholders.

Then, in February 2013 and again in March, USACE, in concert with Reclamation, CVFPB/DWR and SAFCA, convened facilitated sessions so that the stakeholders in all the interest groupings could come together to continue the discussions begun in September.

The purpose of the February and March 2013 sessions was to provide a forum for the four government agencies and the stakeholders to jointly review and discuss three documents: the Interests and Issues Statements of the stakeholder groupings; the Draft Stakeholder Engagement Plan; and the Project Schedule that would inform the timing of stakeholder involvement. As requested by the stakeholders, another key part of the session was a presentation and discussion on the technical work being done for the Manual Update.

Based on stakeholder feedback at the February and March 2013 sessions, the Draft Stakeholder Engagement Plan was modified. The Stakeholder Engagement Plan will be discussed later in this report.

See Appendices 3 and 4 for the power point presentations from the September 2012 and February/ March 2013 stakeholder sessions.

Stakeholder Interests and Issues

The identification of stakeholder interests and issues is one of the most important aspects of an assessment. The following tables capture each group's concerns, questions and observations. As mentioned above, the stakeholders reviewed and approved their respective statements.

These Interest and Issue Statements come directly from each of the interest groups. The inclusion of these statements in this Assessment does not imply that the four government agencies working on the Manual Update necessarily agree with these statements. However, these four agencies do recognize and respect the concerns expressed.

Each of the statements is organized into three columns, respectively providing Interests, Issues, and Questions / Observations. The Interests (first column) are the overarching needs. The Issues (second column) are the more specific policy, technical, operational, physical, procedural concerns and requests related to each Interest. The Interest and Issues Statement from the Central Valley Project (CVP), State Water Project (SWP) Contractors and Electric Power Utilities and their Associations are combined into one statement. See notations after each entry in that joint statement to identify the associated interest.

The Interest and Issues Statements for each of the groups can be found on the following pages:

Regional Flood Management Organizations' Interests and Issues

Interest	Issues	Questions/ Observations
Reducing and understanding impacts on systems so can plan and prepare for needed maintenance, restoration and improvements.	1. Concern with bank erosion on Sacramento River: i. Prolonged medium-sized flows. (70,000 – 80,000 cfs) can be more damaging than less frequent higher flows. Can tolerate higher flows if medium flows are managed. ii. Concerned with high/ peak flows if duration is long. 2. Concerns regarding exceeding the capacity of the Yolo Bypass. Bypass not designed for concurrent flood events on American, Sacramento, Yuba and Feather Rivers. Once weir gates are open, flows go into Bypass, not Sacramento River. 3. Need a detailed understanding of routing – where and when do flows hit the Sacramento River?	1. Explore possibility of waiting to release flows/ stretching out Reservoir evacuation over time to make sure capacity of Yolo Bypass is not exceeded. 2. What are the impacts of various Folsom operations under a range of storms?
Financing of maintenance / restoration/ improvements to their systems due to WCM operation of Folsom	1. Will there be a change to the trigger for PL 84-99 based on WCM operations? Do not want to be ineligible for funding support. 2. Who pays for maintenance costs? 3. Study should evaluate need for compensation for floodway damages associated with WCM.	
Update triggers for population evacuations in flood situations	Involvement of emergency response agencies in the WCM process	

Recreationists' Interest and Issues

Folsom Lake and Lake Natoma Recreation		
Interests	**Issues**	**Questions/ Observations**
Maintain Lake levels for recreation use; particularly from May to September, with June – August being most important.	1. Impacts of low Folsom Lake shorelines: • Boat ramp access/ availability • Distance of parking area to swimming beaches and marina • Loss of Park revenue due to reduced day usage • Loss of revenue to private marinas and concession operations 2. WCM modeling effort needs to take advantage of existing data that correlates recreation use by reservoir level by month to conduct a sophisticated analysis. 3. Interested in review of impacts to/ thresholds of significance for Folsom Lake, especially in advance of issuance of draft EIS/EIR	Will PCWA's or SMUD's FERC new license requirements have an effect on Lake Folsom?
State Parks, private marinas and Sac State Aquatic Center need continued advance notification of high release rates from Folsom Reservoir for safety and informational purposes.	Lake Natoma and downstream: Rowing event safety and equipment impacts with high flows	

Recreationists' Interest and Issues

Lower American River (LAR) Recreation		
Interests	**Issues**	**Questions/ Observations**
Boating recreational and safety impacts related to flow levels and timing, especially on weekends from May - September. Flows over 6000 cfs can present boating safety issues.	1. Adequate flows for recreational boating in LAR are 1750 -6000 cfs, although can boat at 1500 cfs. Some locations are safe up to 8000 cfs, but 6,000 cfs is best safety threshold to use. Above 6,000 cfs, the danger can increase due to water flows through trees. Below 1750, the chance of puncturing a tube increases. 2. Continued advance notification of higher flows (above 6000 cfs) for boater safety reasons (routinely done now; some organizations want to be added to notification list).	Instances of increased releases catching wading fisherman by surprise
Loss of Sacramento County Park's recreational infrastructure in the American River Parkway with very high flows	1. High flows in the LAR Parkway can cause: • Submerged trails and bike paths • Bank damage • Submerged bathrooms • Damages to electrical equipment at Discovery Park	1. County Parks has good data correlating river stage with impacts to park land and infrastructure. Should be used in effects evaluation 2. Models should determine which American River Parkway infrastructure is submerged at what LAR flow levels. This will provide information to help County prepare for damages.
Recreational fishing interests concerned with health of fisheries, particularly temperature control issues.		

Regional Environmentalists' Interests and Issues

Interests	Issues	Questions/ Observations
Successful WCM operation of Folsom such that upstream detention dams are not necessary to reduce flood risks.	1. Need WCM that not only meets but exceeds the CA Standard (200 yr. flood). Through spillway and new tools, a larger number of hypothetical floods can be accommodated. 2. Support conditional storage (water stored in flood reserve space), when warranted, in exchange for draw down of conservation space when warranted. i. Confirm that USACE has fed authorities to do above. ii. Above "exchange" written into WCM rules so can count on it. 3. Need to create rules in WCM for early and aggressive releases/ forecasting for big storms (i.e. Pineapple Expresses don't sneak up on us). Need rules that do not constrict forecasting, and allow for outflows at beginning of a storm larger than in-flows. 4. Want rules optimized, but do want rules rather than open-ended flexibility so that the intended flood control benefits are realized. 5. Fed Authorities: 2 views i. Concern that USACE and its partners do not have a common understanding of the range of federal authorities that can be used. ii. May be better to engage in problem-solving on how to optimize operations rather than focus on authorities.	1. Primary risks with developing WCM: Releasing water "too early" that cannot be recovered; and risk of maintaining conditional storage leading to damaging high releases and possible flooding. 2. Need to review stream flow frequency curves to determine if WCM can meet and exceed 200 year CA Flood Standard. 3. What are assumptions for / characteristics of 200 year flood? 4. Want to discuss how to leverage different authorities, if needed for a robust WCM. 5. What is the magnitude of what can be done with forecasting? What operational flexibility is gained through using forecasting? 6. What would be the rules regarding conditional storage?

Regional Environmentalists' Interests and Issues, Continued

Interests	Issues	Questions/ Observations
The health of the downstream fisheries related to temperature/ cold water pool and flow regimens. Of particular concern is protecting, restoring and meeting the various life stage needs of the Chinook salmon and steelhead.	1. Cold water pool: • Use the WCM Project as an opportunity / obligation to improve the cold water pool • Cannot wait for Dam Raise Temperature Control Device (TCD) to improve cold water pool 2. Support of Conditional Storage (water stored in flood reserve space), when warranted, if: i. Potential new water is also available for Reclamation's revised water right for Folsom (Water Forum LAR Flow Standard), including storage targets for end of September. ii. Pulse releases provided during Jan.-May as conditional storage is associated with lost out-flow, effecting out-migration of young salmonoids. ii. Understanding that fish stranding occurs if sudden short duration, high releases are necessary. 3. Shutter Configuration: Congress authorized automated configuration. Needs to be implemented unless demonstrate that same effect can be achieved through other means (e.g. current lifting and blending of shutters). 4. Need Elephant Trunk	1. When is the strategic thinking for the cold water pool going to get done? There is $2 Million set aside now for cold water pool. 2. WCM Modeling analysis needs to provide opportunity for close review regarding what helps and hurts the cold water pool. 3. Need analysis of what out-flow levels are needed for young salmonoids in Jan – May period, especially Jan – March. 4. As part of WCM analysis: i. Identify biological needs of Chinook salmon and steelhead, including temperature information at selected downstream points. ii. Identify operational alternatives that are protective of Chinook salmon and steelhead. 5. Need effects analysis of high flows in the Lower American River (LAR). 6. Studies have shown that there is significant flow of water through the current shutters, which reduces the ability to conserve and manage the cold water pool. Potential fixes should be investigated, including rehabilitation and replacement.

In-Basin Purveyors’ Interests and Issues

Interests	Issues	Questions/ Observations
Enhanced management of water supplies for the protection of in-basin municipal/industrial and environmental uses, particularly through a proactive approach to the acquisition and use of high quality data.	1. Concern that Folsom Reservoir could be drawn down below the intakes of several purveyors that do not have alternative sources of supply. 2. Modeling of the Bureau of Reclamation’s current operating plan, under future level of demands, indicates that Folsom Reservoir will be drawn down to dead pool in back to back critically dry years. 2. Because Folsom Reservoir is relatively small compared to the size of potential flood events and in-basin municipal and environmental water needs, there is a natural conflict between water supply and flood control interests. It is the water purveyors’ desire to investigate the ability to temporarily increase the amount of water allowed to be held in storage in Folsom Reservoir, while carefully monitoring water content within the watershed and projected precipitation, until either the probability of significant near term precipitation reaches a level of concern for possible flooding or the level of water content reaches a level needed to diminish concern for drought. 3. We believe that everyone involved in this effort would benefit from a thorough understanding of the risks (loss of stored water; flooding) and benefits (reduced drought impacts; reduced flood risks) associated with differing levels of flood and water storage, especially with the operation of	1. Does the Corps have the authority to be flexible in WCM operation of Folsom? 2. Upstream in-basin purveyors want to make a contribution to identifying and collecting quality data for modeling as well as real-time guidance during possible flood event. 3. How do we make sure we incorporate our additional data with data that is currently collected? 4. If we need more tools, where are they needed? 5. Request for model to address South Fork unimpaired flow as it is difficult to measure due to granite topography.

	In-Basin Purveyors' Interests and Issues, Continued the new flood outlet gates at Folsom. 4. Need more instrumentation monitoring, collection and use of accurate data for watershed modeling as well as for real-time guidance during possible flood event 5. Better understanding of level of confidence in technology tools (e.g. basin wetness parameters; conditions of upstream reservoirs; forecasting) 6. As related to outcome of WCM effort, USACE and USBR should engage in SWRCB process for establishing new Delta flow standards.	

CVP/SWP Contractors' and Electric Utilities' Interests and Issues

Interests	Issues	Questions/ Observations
Maximizing water resources for all purposes (CVP/SWP/Power)	1. Take advantage of opportunities to optimize end of May storage for additional and colder water than current condition. In particular, examine potential for higher carryover storage for critically dry years, made possible by better flood control capacity. Also enhances power generation and recreation. (CVP/SWP/Power) 2. Flexibility built into WCM to maximize water resources for all purposes. Specifically, need flexible rule curve for Folsom flood control depending upon basin moisture conditions, and the incorporation of forecast-based operations into the flood control guidelines. (CVP/SWP/Power) 3. Minimize operations/ conditions that would require releases to by-pass penstocks. (Power) 4. Update Folsom Dam shutters to improve control of water temperatures releases from Folsom Reservoir. (CVP/SWP/Power)	1. What are the confidence levels associated with forecasts? 2. What is the duration of peak downstream releases? 3. Who pays the operations and maintenance (O&M) costs on Folsom shutters, if updated?

	CVP/SWP Contractors' and Electric Utilities' Interest and Issues, Continued 5. Important to track Delta flow standard discussions at SWRCB as related to WCM Project. Particularly interested in salinity quality for Delta and sensitivity analysis regarding X-2 Standard. (CVP/SWP)	
Cost allocation related to WCM Operations (CVP/Power)	How will the revised WCM Operations affect authorized project purposes in the existing cost allocation for Folsom Dam/Reservoir and the ongoing CVP Cost Reallocation Study which is scheduled to be completed by 2016/2017? (CVP/Power)	
WCM assumptions (hydrological; environmental, etc.) should be carried forward in other studies (CVP/SWP/Power)	Downstream environmental regulatory baseline for Folsom Dam WCM should be coordinated with CVP Cost Reallocation Study (CVP/Power).	
Ensuring informed decision making processes exist by having access to integrated input from all other interests (CVP/SWP/Power)	Want to understand how all impacts fit together, especially environmental impacts. Do not want to get to the end of this effort and not be aware of integrated input and impacts. (CVP/SWP/Power)	

Shared Perspectives among the Six Stakeholder Groupings

This part of the Stakeholder Situational Assessment compares the interests and issues of the six major stakeholder groups to identify where their various perspectives align. (See box insert on page 4 for a list of the stakeholder groups.) Where interests align, there can be opportunities for approaches and solutions that meet the needs of multiple, and possibly, all constituencies.

For the Manual Update process, it is fortunate that many of the stakeholders' needs and concern are similar, or at least not contradictory. This provides a path for potential mutual gains, which are usually elusive in other water and flood endeavors.

There are nine key shared perspectives among the stakeholder groupings:

1. **Reduced Flood Risks for the Sacramento Area**: All stakeholders understand and support the reduction of flood risks for the Sacramento area.

2. **Use of Conditional Storage**: There is a potential, but not a guarantee, for all interests to benefit from a revised Manual Update that enhances conditional storage in Folsom Reservoir. This means that when there are no expectations of moderately high or severe precipitation and relatively dry conditions upstream, there is little risk in storing water in what otherwise would be dedicated to flood space in Folsom Reservoir. This could enhance water supplies, hydro-power, fishery, and recreational opportunities through higher seasonal water storage at Folsom Reservoir. And, in turn, conditional storage also means that when severe storms or high precipitation are anticipated, water can be evacuated from the Reservoir beyond what would otherwise be retained in the conservation space for water supply, thus reducing flood risks.

3. **Balancing Risks and Benefits**: Regarding conditional storage, stakeholders agree that the risks (loss of stored water; flooding; potentially damaging releases during flood situations) and benefits (reduced flood risks; increased water availability; lower volume of releases during potential flood situations) need to be carefully assessed. The challenge is to develop a Manual Update that neither releases water "too late" resulting in damaging high releases and possible flooding, nor releases water "too early" so that water cannot be recovered for water supply, hydropower, fishery and recreational needs.

4. **Use of All of the Tools**: Stakeholders want to maximize the combined use of conditional storage within Folsom Reservoir, the auxiliary spillway, basin wetness information, weather forecasting, and incidental storage in upstream reservoirs to reduce flood risks as well as have the opportunity to store more water in Folsom Reservoir. Stakeholders also want a better understanding of the magnitude of what can be accomplished with the use of these tools as well as the levels of uncertainty with such use.

5. **Basin Wetness and Weather Forecasting**: The stakeholders agree that basin wetness and forecasting information can be powerful assets to reduce flood risks. But they also realize that there can be uncertainties in the use of this data. They would like to explore the level of confidence in technology tools related to basin wetness and forecasting.

6. **Folsom Dam Raise**: Stakeholders agree that, when built, the Folsom Dam raise will be another asset with which to reduce flood risks and store water. They would like to better understand how the Folsom Dam raise and associated flood control surcharge space would potentially effect Folsom's operations and impacts. Stakeholders acknowledge that the Dam raise is not a part of this Manual Update. However, Dam raise assumptions will be addressed as part of the CEQA and NEPA cumulative impacts. When the Dam raise is constructed (2019), the Water Control Manual will be updated again to reflect the raise.

7. **Access to Information by Stakeholders**: Stakeholders expressed a need for access to information on technical issues, integrated impacts, and the perspectives of other stakeholder interests.

8. **Cold Water Pool**: Although not central to all interests, stakeholders believe that there may be an opportunity to improve the cold water pool for the fisheries though conditional storage, assuming that that flood risks are appropriately managed. Stakeholders understand (but may not all necessarily agree with) the government agencies' determination that opportunities for improving the cold water pool are incidental to the main purpose of the Water Control Manual Update. Stakeholders would like to know what operations help and hurt the cold water pool.

9. **Downstream Releases in a Flood Situation**: Although not central to all interests, stakeholders share a need to understand and reduce the effects of medium and high flows as well as peak downstream releases on the American and Sacramento Rivers.

Potential Challenges

For the most part, stakeholders see much more commonality among their interests than differences. Yet, challenges do remain, but most believe that these challenges can be managed. The six challenges 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. There are sure to be other challenges, but these are the ones that stand out at this point.

1. **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.

2. **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.

3. **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.

4. **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.

5. **Use of Weather Forecasting Informatio**n: 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.

6. **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.

Stakeholder Engagement Plan

Overview

The following Stakeholder Engagement Plan is based on the seven discussion sessions that USACE, in partnership with the Reclamation, SAFCA, and CVFPB/DWR, convened with the stakeholders. (See previous section, "How was the Stakeholder Situational Assessment Done?" for a description of these sessions.)

Various stakeholder groups desire different levels of engagement in the Manual Update. The Regional Flood Management Organizations and the Recreational Representatives want occasional meetings tied to their interests and the overall project schedule.

The Environmental Group and In-Basin Purveyors desire more frequent, in-depth, technical, and policy-related sessions. Some CVP Contractors, SWP Contractors, and Electric Power Utilities and their Associations preferred occasional meetings, while others wanted more involvement. Stakeholder desiring more frequent and in-depth discussions expressed interest in such topics as modeling results, development of and criteria for NEPA and CEQA alternatives, impacts, and risk/benefit analyses.

Lastly, some groups asked for in-depth discussions on a particular topic. The In- Basin Purveyors, especially San Juan Water District, the City of Folsom and the City of Roseville, want more direct involvement in how basin wetness parameters will be incorporated into the Manual Update. The Environmental Interest Group requested more concentrated focus on weather forecasting as well as improvements to the cold water pool through the Manual Update process.

Almost all stakeholders want opportunities to provide feedback in advance of decisions and releases of the public draft and final Manual Update documents, particularly ones involving NEPA and CEQA. Most stakeholders also desire that relevant documents and analyses be sent to them in advance of meetings designed to get their feedback. Stakeholders expect that technical information will be shared with them at meetings. Meetings that include stakeholder feedback will be consistent with the Federal Advisory Committee Act (FACA).

There was an understanding among all the stakeholders that USACE, in concert with Reclamation, CVFPB/DWR and SAFCA, makes all final decisions, and that stakeholder input is seriously considered in their decisions-making.

The Stakeholder Engagement Plan

The Stakeholder Engagement Plan consists of four venues for stakeholders to provide feedback on the Water Control Manual Update:

1. **All-Stakeholder Policy Discussions on a Quarterly Basis:** Starting in Fall of 2013 and continuing throughout the Project Alternative Models period (October 2013 – August 2014), USACE will convene all-stakeholder sessions quarterly. These meetings will provide the venue for periodic policy and technical discussions on the Manual Update. The current project milestone calendar will be distributed and discussed at each of these meetings. The sessions will be 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.

   After August 2014, USACE and its federal and non-federal partners will discuss with stakeholders the need for and frequency of similar sessions for the next phase of the Manual Update.

2. **More In-Depth Sessions for Governmental Stakeholders:** Government stakeholders are invited to attend USACE's Technical Working Group and Environmental Effects Working Group on the Manual Update. Starting in June 2013, each of the Working Groups will meet quarterly. For the In-Basin Purveyors, the Technical Working Group will be the forum within which to address basin wetness parameters.

3. **Non-Governmental Stakeholders:** SAFCA will provide two venues for non-governmental stakeholders, which are described below in (a) and (b). SAFCA has the responsibility 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 all-stakeholders meetings will provide a venue for the non-governmental stakeholders to have direct discussions with USACE, Reclamation and CVFPB/DWR.

   a. <u>Lower American River (LAR) Task Force</u>: SAFCA will provide briefings and discussions on the Manual Update at each of the Task Force meetings. The LAR Task Force meets quarterly.

   b. <u>More In-Depth Sessions for Non-Governmental Stakeholders</u>: SAFCA will hold discussions to provide more extensive information on the Manual Update to interested non-government stakeholders. The type of detailed information available to the governmental stakeholders through the USACE's Technical and Environmental Working Groups can be made available.

4. Other Conversations: If government or non-governmental stakeholders have questions or issues that are not addressed in the above venues, they are invited to contact USACE to set up a meeting through Mr. Art Ceballos at Arturo.Ceballos@usace.army.mil

Separate from the Manual Update process, Reclamation and SAFCA will jointly sponsor meetings for interested stakeholders on how to improve the cold-water pool. (The four government agencies working on the Manual Update believe improvements to the cold water pool are incidental to the main purpose of the Water Control Manual Update. However, all recognize the importance of this issue.)

Final Comments

This Assessment provides an overall framework for stakeholder participation in the Folsom Dam Water Control Manual Update. It identifies the organizations, groups and individuals with a direct interest in the Manual Update and provides stakeholder-approved Interest and Issues Statements for the six major stakeholder groupings. The discussion on common perspectives and potential tensions among the stakeholder groups can help to anticipate and resolve challenges that may arise. And finally, based on stakeholder feedback, the Assessment provides a specific Stakeholder Engagement Plan.

The Assessment and the framework it puts forward are "living documents." This means that as the stakeholders as well as the government agencies producing the Manual Update learn more, their needs might change. For example, stakeholders may want to refine their Interests and Issues Statements, or the Stakeholder Engagement Plan may need to be revised. Now there is a solid foundation from which to have those discussions and a point of departure for future changes.

As previously mentioned, it is fortunate that many of the underlying interests of the stakeholders and those agencies developing the Manual Update are similar – or at least not contradictory. These commonalities place the Manual Update on a course to substantially reduce flood risks in Sacramento while at the same time doing a better job than current operation at conserving Folsom Reservoir water for other purposes, including municipal and industrial water supply, agricultural irrigation supply, hydropower generation, fish and wildlife protection, water quality, and recreation.

The "Stakeholder Situational Assessment for Folsom Dam Water Control Manual Update" was developed and written by Susan Sherry, Executive Director, Center for Collaborative Policy, California State University Sacramento under contract to HDR Engineering, Inc. Ms. Sherry would like to thank all of the many stakeholders, USACE, Reclamation, CVFPB/DWR, SAFCA and HDR Engineering, Inc. for their thoughtful contributions to this effort.

Appendices

1. USACE Briefing Memorandum on Folsom Dam Water Control Manual Update, July 2012

2. Stakeholder Organizations and User Groups

3. Power Point Presentations from September 2012 Stakeholder Meetings

4. Power Point Presentation from February and March 2013 Stakeholder Meetings

Note Regarding Appendices 3 and 4: The information in these presentations was current as of the date listed. As the project progresses, information may evolve and change over time. For more current information, see http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomDamAuxiliarySpillway.aspx. Readers can access material on Folsom Dam Water Control Manual Update on the lower right side of the page.

Appendix 1

USACE Briefing Memorandum on Folsom Dam Water Control Manual Update

July 2012

FOLSOM DAM WATER CONTROL MANUAL UPDATE

July 18, 2012

Briefing Memorandum

Overview of the Folsom Dam Water Control Manual Update

Introduction

As directed by Congress, the U.S. Army Corps of Engineers (USACE), in collaboration with the U.S. Department of Interior Bureau of Reclamation (Reclamation), the State of California Central Valley Flood Protection Board (CVFPB), and the Sacramento Area Flood Control Agency (SAFCA) are taking steps to reduce flood risk to the Sacramento area through a variety of authorized facilities (including existing, those under construction and those yet to be constructed). These steps also include the revision of operation rules and criteria for Folsom Dam and Reservoir.

A key component to improved flood risk management for the Sacramento area is the Folsom Dam Joint Federal Project (JFP), currently under construction. The JFP will 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 when it arrives. The JFP has twin goals that simultaneously serve the specific missions of two Federal agencies. The flood risk management goal of USACE and their non-Federal partners, CVFPB and SAFCA, is to reduce flood risk in the Sacramento area in conjunction with other elements of the regional flood control system. The safety of dams goal of Reclamation is to pass the probable maximum flood (PMF) without causing failure of Folsom Dam. The PMF peak inflow is 906,000 cfs, of which, up to 314,000 cubic feet per second (cfs) will pass through the auxiliary spillway. These goals will be accomplished through construction of a gated auxiliary spillway, with a spillway crest elevation 50 feet lower in elevation than the current gated spillways on the main dam. In order to fully realize the benefits of the new auxiliary spillway, the existing water control manual (*Water Control Manual, Folsom Dam and Lake, American River, California;* USACE 1987) must be updated.

USACE is responsible for prescribing operations for flood risk management at Folsom Dam. The dam's water control manual, which includes the water control diagram and emergency spillway release diagram, is the document that stipulates the flood control operations of the dam. The water control diagram has been modified several times since Folsom Dam was constructed in 1956.

USACE, Reclamation, CVFPB, and SAFCA are seeking to minimize the risk that flood operations have been imposing on other authorized Folsom Dam project purposes since 1995, due to the 670,000 ac-ft variable operation. Congress has directed USACE to utilize a variable operation of up to 600,000 ac-ft for flood risk management purposes. An important goal of the Water Control Manual Update is to identify the use of that space in a way that conserves as much water as possible and maximizes all other project functions to the extent practicable, consistent with the flood risk management objectives of the Water Control Manual Update.

Background and Congressional Authorities

Folsom Dam and Reservoir form a multipurpose water project, constructed by USACE in 1956 and operated by Reclamation as an integrated part of the Central Valley Project (CVP). The dam and reservoir reduces flood risk for the Sacramento area while serving other project purposes including water supply (agricultural, domestic, municipal, and industrial), hydropower, fish and wildlife protection, water quality (including water temperature), recreation, and navigation.

As directed by Congress in the Flood Control Act of 1944, USACE is responsible for prescribing regulations for the use of storage allocated for flood control at Folsom Dam and Reservoir. USACE maintains a flood operations plan and Water Control Manual, last updated in 1986, that utilizes a flood control storage space of 400,000 acre-feet (ac-ft).

The 1986 flood raised concerns over the adequacy of the existing flood risk management system of the Sacramento area. These concerns led to a series of investigations and subsequent study authorizations (beginning with the 1991 American River Watershed Investigation Feasibility Report) to reduce the level of flood risk in the Sacramento area, and address the dam safety issues (safe passage of Probable Maximum Flood) at Folsom Dam. This report was followed by the American River Watershed Project, Supplemental Information Report in 1996. Although both reports recommended construction of a flood detention dam on the North Fork of the American River, Congress chose not to authorize the flood detention dam, but instead chose to rely on a series of modifications to the Folsom Dam and Reservoir along with levee improvements downstream of Folsom Dam to provide additional flood risk reduction for the Sacramento area, and to address the safety issues at Folsom Dam.

In 1995, SAFCA entered into an agreement with Reclamation to provide additional flood risk reduction for the Sacramento area. In accordance with the 1995 agreement, Reclamation operates Folsom Dam and Reservoir to provide additional flood storage space in the reservoir on an as-needed basis. This operations plan, commonly referred to as a 400,000 - 670,000 ac-ft creditable space plan, states that beyond the 400,000 ac-ft (regulated by the USACE) up to an additional 270,000 ac-ft, for a total storage of 670,000 ac-ft, may be used for flood control in Folsom Reservoir based on creditable storage from upstream reservoirs. According to the 1995 agreement, SAFCA would purchase water to replace any water storage shortage caused by the creditable storage operation. SAFCA also agreed to fund several physical improvements to Folsom Dam and the downstream river channel to offset the risk of reduced reservoir storage levels. These included modifications to the temperature control shutters on the intakes to Folsom Dam's power penstocks; boat ramp extensions; and shallow floodplain habitat improvements in the lower portion of the American River.

In the Water Resources Development Act of 1996 (WRDA 1996) Congress directed Reclamation to continue the creditable 400,000 - 670,000 ac-ft operation and to extend the 1995 agreement with SAFCA until such time as a comprehensive flood damage reduction plan for the American River watershed has been implemented. WRDA 1996 and the Energy and Water Development Appropriations Act of 2002 established a new cost-sharing formula for the creditable flood control option; SAFCA shall be responsible for 25 percent of any costs incurred and Reclamation is responsible for the remaining 75 percent.

The Water Resources Development Act of 1999 (WRDA 99), Section 101, states that, upon completion of what is now the JFP, the variable space allocated to flood control within the reservoir shall be reduced from the current operating range of 400,000-670,000 ac-ft to 400,000-600,000 ac-ft. Additionally, WRDA 99 states that USACE, in cooperation with Reclamation, shall update the flood management plan for Folsom Dam to reflect the operational capabilities created by authorized improvements and improved weather forecasts based on the Advanced Hydrologic Prediction System of the National Weather Service. In addition, WRDA 99, Section 556 states that USACE, in consultation with the State of California and local water resources agencies, shall undertake a study of increasing surcharge flood control storage and there is to be no increase in conservation storage at the Folsom Dam Reservoir. This section also authorized the American River Watershed, Long Term Study 2002, which recommended the Folsom Dam raise.

The Energy and Water Development Appropriations Act of 2004 authorized raising Folsom Dam by seven feet for flood risk management purposes (Dam Raise) as well as construction of a permanent bridge to replace Folsom Dam Road, which was closed to public access in 2001.

Shortly thereafter, the Energy and Water Development Appropriations Act of 2006 (2006 EWDAA) directed USACE and Reclamation to collaborate to maximize flood damage reduction and address dam safety at Folsom Dam. The 2006 EWDAA directed the USACE and Reclamation to consider reasonable modifications to the existing authorized activities, including an auxiliary spillway. This collaboration resulted in the JFP at Folsom Dam.

In March of 2007, the Folsom Dam Modification and Dam Raise, Post Authorization Change Report (2007 PACR) was completed and recommended the JFP (which addressed both USACE flood damage reduction project and Reclamation's dam safety issues) and the 3.5-foot Dam Raise (which addresses USACE's flood damage reduction only). The JFP includes a six submerged tainter gate structure and an auxiliary spillway. The 3.5-foot Dam Raise includes upgrades to the three emergency spillway tainter gates at the dam, and various dam safety features at and around Folsom Dam. The results of the 2007 PACR are anticipated to reduce flood risk downstream generally equivalent to the flood risk reduction intended to be provided by the Folsom Modification Project and the 7 foot Dam Raise. The new auxiliary spillway is now effectively the plan referred to in WRDA 99 subsection (A). Authorization to construct the auxiliary spillway and dam safety features were included in the Water Resources Development Act of 2007 (WRDA 2007).

Water Control Manual Update Purpose

The purpose of the analysis is to develop the technical information required to update the existing WCM, namely, *Water Control Manual, Folsom Dam and Lake, American River, California* (USACE 1987).

SPK will use the findings from the analysis to:

- Revise operation rules for Folsom Dam to reduce flood risk, and
- Integrate NWS forecasts into flood operation rules.

The new operation rules will be developed to, at a minimum, meet the following three (3) primary dam safety and flood risk management objectives of the Manual Update partners:

1. Pass the Probable Maximum Flood (PMF) while maintaining 3 feet of freeboard below the top of dam to stay within the Dam Safety constraints of Reclamation.

2. Control a 1/100 annual chance flow (i.e. "the 100-year flood") to a maximum release of 115,000 cubic feet per second (cfs) to support Federal Emergency Management Agency (FEMA) levee accreditation along the American River, by SAFCA.
3. Control a 1/200 annual chance flow (i.e. "the 200-year flood"), as defined by criteria set by the State of California Department of Water Resources (DWR), to a maximum release of 160,000 cfs, when taking into account all the authorized modifications within the American River Watershed.

Key considerations in the development of the water control plan include dam safety requirements; Endangered Species Act (ESA) requirements; other fish and wildlife needs; water quality requirements; and water supply, water rights permit terms and conditions, power generation, and recreational needs. In its development, the Manual Update will conform as equitably as possible with other authorized Folsom Dam Project purposes and operational criteria, including seasonal downstream flow and temperature requirements specified by National Marine Fisheries Service (NMFS) Biological Opinion. The Manual Update will also consider fishery requirements for ramping rates for releases from Folsom Dam.

The findings of the Water Control Manual Update will be used to define the dam's new operational rules. USACE will then update the existing water control manual, namely, *Water Control Manual, Folsom Dam and Lake, American River, California* (USACE 1987). This update will include a new water control diagram and emergency spillway release diagram. The Water Control Manual Update will be completed prior to completion of the auxiliary spillway, and will be accompanied by appropriate environmental documentation that will describe the decision-making process that was followed to arrive at the recommended changes to flood control operations.

Future updates to the water control manual are expected as additional modifications are completed. Future modifications would include the authorized 3.5-foot dam raise which will provide additional space for flood operations, and future downstream levee improvements (erosion protection) allowing for increased releases.

Partner Roles and Responsibilities

There are four partnering agencies on this Water Control Manual Update:

- U.S. Army Corps of Engineers: USACE is the lead Federal agency for the Water Control Manual Update, as well as the National Environmental Policy Act (NEPA) lead agency. USACE will prepare all necessary documents and update the water control manual in collaboration with the other partners.

- U.S. Department of Interior Bureau of Reclamation: Reclamation is the Federal partner responsible for operation and maintenance of Folsom Dam and Reservoir. Reclamation is also a cosignatory of the interim agreement with SAFCA and provides technical and policy support to the Manual Update. As operator of Folsom Dam, Reclamation will also be the cosignatory on the updated water control manual.

- Central Valley Flood Protection Board: The State legal entity for the JFP is the Central Valley Flood Protection Board (CVFPB). CVFPB is a non-Federal cost sharing partner with USACE for the JFP and the Water Control Manual Update. The project operational portion of the CVFPB for the JFP is represented by the State of California Department of Water Resources (DWR). CVFPB is also the lead agency responsible for the California Environmental Quality Act (CEQA) and signatory of the decision document for the State. DWR provides policy and technical expertise and staff to support the CVFPB's activities associated with the Manual Update.

For JFP, DWR collaborates State's interest in Oversight Management Group, Change Management Board, Project Management Group, Integration Team and Project Delivery Team (PDT). For the Water Control Manual Update, DWR collaborates the State's interest in Project Alternative Solutions Study (PASS), Mid-level Management Group and PDT. Other roles and responsibilities for the State (CVFPB/DWR) are described in the Project Cooperation Agreement and the subsequent amendments between USACE, the State of California and SAFCA for Construction of the American River Watershed, California (Folsom Dam Modifications)

- Sacramento Area Flood Control Agency: SAFCA is the local cost sharing partner with CVFPB for the JFP and the Water Control Manual Update, a CEQA responsible agency, and cosignatory of the interim agreement with Reclamation.

Overview of the Engineering Modeling Process

The USACE engineering modeling process has three primary goals:

- To produce an updated water control manual for Folsom Dam that includes an updated Water Control Diagram and Emergency Spillway Release Diagram.
- To produce data that supports the decision making process for identifying the recommended plan.
- To produce data that supports fulfillment of the Water Control Manual Update partners' policy and legal requirements, such as compliance with NEPA, CEQA, and other laws and regulations.

Operators must be able to rely on the updated water control manual in flood situations. Each point of the manual must be studied and developed in detail, to ensure successful operation of the Dam for flood risk management and dam safety purposes.

Considerations in this modeling effort include the non-federal sponsors' flood management goals of successful operation of the dam and reservoir, to route both a one percent chance event (1/100 inflow design event) sustaining a release of 115,000 cubic feet per second (cfs), and a 0.5% chance event (1/200 inflow design event), sustaining releases at 160,000 cfs. The engineering models are being used to simulate hydrologic and hydraulic conditions on the American River as they relate to the Dam and Reservoir only. The analysis of risk and uncertainty, as related to inflow hydrology, operational variation, and geotechnical issues are not considered in these models, but will be addressed elsewhere.

The emergency spillway release diagram's purpose is operational consideration of dam safety. Reclamation is assisting USACE with an operations plan that will pass a Probable Maximum Flood (PMF) within 3' of freeboard of the top of dam.

USACE uses HEC-ResSim, developed by USACE's Hydraulic Engineering Center, for reservoir routing applications and development of the Reservoir Operation Sets (ROSs) to be evaluated as part of the Water Control Manual Update. HEC-RAS and FLO-2D will be used to perform floodplain analyses.

Reclamation and the DWR use CalSim II to evaluate CVP and SWP contract deliveries. Comparisons of period of record (1921 – 2002) model output from HEC-ResSim and CalSim II will be used to determine how a particular ROS could be modified to better meet CVP/SWP beneficial use criteria. These comparisons are referred to as Tier 1 analyses.

Fundamental engineering questions for USACE and partners to answer include:

- How will the JFP be operated in a flood event?
- What does the guide curve look like, including both the fall drawdown and spring refill components?
- How will the operation plan incorporate the use of forecasts from National Weather Service?
- How will the new plan include creditable storage considerations and the upstream reservoirs' capability for capturing inflow?
- How will accumulated precipitation in the basin and other basin wetness indices be incorporated into the updated plan?

Environmental Analyses Summary

The evaluation of environmental effects will be focused on changes that flood management operation alternatives would have on other authorized Folsom Dam Project purposes, including water supply, hydropower, water quality, fish and wildlife protection, recreation, and navigation.

USACE has prepared a Water Resources Modeling Work Plan describing the modeling strategy for integrating output data between HEC-ResSim and CalSim II. The Water Resources Modeling Work Plan identifies the approach for evaluating the potential project impacts to power generation, temperature, and other environmental considerations. As outlined within that plan, the following evaluations, in addition to the Tier 1 analyses noted above, will be conducted:

- Tier 2 Analysis – An assessment of metrics related to SWP/CVP beneficial water uses as reflected in output from CalSim II. The Tier 2 analysis will only be completed on selected operational alternatives that have been screened and brought forward as potential with-project conditions.

- Tier 3 – Analysis of temperature, water quality, fish mortality, sediment transport, power generation, and recreation. As with the Tier 2 assessment, the Tier 3 analysis will only be completed on selected operational alternatives that have been screened and brought forward as potential with-project conditions.

The environmental effects analyses will be based on comparisons between computer model simulations of the alternatives, including the No Action/Future Without-Project Condition (FWOP), and baseline/existing conditions. The existing condition baseline flood management operation will reflect the current 400,000 – 670,000 ac-ft water control plan without the auxiliary spillway in place. The No Action/FWOP will reflect a 400,000 – 670,000 ac-ft operation similar to the current plan, but with the auxiliary spillway in place.

There is interest from certain stakeholders to compare project alternatives to a historic reference condition that reflects flood management operations prior to the implementation of creditable space storage operations. This reference condition would reflect operations utilizing the USACE 1986 WCD with a maximum flood storage capacity of 400,000 ac-ft at Folsom Dam. The need for carrying out full environmental effects analyses against this reference condition will be determined during the scoping process.

Effects, both adverse and beneficial, will be identified and quantified to the appropriate extent. Adverse effects will be avoided, minimized, or mitigated to the extent practicable.

Depending on results of the environmental effects analyses, formal consultation with U.S. Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Service (NMFS) under Section 7 of the Endangered Species Act (ESA) may be necessary if adverse effects to federally protected species could occur as a result of implementation of the selected flood management operations alternative. Likewise, consultation with California Department of Fish and Game (CDFG) would be necessary if the selected alternative could have adverse effects on state-protected species. Along with NEPA, CEQA, ESA, and the California Endangered Species Act, all other applicable Federal, state, and local laws will be complied with.

NEPA and CEQA public involvement efforts will include hosting public scoping meetings, providing study information and status updates on a study website and through periodic workshops, and soliciting comments on the Draft and Final NEPA and CEQA documents through public meetings, mailings, and email.

Appendix 2

Stakeholder Organizations and User Groups Folsom Dam Water Control Manual Update

Stakeholder Organizations and User Groups

Regional Flood Management Organizations	**In-Basin Purveyors/ Water Suppliers**
Reclamation District 1000	County of Sacramento - Water Agency
City of West Sacramento	City of Folsom - Utilities Dept.
DWR Maintenance Area 4	Placer County Water Agency
Yolo Basin Foundation	El Dorado Irrigation District
Central Valley Flood Control Association	El Dorado Water and Power Authority
American River Flood Control District	Sacramento Suburban Water District
DWR Maintenance Area 9	City of Sacramento - Utilities Dept.
Extreme Precipitation Symposium	County of Sacramento - Engineering & Admin.
County of Sacramento	City of Roseville - Utilities Dept.
	San Juan Water District
Regional Environmental Interests	El Dorado County Water Agency
Save the American River Association (SARA)	Carmichael Water District
The Nature Conservancy	Sacramento Municipal Utility District
California Waterfowl Association	Carmichael Water District
League Women Voters	Sacramento Municipal Utility District
Fish User Group (5 Individuals)	Carmichael Water District
CA Fly Fishers Unlimited	Sacramento Municipal Utility District
Sacramento Water Forum	
Friends of the River (FOR)	**CVP / SWP Contractors**
Sierra Club	Central Valley Project Water Association
Planning and Conservation League	Westlands Water District
Ducks Unlimited	Kern County Water Agency
Environmental Council of Sacramento	Metropolitan Water District
Federation of Fly Fishers	San Joaquin River Exchange Contractors
Audubon Society	State Water Project Contractors Association
California - American Water Company	State & Federal Contractors Water Agency
Golden State Water Company	San Luis Delta Mendota Water Authority
Sacramento Regional Water Authority	Santa Clara Valley Water District
	Contra Costa Water District
Regional Recreation Interests	Northern California Water Association
State Department of Parks and Recreation	Santa Clara Valley Water District
Folsom Lake Marina	East Bay Municipal Utilities District
River Rat Rentals	
Sac State Aquatic Center	**Electric Power Utilities and Their Associations**
Adventure Sports	Western Area Power Administration
California Canoe and Kayak	Sacramento Municipal Utility District
Current Adventures	Northern California Power Agency
Sacramento Area Bicycle Advocates	El Dorado Water and Power Authority
Gold Fields District, State Parks	
Larson Marine	
El Dorado Co. River Recreation Department	
Sacramento County Parks	
River City Paddlers, Inc.	
American Raft Rental	
Adventure Connections	

Appendix 3

Power Point Presentation
September 2012 Stakeholder Meetings

Note Regarding Appendix 3: The information in this presentation was current as of the date listed. As the project progresses, information may evolve and change over time. For more current information, see http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomDamAuxiliarySpillway.aspx. Readers can access material on Folsom Dam Water Control Manual Update on the lower right side of the page.

Folsom Dam Water Control Manual Update

Stakeholder Discussion

September 26, 2012

Tsakopoulos Library, Downtown Sacramento

Central Valley Flood Protection Board

SAFCA

Sacramento Area Flood Control Agency

Reclamation
Mid-Pacific Region
Sacramento, CA

US Army Corps of Engineers
BUILDING STRONG®

WELCOME AND INTRODUCTIONS

PURPOSE OF WATER CONTROL MANUAL UPDATE

(Manual Update)

PURPOSE OF MANUAL UPDATE

- Revise operation rules for Folsom Dam to reduce flood risk based on the capabilities of the Folsom Joint Federal Project (JFP)
- Reflect operational capabilities created by improved weather forecasts
- Potentially reduce the volume of flood control reservation in Folsom Reservoir at any particular time by comparison to the operations that have been in effect since 1995

DISCUSSION OVERVIEW

* Purpose of discussion
* Flood Risk Reduction for Sacramento Area
* Folsom Dam Background
* Current Project Activities
* Current Project Status
* Next Steps
* Questions and Discussion

PURPOSE OF DISCUSSION

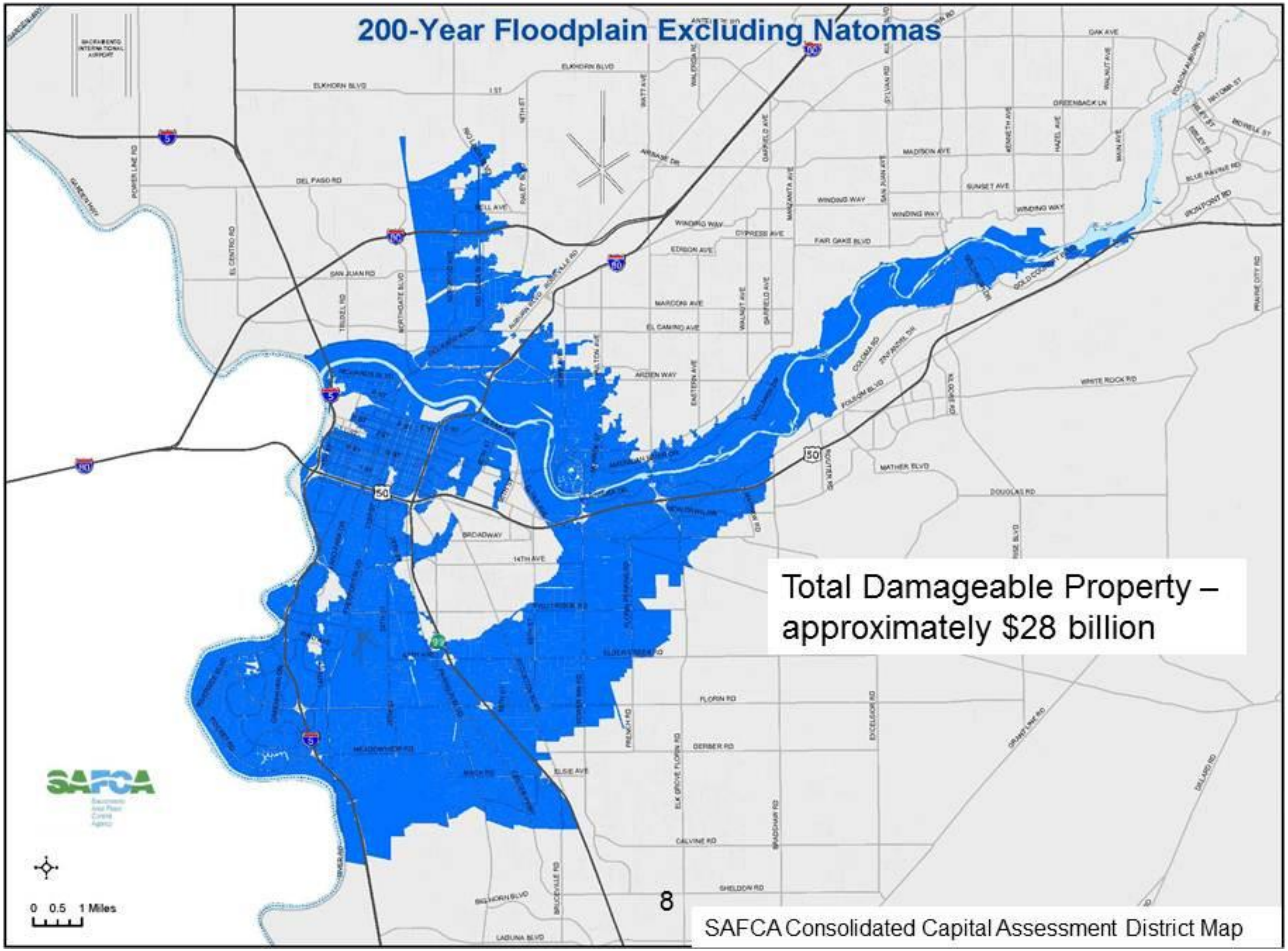
* Engage key stakeholders in the policy and technical work of the Manual Update.

* Understand stakeholders' interests, concerns and suggestions

*Discuss how best to involve stakeholders in future

FLOOD RISK REDUCTION IN SACRAMENTO AREA

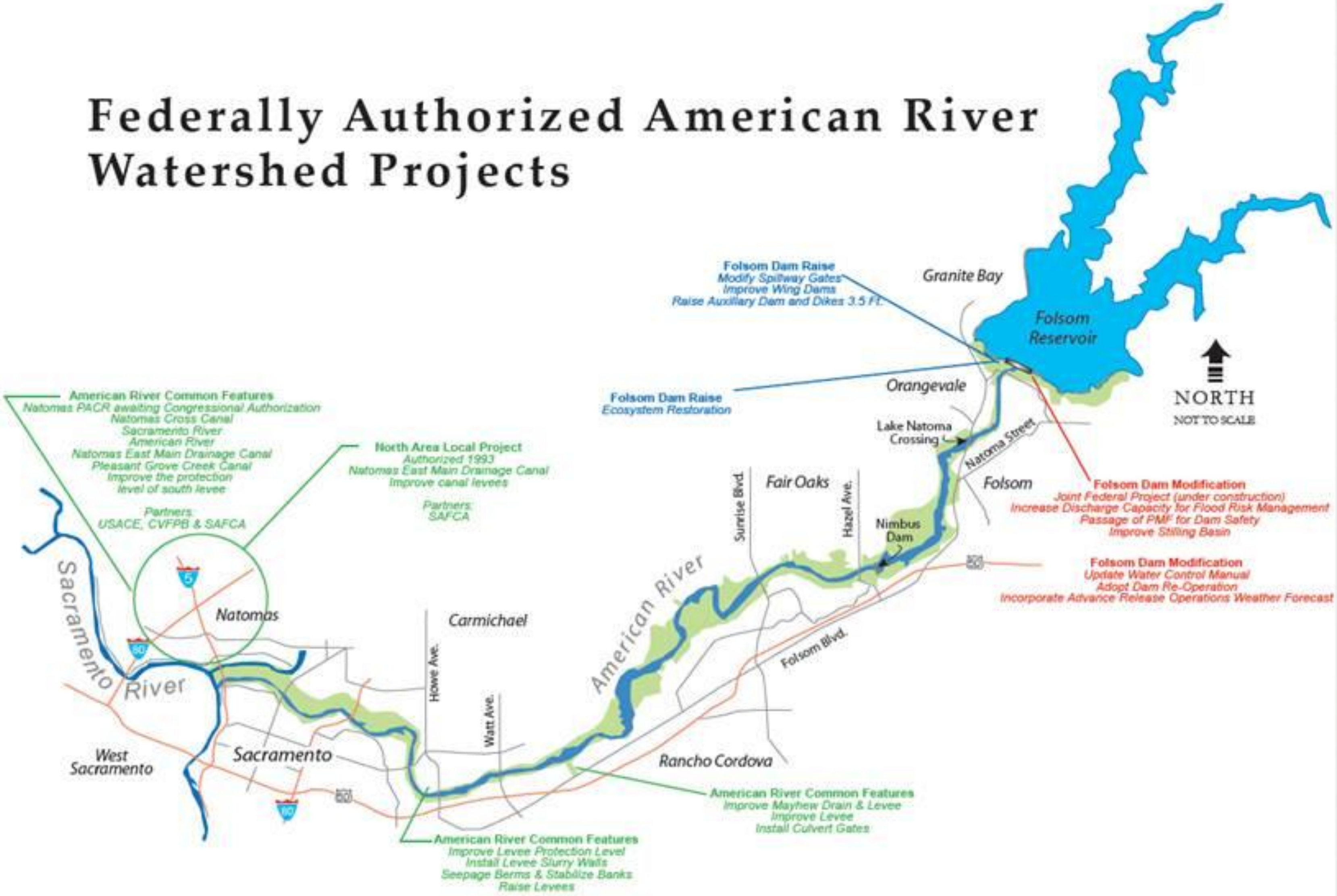
200-Year Floodplain Excluding Natomas



Total Damageable Property – approximately $28 billion

SAFCA Consolidated Capital Assessment District Map

Federally Authorized American River Watershed Projects



Folsom Dam Raise
Modify Spillway Gates
Improve Wing Dams
Raise Auxiliary Dam and Dikes 3.5 Ft.

Folsom Dam Raise
Ecosystem Restoration

American River Common Features
Natomas PACR awaiting Congressional Authorization
Natomas Cross Canal
Sacramento River
American River
Natomas East Main Drainage Canal
Pleasant Grove Creek Canal
Improve the protection
level of south levee

Partners:
USACE, CVFPB & SAFCA

North Area Local Project
Authorized 1993
Natomas East Main Drainage Canal
Improve canal levees

Partners:
SAFCA

Folsom Dam Modification
Joint Federal Project (under construction)
Increase Discharge Capacity for Flood Risk Management
Passage of PMF for Dam Safety
Improve Stilling Basin

Folsom Dam Modification
Update Water Control Manual
Adopt Dam Re-Operation
Incorporate Advance Release Operations Weather Forecast

American River Common Features
Improve Mayhew Drain & Levee
Improve Levee
Install Culvert Gates

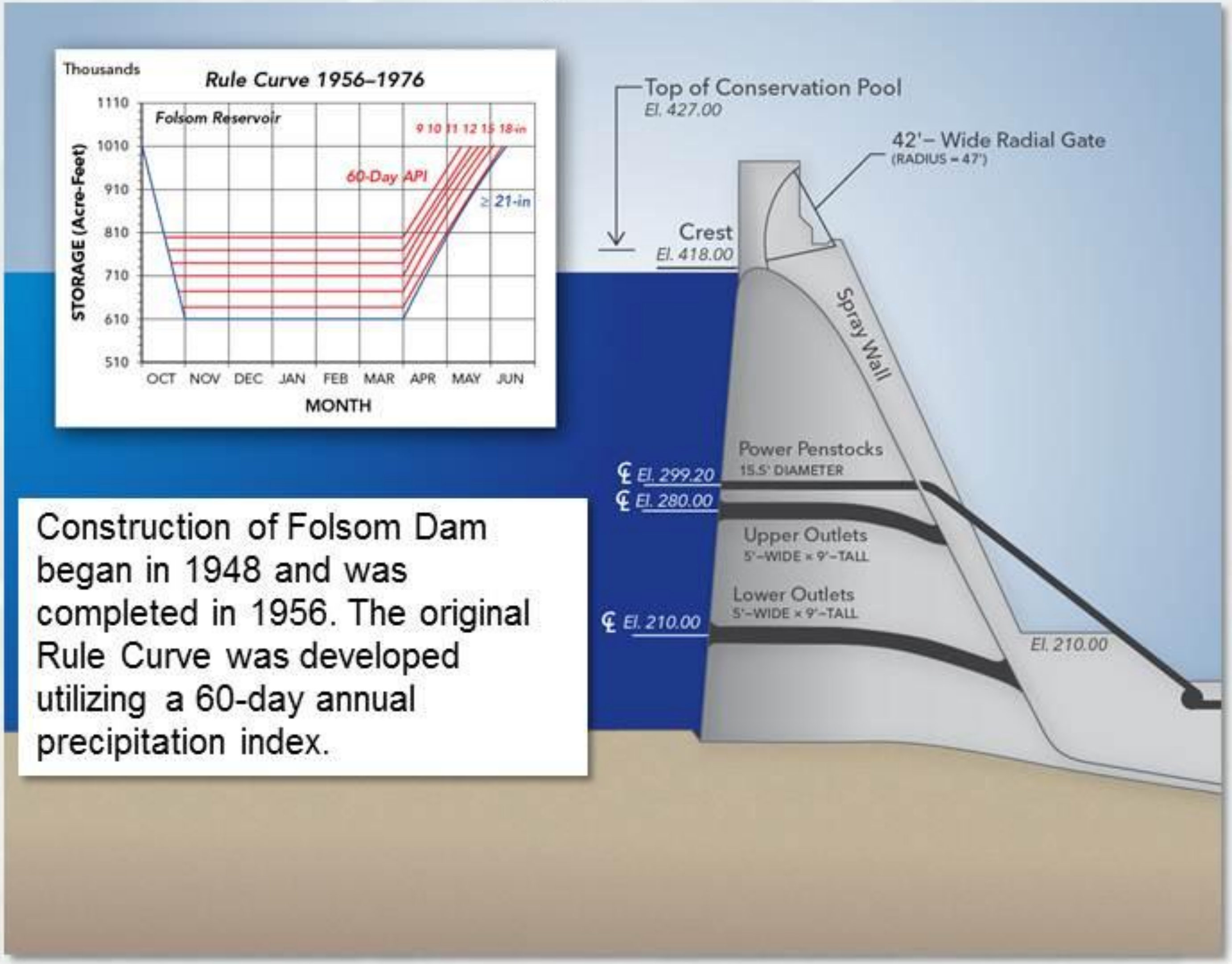
American River Common Features
Improve Levee Protection Level
Install Levee Slurry Walls
Seepage Berms & Stabilize Banks
Raise Levees

FOLSOM DAM BACKGROUND

Past and Present

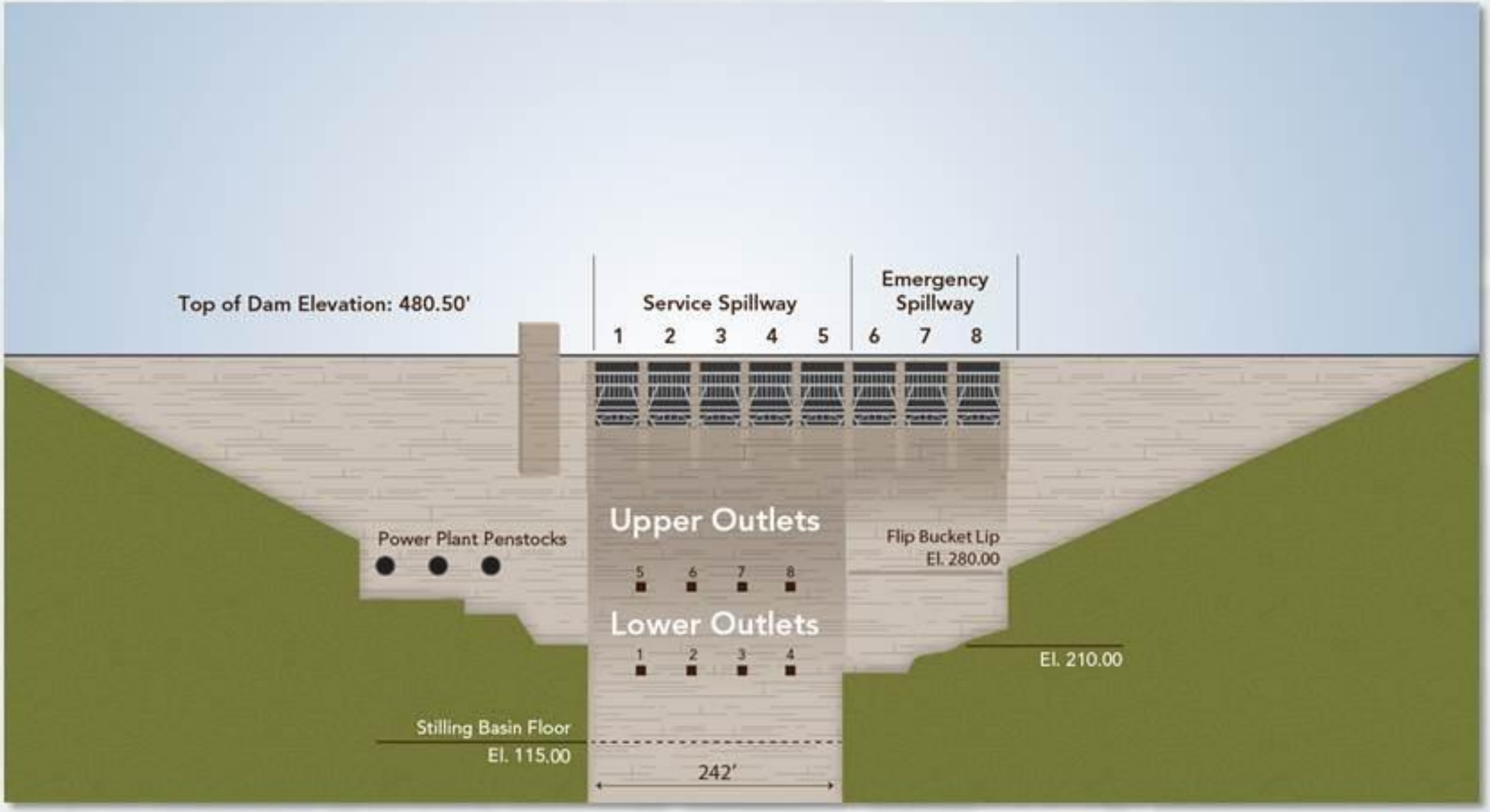
- Construction
- Modifications – Past, Present, Future
- Rule Curve – Past, Present, Future

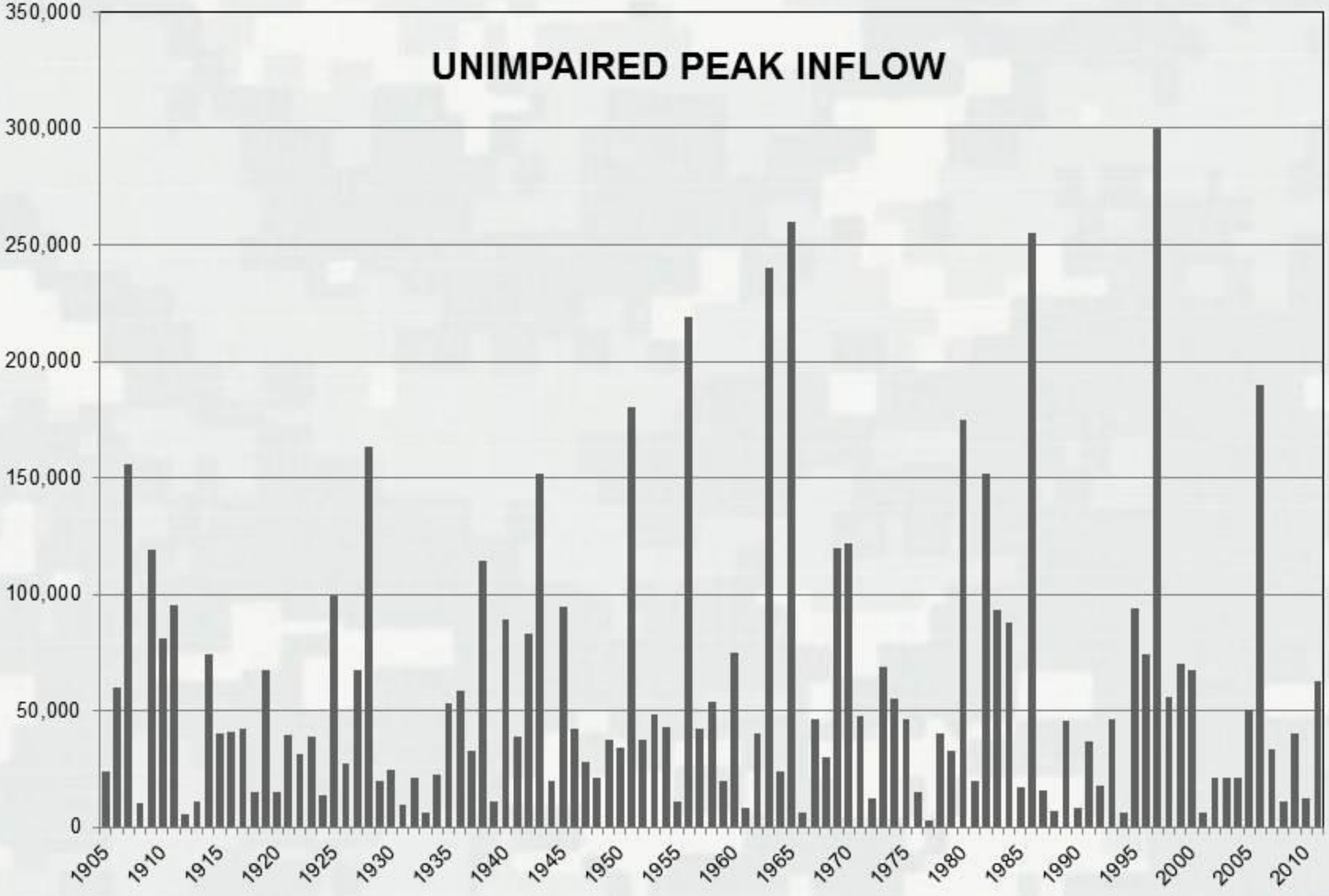
Folsom Dam, As Built - 1956



Construction of Folsom Dam began in 1948 and was completed in 1956. The original Rule Curve was developed utilizing a 60-day annual precipitation index.

Folsom Dam, As Built - 1956

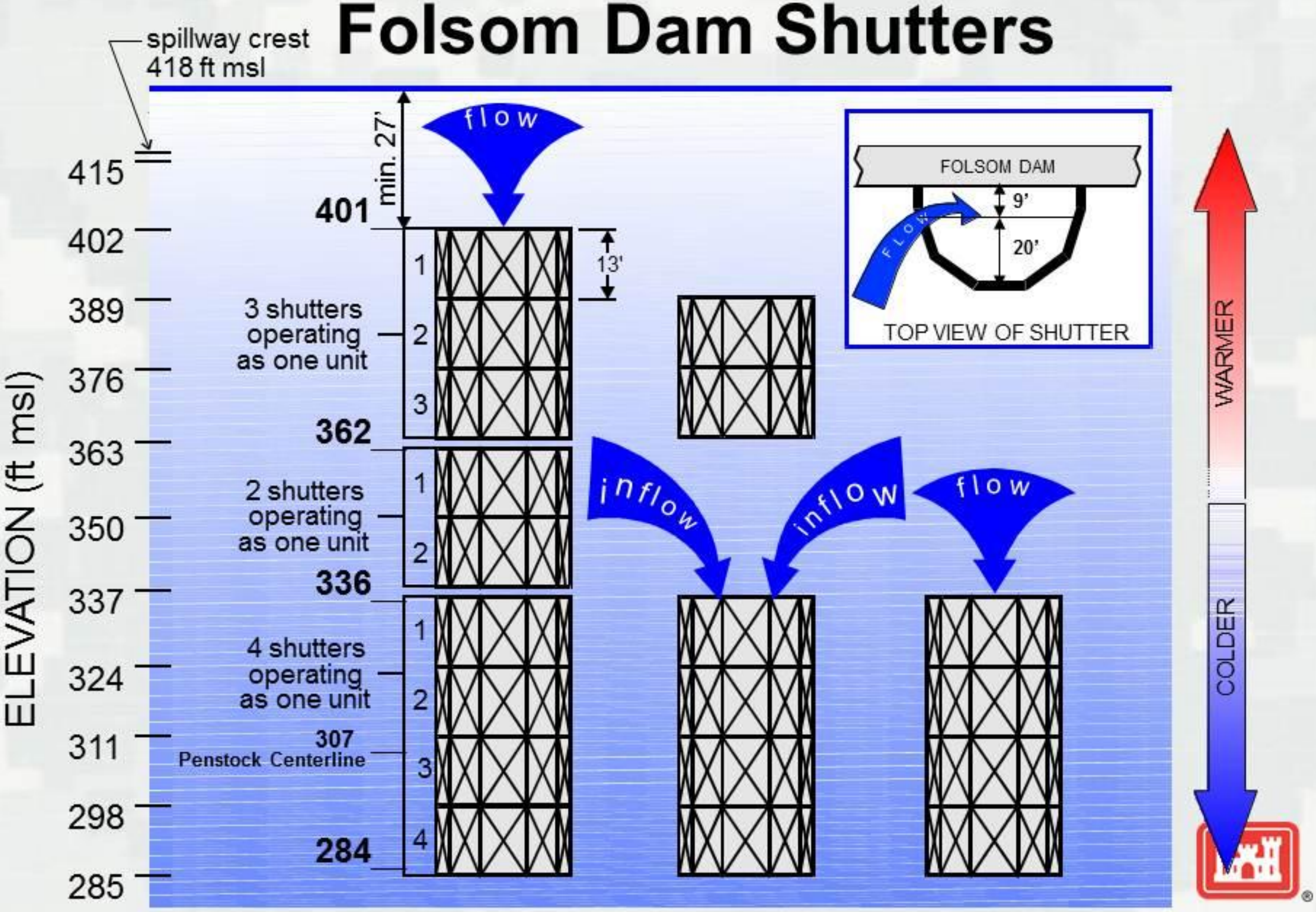




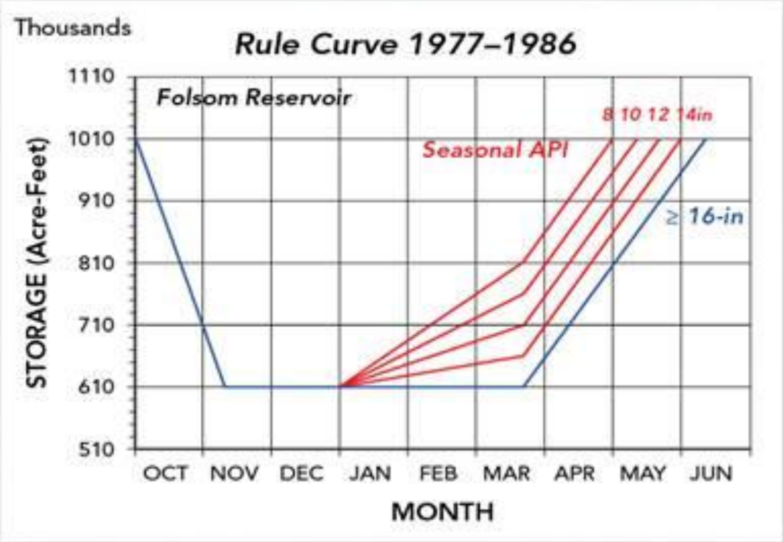
BUILDING STRONG®

Temperature Shutters on Penstocks for Selective Withdrawal

Folsom Dam Shutters

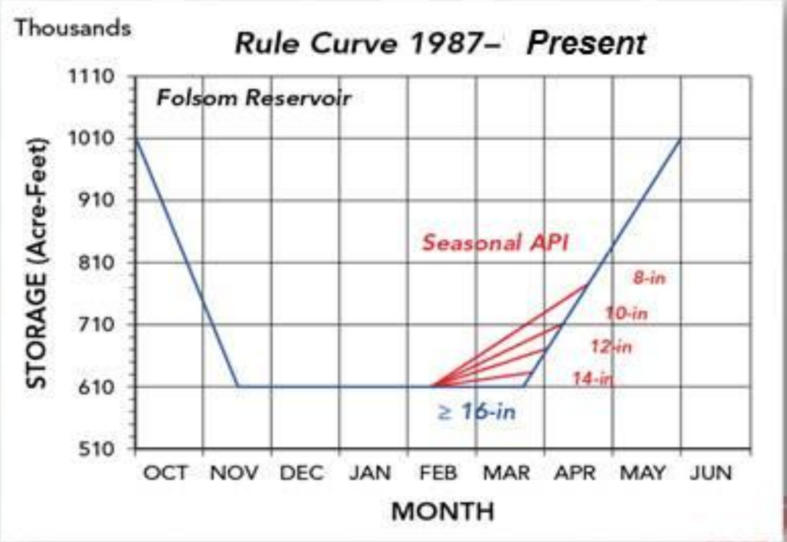


Water Control Manual Updates

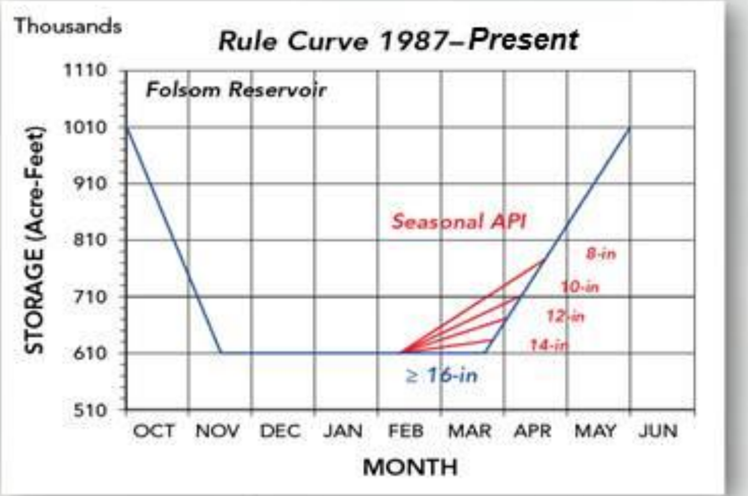


1986 Rule Curve changes include modification to reservoir filling curves starting on February, again based on seasonal precipitation and hydrologic conditions.

The Water Control Manual has been updated twice since construction. 1977 Rule Curve changes include reduction of the Seasonal API and initiation of reservoir filling based on seasonal hydrologic conditions.

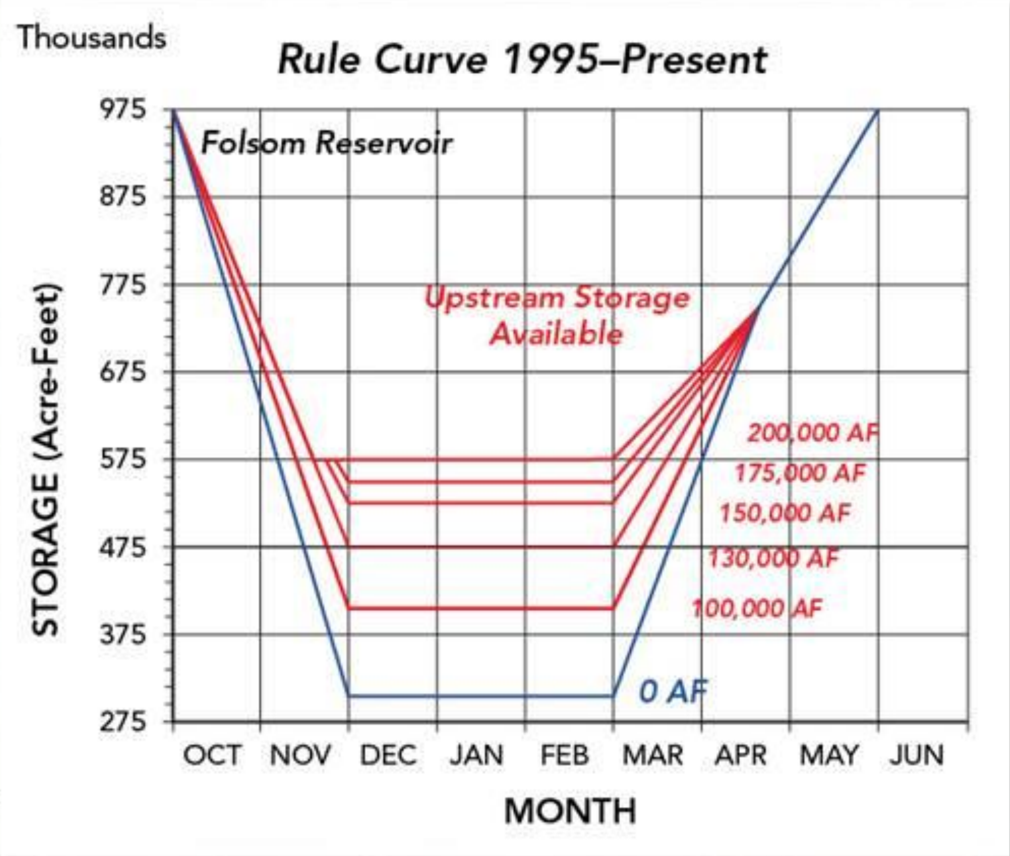


Current Operations



Sacramento Area Flood Control Agency

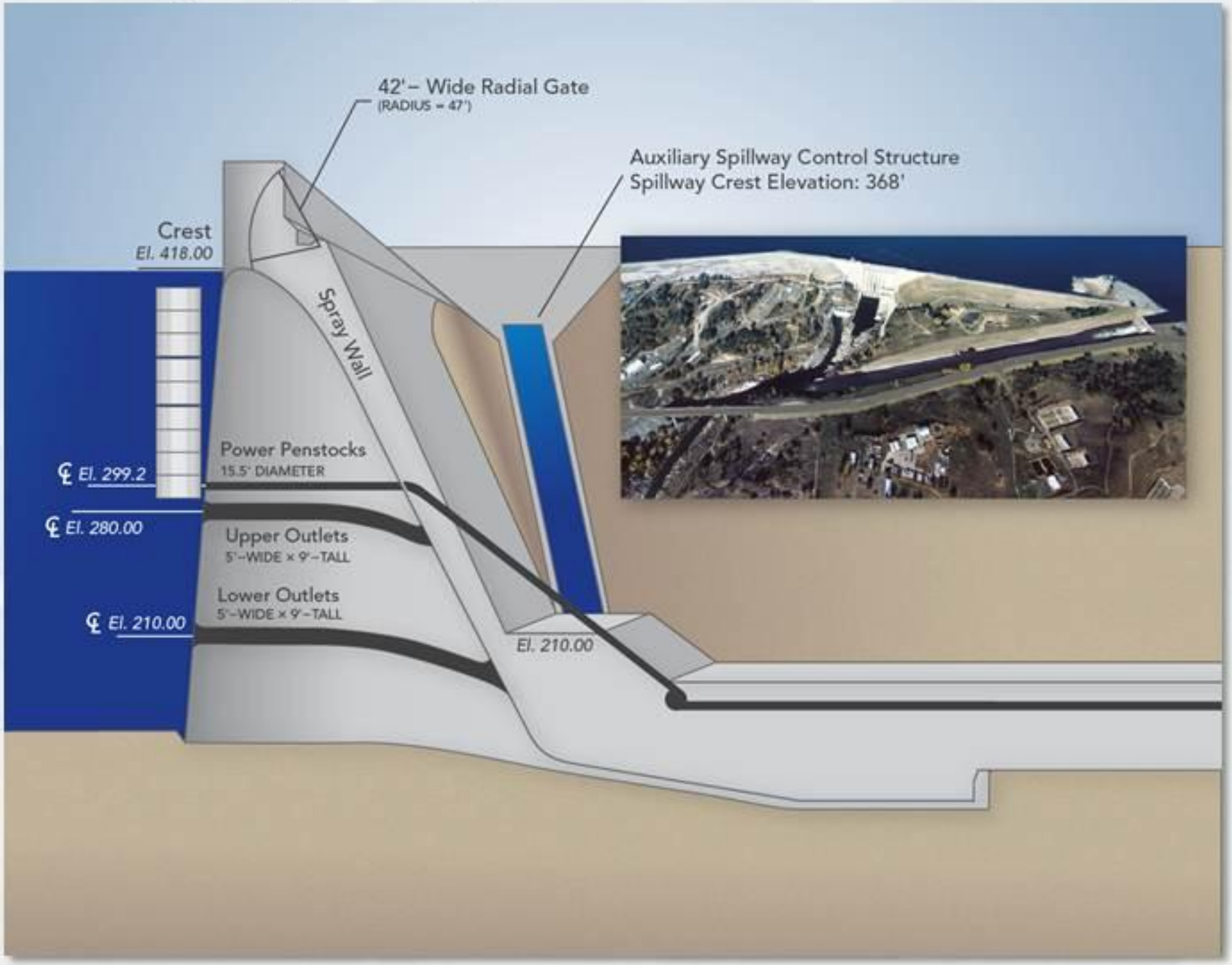
Reclamation
Mid-Pacific Region
Sacramento, CA

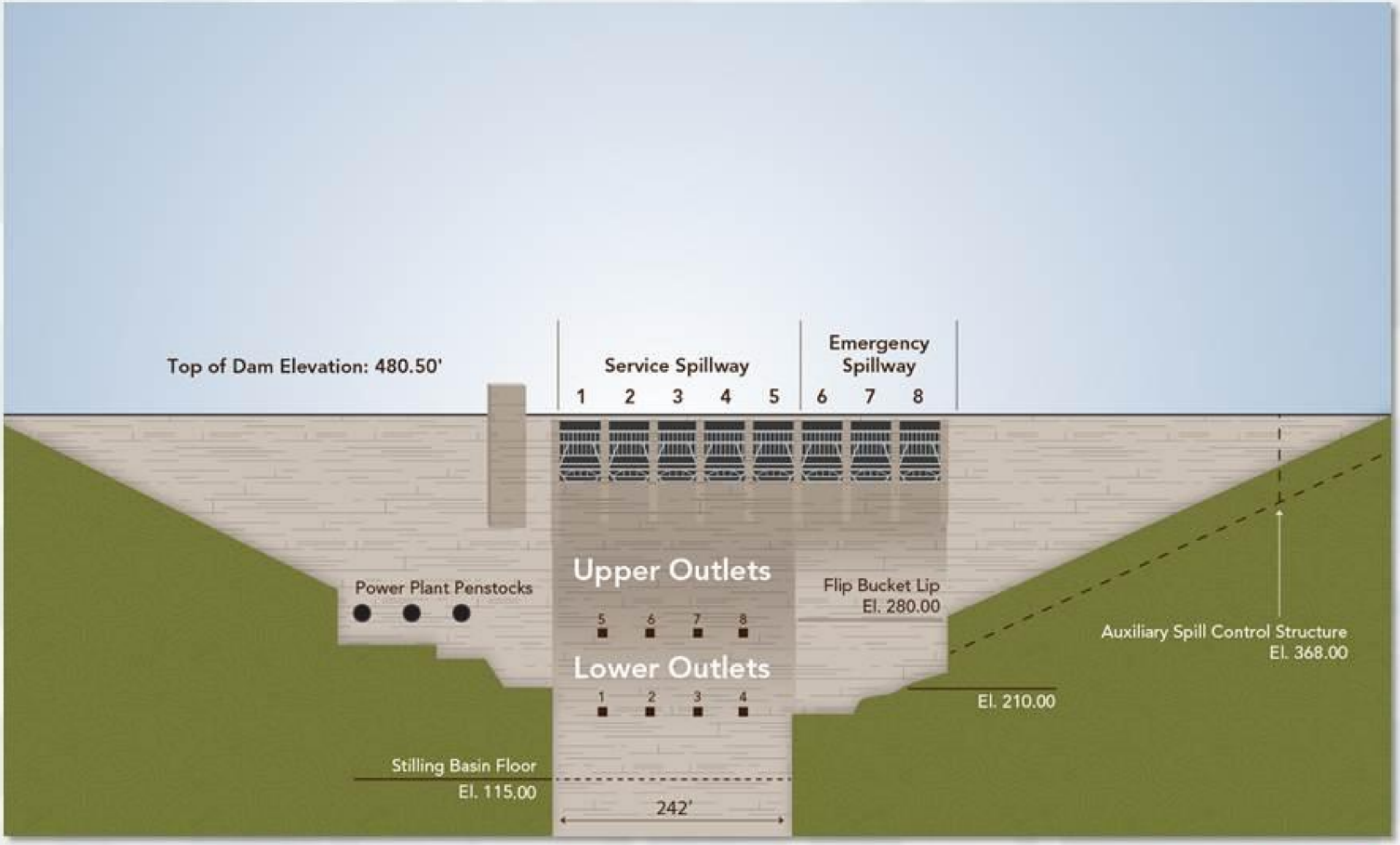


US Army Corps
of Engineers
Sacramento District

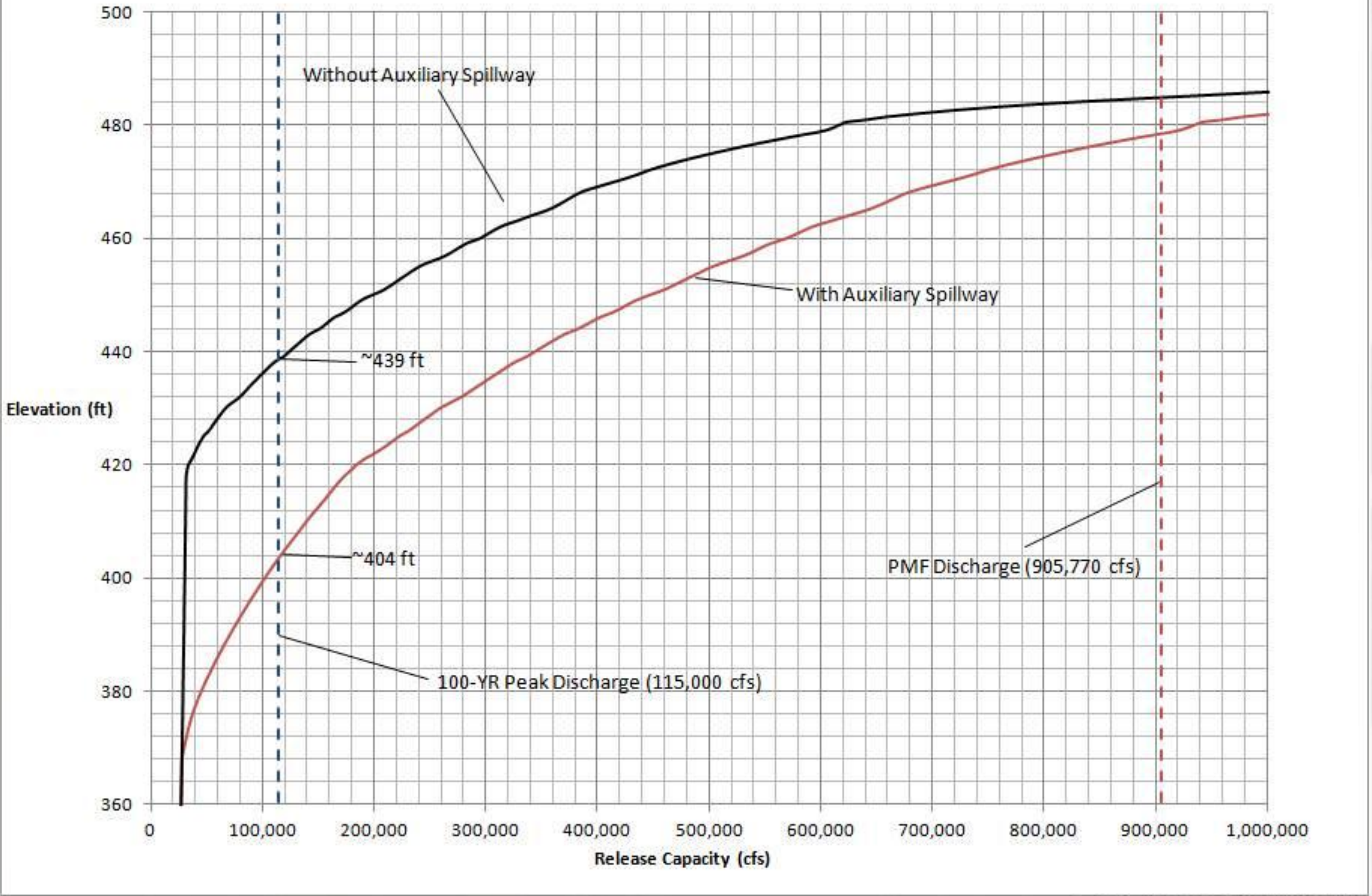
*Requirements of both rule curves are met as part of current operations

Auxiliary Spillway – Current Construction




Top of Dam Elevation: 480.50'
Service Spillway
Emergency Spillway
1
2
3
4
5
6
7
8
Upper Outlets
Power Plant Penstocks
Flip Bucket Lip
El. 280.00
5
6
7
8
Auxiliary Spill Control Structure
El. 368.00
Lower Outlets
El. 210.00
1
2
3
4
Stilling Basin Floor
El. 115.00
242'

Total Release Capacity - With and Without Auxiliary Spillway



Dam Raise – Future Construction

AMERICAN RIVER WATERSHED PROJECT
FOLSOM MODIFICATION AND
FOLSOM DAM RAISE PROJECT
POST AUTHORIZATION CHANGE REPORT

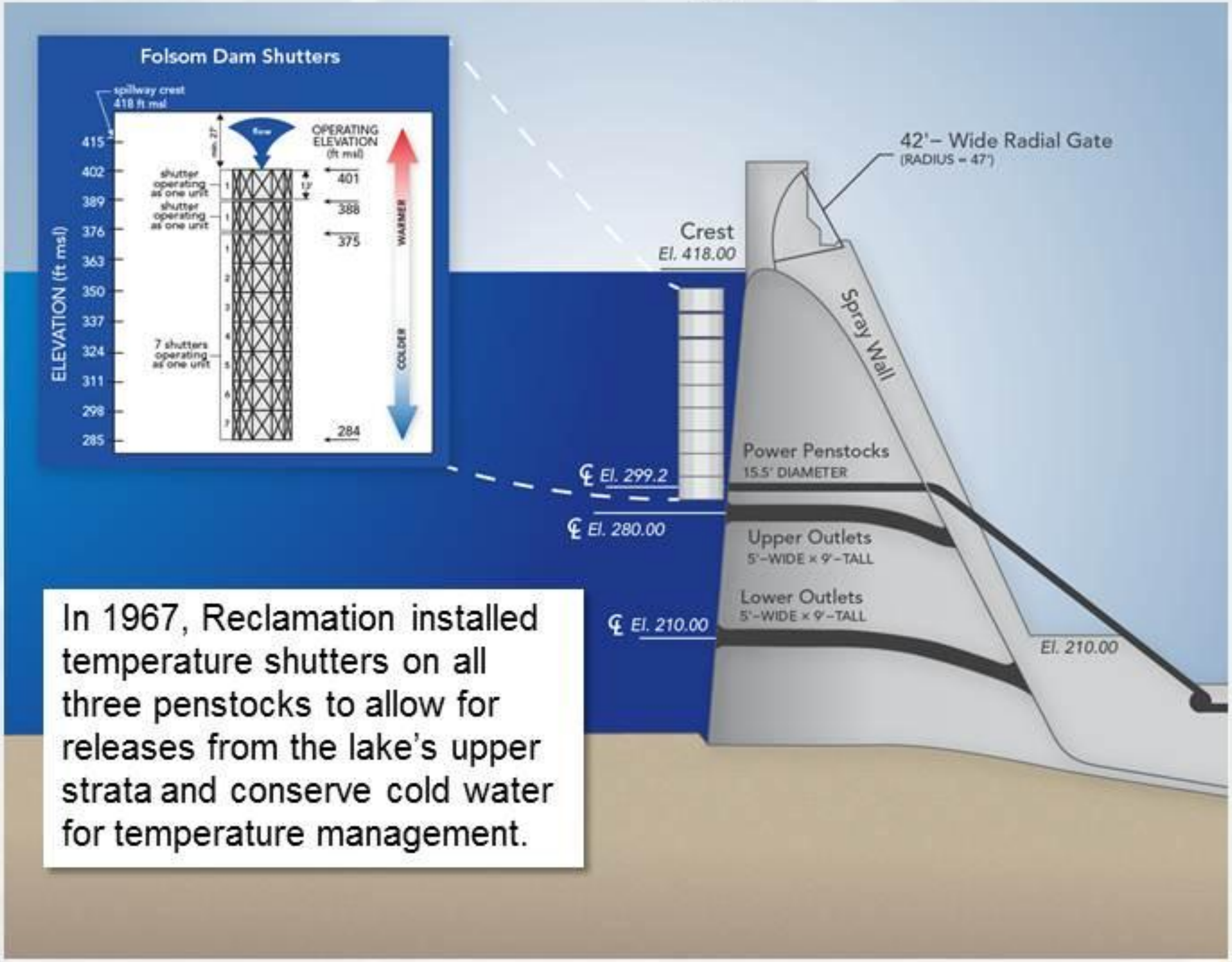
PROJECT FEATURES MAP

MARCH 2007

PLATE 2

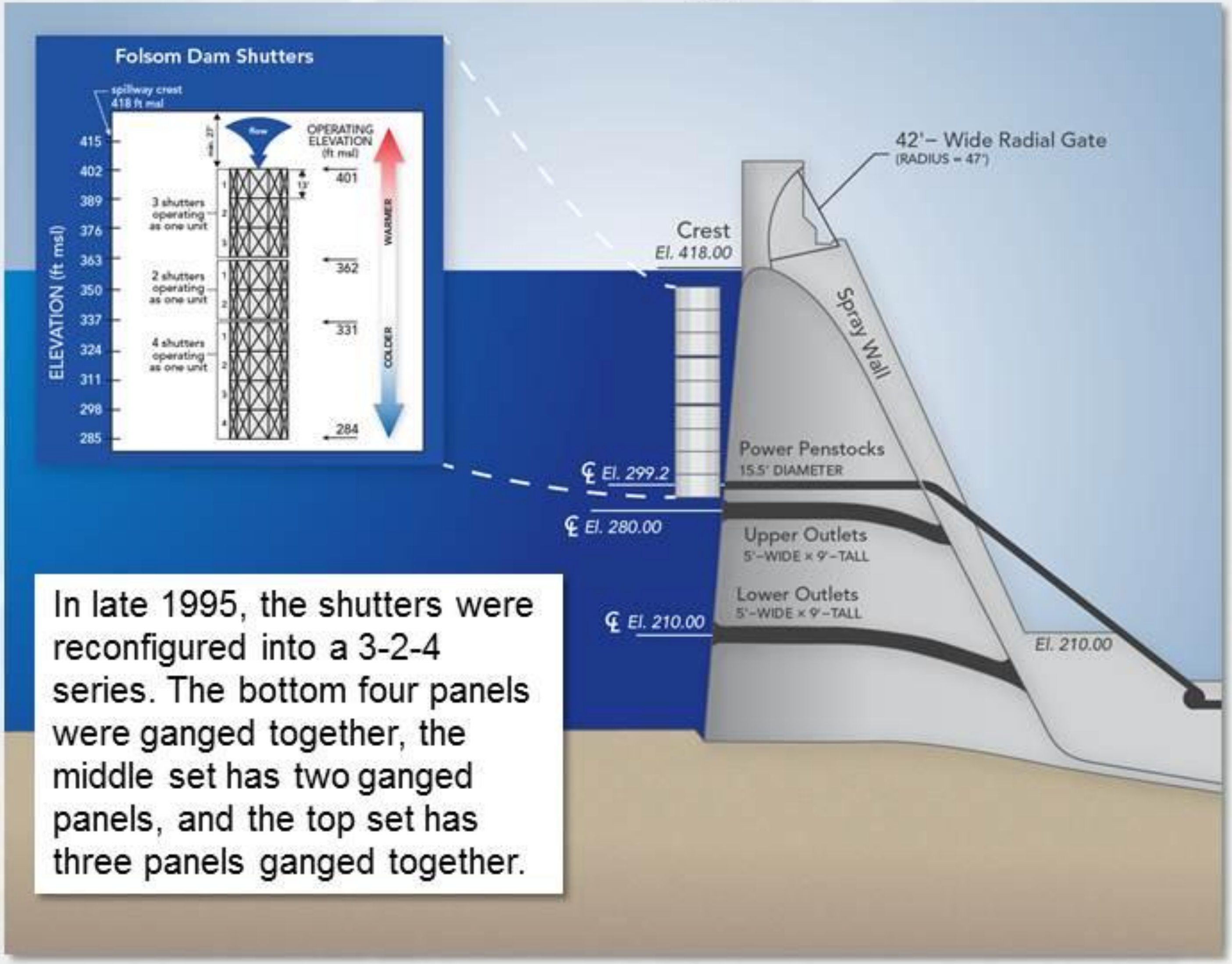
BUILDING STRONG®

1-1-7 Shutter Configuration - 1967



In 1967, Reclamation installed temperature shutters on all three penstocks to allow for releases from the lake's upper strata and conserve cold water for temperature management.

3-2-4 Shutter Configuration - 1995



In late 1995, the shutters were reconfigured into a 3-2-4 series. The bottom four panels were ganged together, the middle set has two ganged panels, and the top set has three panels ganged together.

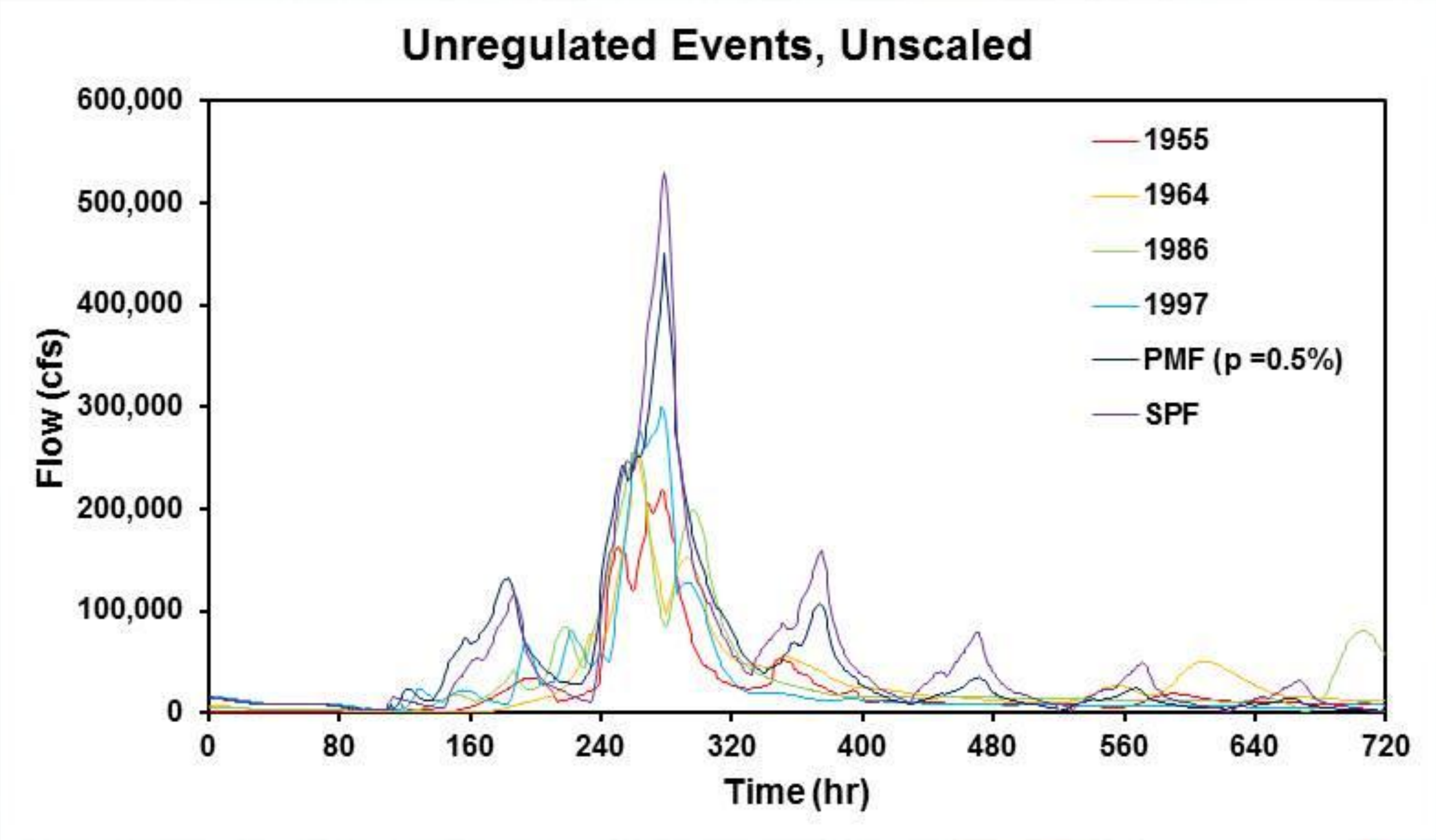
CURRENT PROJECT STATUS

- Hydrology
- Flood Routing Models
- Basin Wetness and Forecasts
- Manual Update Objectives
- Alternatives Development
- Collaboration

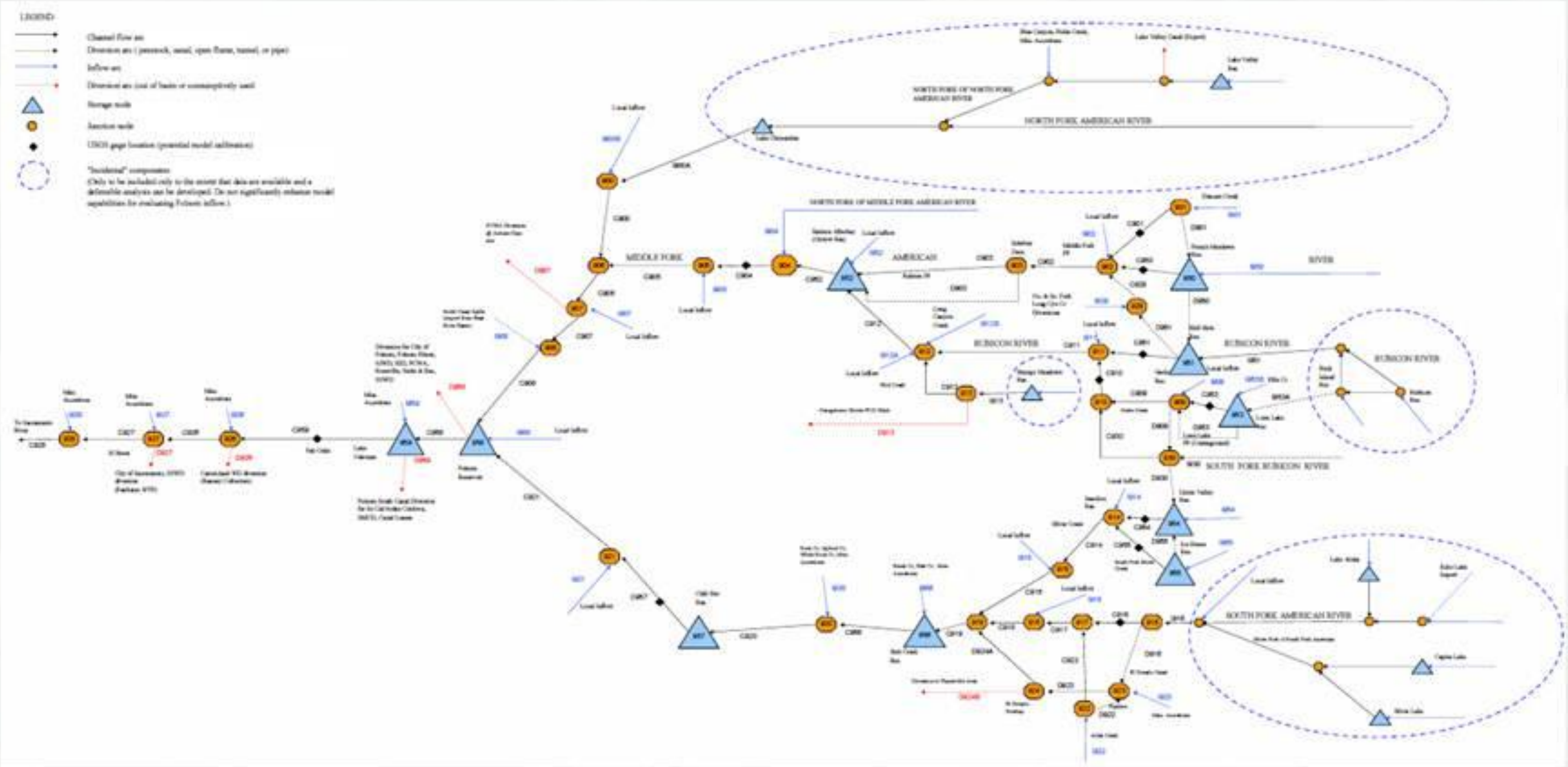
Hydrology

- Models simulate an 86 year period of record (1922 – 2002)
- Models simulate 43 exceedence events (< 1yr → PMF)
- Inflow hydrology is structured around historical patterns:
  ‘55, ’64, ‘86, ’97, SPF, PMF

Hydrology

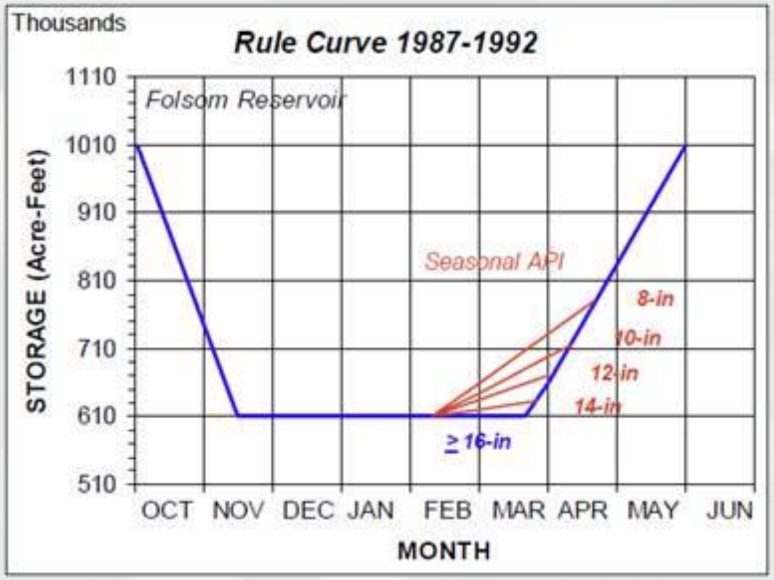

Unregulated Events, Unscaled
Flow (cfs)
600,000
500,000
400,000
300,000
200,000
100,000
0
0
80
160
240
320
400
480
560
640
720
Time (hr)
1955
1964
1986
1997
PMF (p =0.5%)
SPF

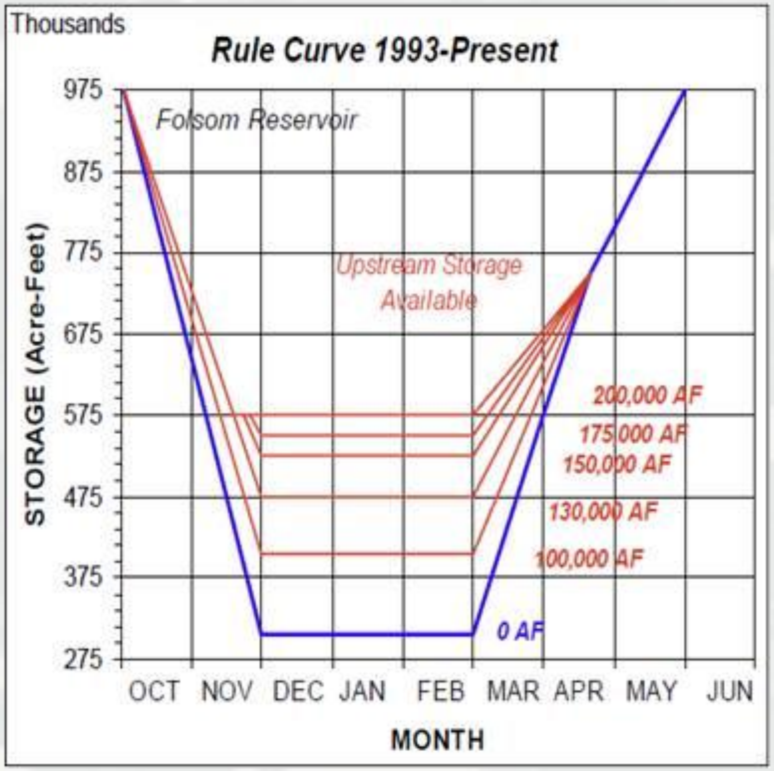
Flood Routing Models



Loon Lake, Ice House, Union Valley – Hell Hole, French Meadows

Basin Wetness & Forecasts





Manual Update Objectives

- Pass the Probable Maximum Flood (PMF) while maintaining 3 feet of freeboard below the top of dam.
  - Meets Reclamation's Dam Safety Requirements.

Manual Update Objectives

- Control a 1/100 annual chance flow (i.e. “the 100-year flood”) to a maximum release of 115,000 cubic feet per second (cfs).
  - ►Supports FEMA levee accreditation along the American River.

Manual Update Objectives

- Control a 1/200 annual chance flow (i.e. “the 200-year flood”) to a maximum release of 160,000 cfs.
  - ►Supports California urban area flood protection standards.

BASIS OF ALTERNATIVE DEVELOPMENT

- Flood Storage: As authorized by Congress, 400/600 TAF

- Outlet Configuration: Existing outlets and auxiliary spillway

- TCD Configuration: 3-2-4 shutter configuration

- Operating Rules: Rule curves that derive flood storage reserve requirements from some combination of the following:
  - Storage Reserve in Folsom Reservoir
  - Basin Wetness
  - Forecast Information

ENVIRONMENTAL EFFECTS ANALYSIS

NEPA and CEQA

Corps of Engineers

NEPA Lead Agency

Central Valley Flood Protection Board

CEQA Lead Agency

Bureau of Reclamation

NEPA Cooperating Agency

Department of Water Resources

CEQA Responsible Agency

Sacramento Area Flood Control Agency

CEQA Responsible Agency

Effects Analysis Overview

- Environmental effects analyses will be centered around effects flood management operations alternatives would have on the other Folsom Dam Project purposes:

- Flood Control
- Water Supply (Irrigation and M&I)
- Fish and Wildlife
- Power Generation
- Water Quality
- Navigation
- Recreation

Effects Analysis Overview

- Based on previous environmental analysis approach for past flood management operation changes (e.g., Long-term Reop)
- Key resources: water supply, power supply, fisheries, water quality, terrestrial resources, and recreation

Effects Analysis

- Based primarily on output from the CalSim II model, but will include other models, such as:
  - Water temperature models (Reclamation and Water Forum)
  - Fish mortality models (Reclamation)
  - Delta Simulation Model 2 (DSM 2)
  - Economic models (SWAP, LCPSim, OMWEM)
  - Power Generation (LTGen and SWPGen)
  - Others

Water Resource Management Conditions for Effects Evaluation

- CalSim II Build from 2011 DWR Delivery Reliability Report subject to concurrence between USACE, Reclamation and DWR
  - ►Base model concurrence in October 2012
- Any minor modifications to base model assumptions will be further discussed by the partner agencies

Folsom Reservoir Flood Operation and Configuration

Baseline Conditions-

Pre-Existing Condition

- Flood Storage: 400 TAF (Fixed)
- Outlet Configuration: Existing (No Auxiliary Spillway)
- TCDs: 1-1-7 Shutter configuration
- Operations: 1987 Water Control Manual

Folsom Reservoir Flood Operation and Configuration

Baseline Conditions- CEQA Existing Conditions

- Flood Storage: 400/670 TAF
- Outlet Configuration: Existing (No Auxiliary Spillway)
- TCDs: 3-2-4 shutter configuration
- Operations: Current

Folsom Reservoir
Flood Operation and Configuration
Baseline Conditions-
NEPA Future No Action/No Project

- Flood Storage: 400/670 TAF
- Outlet Configuration: Existing plus Auxiliary Spillway (JFP)
- TCDs: 3-2-4 shutter configuration
- Operations: Current

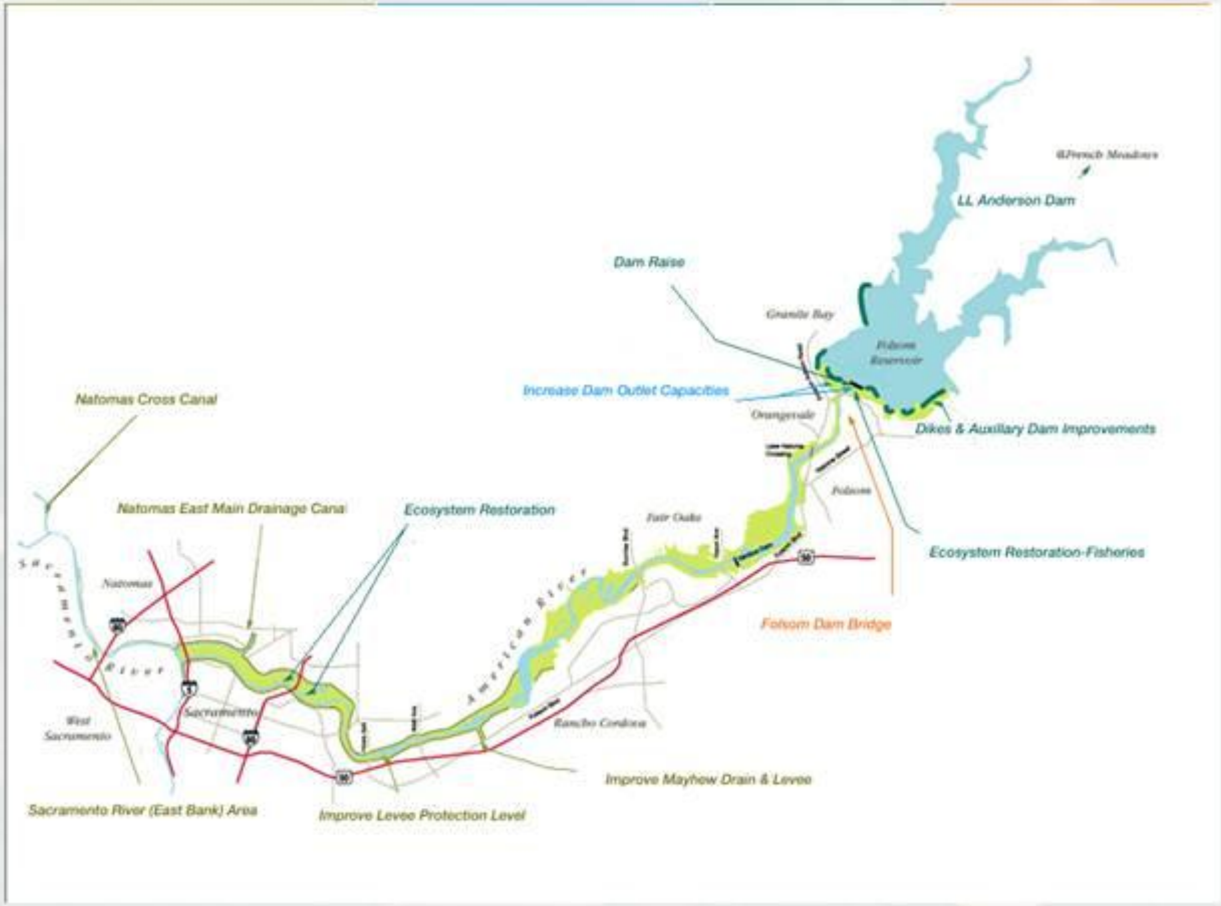
Approach to Effects Analysis

- Comparison of alternatives to baseline conditions
  - Long-term average values (period of record) and sorted by water year type

- Closer evaluation of effects in Lower American River

- Screening level evaluation for more distant parts of CVP/SWP system followed by detailed evaluation, as needed

Local Project Area



Regional Project Area

Tier 3 Work Plan

- Roadmap for effects analysis
- Developed with input from partners, NMFS, FWS, NCPA, DFG, and State Parks at Tier 3 Working Group Meetings

Ag, M&I Water Supply

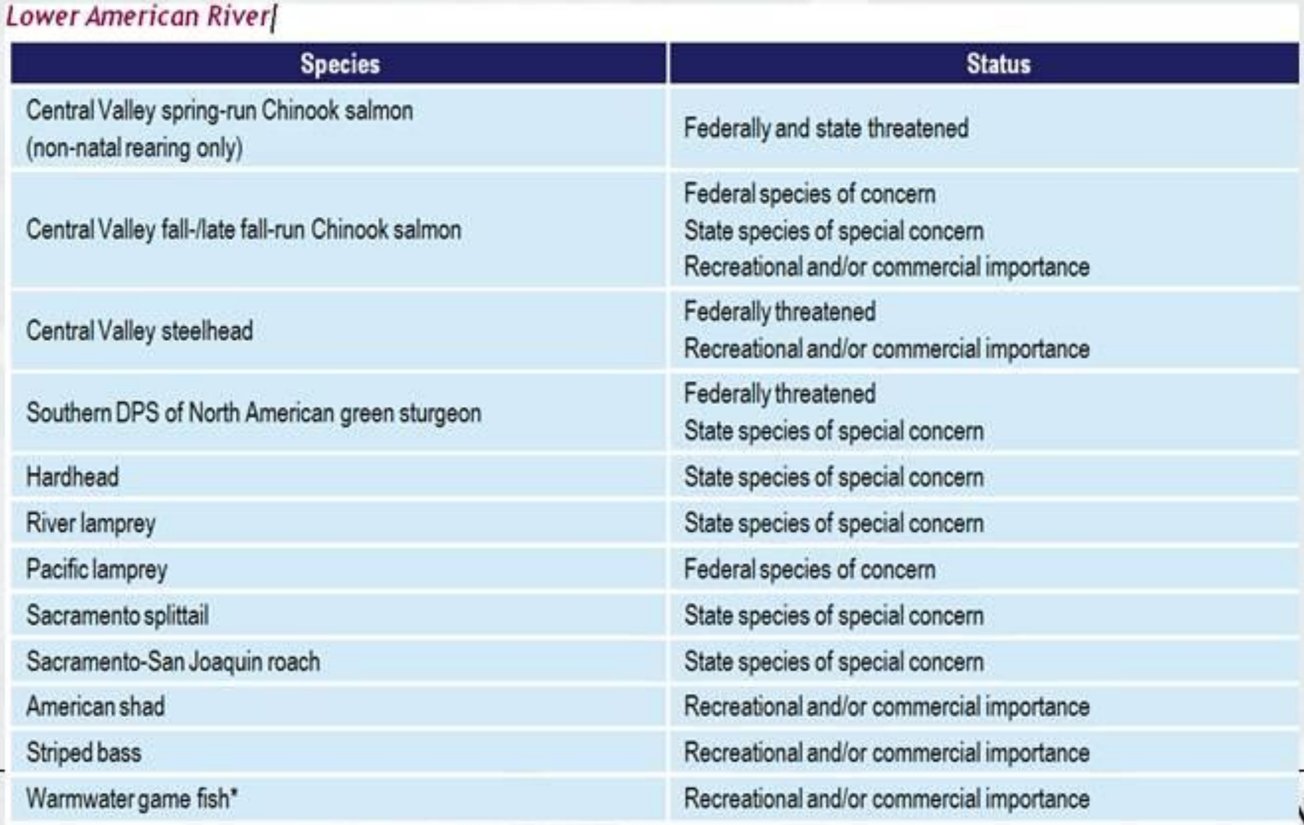
Model Parameter	Index Location
Central Valley Project (CVP) deliveries (TAF)	Refuges north and south of Delta (NOD, SOD, respectively)) Lower American River Water Purveyors City of Folsom Sacramento Suburban Water District Placer County Water Agency City of Roseville San Juan Water District and Consortium In Sacramento San Juan Water District South Sacramento County Agriculture Sacramento Municipal Utility District Carmichael Water District City of Sacramento Municipal and Industrial (M&I) Contractors (NOD) Agricultural (Ag) Contractors (NOD) Settlement Contractors (NOD) M&I Contractors south of Delta (SOD) Ag Contractors (SOD) Exchange Contractors (SOD)
State Water Project (SWP) deliveries (TAF)	Upper Feather River Delta Exports
End-of- May Storage (TAF)	Shasta, Oroville, and Folsom Reservoirs
End-of-September Storage (TAF)	Shasta, Oroville, and Folsom Reservoirs

Power

- CalSim II reservoir storages and releases applied to LTGen and SWPGen models
- Evaluation of:
    - Total capacity, quantity and timing of energy production
    - Any changes in Project use
    - Net capacity and energy at load center
    - Effects to peaking operations at Folsom Dam

Fisheries Resources

- Effects analysis based on river flows, lake levels and water temperature modeling.
- Focus on special-status and recreationally important fish species.



Lower American River

Species	Status
Central Valley spring-run Chinook salmon (non-natal rearing only)	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

Fisheries Resources

Tool	Parameter Evaluated	Location
CalSim II	End-of-month reservoir water surface elevation End-of-month reservoir storage Average monthly flow	American River watershed CVP/SWP region
CalSim II	Delta Outflow X2 Old and Middle Rivers (OMR) Flows	Delta
Upper Sacramento River Daily Operations Model (USRDOM)	Daily average flows	Upper Sacramento River
Reclamation Water Temperature	Average monthly water temperature	American River watershed CVP/SWP region
Upper Sacramento River Water Quality Model (USRWQM)	Daily average water temperature	Upper Sacramento River
DSM 2	Hourly electrical conductivity ([EC], indicative of salinity) Hourly water temperature	Delta
HEC-RAS	Daily average hydraulics Daily average and hourly temperature	Lower American River
Flow-Habitat Relationships	Average monthly Chinook salmon and steelhead spawning habitat availability (Weighted Useable Area [WUA])	Lower American River Lower Feather River Upper Sacramento River
Flow-Habitat Relationships	Useable Flooded Area (UFA) – splittail spawning habitat	Lower American River Lower Feather River
Reclamation Salmon Mortality Model	Water temperature-related early life stage mortality of all runs of Chinook salmon	Lower American River Lower Feather River Upper Sacramento River Trinity River
Export-Salvage Density Relationships	Estimated salvage of fish	CVP and SWP south Delta pumping facilities
Interactive Object-Oriented Simulation (IOS)/Delta Passage Model (DPM)	Winter-run Chinook salmon life cycle	Sacramento River and Delta
Sacramento River Ecological Flow Tool (SacEFT)	Steelhead spawning habitat availability, redd dewatering, redd scour, juvenile habitat availability, juvenile stranding, and egg-to-fry survival Green sturgeon water temperature-related egg mortality	Upper Sacramento River
SALMOD	Juvenile Chinook salmon production	Sacramento River

Water Quality

- Parameters evaluated as part of the Fisheries analysis:
  - Water temperature in the Lower American River
  - Salinity dynamics in the Delta

- Salinity dynamics in the Delta
  - addressed at a screening level (changes in X2, total Delta inflow/outflow, and the E/I ratio).
  - Substantial changes may warrant more detailed evaluation using DSM2

- Salinity quality at key in-Delta points for local Ag and M&I supplies

Courtesy of CA Department of Water Resources
Modified by the U.S. Geological Survey

Terrestrial Resources

- Shoreline understory and wooded areas.

- Reservoir parameters:
  - water surface elevations
- Riverine parameters:
  - Flow

Recreation

- Primary focus is Folsom Lake and Lower American River

- Folsom Lake
  - Water surface elevation as it relates to access, inundation, aesthetics, and time of year

- Lower American River
  - Flows and timing

Recreation

Reductions in water surface elevations for accessibility and safety thresholds evaluated to identify significant effects to recreation

Model Parameter	Index Location
Reservoir Water Surface Elevations	Trinity Shasta Keswick Whiskeytown Oroville Folsom
Flow	Lower American River at Nimbus Lower American River below H Street Sacramento River below Keswick Sacramento River below Freeport Feather River below Thermalito Afterbay

Next Steps

Questions and Comments

Appendix 4

Power Point Presentation
February and March 2013 Stakeholder Meetings

Note Regarding Appendix 4: The information in this presentation was current as of the date listed. As the project progresses, information may evolve and change over time. For more current information, see http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomDamAuxiliarySpillway.aspx. Readers can access material on Folsom Dam Water Control Manual Update on the lower right side of the page.

Folsom Dam Water Control Manual Update

Stakeholder Discussion

March 28, 2013

Location: Tsakopoulos Library Galleria, East Room, 828 I Street, Sacramento

Reclamation
Mid-Pacific Region
Sacramento, CA

Sacramento Area
Flood Control Agency

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

US Army Corps of Engineers
BUILDING STRONG®

WELCOME AND INTRODUCTIONS

PURPOSE OF MANUAL UPDATE

- Revise operation rules for Folsom Dam to reduce flood risk based on the capabilities of the Folsom Joint Federal Project (JFP).
- Reflect operational capabilities created by improved weather forecasts.
- Potentially reduce the volume of flood control reservation in Folsom Reservoir at any particular time by comparison to the operations that have been in effect since 1995.

PURPOSE OF TODAY'S SESSION

- Review project schedule
- Present/discuss stakeholder assessment
- Discuss stakeholder engagement plan
- Present/discuss technical update
- Discuss next steps

PROJECT MILESTONE SCHEDULE

Oct 2012	*NEPA/CEQA Initial Public Scoping*
Apr 2012–Aug 2013	Develop and Run Existing Condition Reservoir Routing Models
Apr 2012–Jul 2013	*Stakeholder Input for Existing Condition Models*
Jun 2013–Dec 2013	Develop and Run Future without Project Conditions Models
Nov 2013–0ct 2014	*Stakeholder Input for Future without Project Conditions*
Sept 2013–Sept 2014	Establish Existing System Water Operations Conditions
Jun 2013–Apr 2014	*Stakeholder Input for Existing Conditions*
Oct 2013–Sept 2014	Develop and Run With Project Alternative Models
Oct 2013–Aug 2014	*Stakeholder Input for Project Alternative Models*
Jan 2014–May 2014	Establish Future without Project Environmental Condition
May 2014	In Progress Review Conference- SPD/USACE HQ
Jan 2014–Feb 2015	Establish with Project Environmental Conditions and carry out Environmental Effects Analysis for With-Project Alternatives
Jan 2014–Dec 2014	*Stakeholder Input for with Project Environmental Conditions and Effects Analysis for With Project Alternatives*
Jan 2015–Mar 2015	Identification of Recommended Plan with Input from Stakeholders
Jul 2015	In Progress Review Conference- SPD/USACE HQ
Nov 2015	In Progress Review Conference- SPD/USACE HQ
Jan 2016	*Public Review of Draft EIS/EIR*
Mar 2016	Response to Public Comment of Draft EIS/EIR
Aug - Sep 2016	*Public Review of Final EIS/EIR*
Oct 2016	CEQA Notice of Determination
Oct 2016	NEPA Record of Decision
Nov 2016	Final Approval of Water Control Manual Update

STAKEHOLDER ASSESSMENT & ENGAGEMENT PLAN

STAKEHOLDER ASSESSMENT

- Introduction
- Stakeholder Issues and Interests
- Assessment Findings

ASSESSMENT INTRODUCTION

- Why do an Assessment?
- What Stakeholders were part of the Assessment?
- How was the Assessment done?
- What about other stakeholders?

STAKEHOLDERS

- Regional Flood Management Entities
- Folsom Lake, Lake Natoma and Lower American River Recreational Interests
- Regional Environmental Organizations
- In-Basin Purveyors
- CVP and SWP Contractors
- Electric Power Utilities and their Associations

HOW WAS ASSESSMENT DONE?

- Rigorous identification of stakeholders
- Five stakeholder-specific discussions in Sept.
- Significant outreach for stakeholder attendance

- Focus of September Discussions:
  - Engage stakeholders in policy & technical info
  - Understand stakeholders' interests & issues
  - Ask stakeholders how best to involve them

WHAT ABOUT OTHER STAKEHOLDERS?

- Business Community
- Emergency Response Agencies
- Lower Sac/ North Delta
- Tribal
- Agencies/ parties w/ infrastructure in floodway (e.g. Caltrans)

STAKEHOLDER ISSUES & INTERESTS

What is an Interest?
What is an Issue?

REGIONAL FLOOD ORGANIZATIONS INTERESTS

- Understanding/reducing impacts related to:
  - Planning and preparation
  - Financing maintenance & improvements
- Updating of population evacuation triggers (working with emergency management agencies)

REGIONAL FLOOD ORGANIZATIONS ISSUES

- Bank erosion of channels downstream of Dam
  - Medium-sized flows more damaging over time
  - High flows are damaging if prolonged
- Increased Flows in the By-Pass
- Costs
  - Changes to PL 84-99 trigger?
  - Maintenance costs
  - Study to evaluate need for floodway compensation for damages

RECREATION FOLSOM LAKE/LAKE NATOMA INTERESTS

- Lake levels to support recreation, especially May – September
- Continued advanced notification of high releases for informational and safety purposes

RECREATION FOLSOM LAKE/LAKE NATOMA ISSUES

- Low Folsom Lake Levels
    - Boat ramp access
    - Distance from parking area
    - Loss of daily use revenue
    - Loss of revenue for marinas and concessions
- Safety of rowing events with high flows
- Modeling Analysis: Recreation use by lake levels, by month

LAR RECREATION INTERESTS

- Recreational and safety impacts of flow levels and timing of flows, especially weekends May- September
- Effects to Sac County infrastructure with high flows
- Recreation Fishing: Health of Fisheries

LAR RECREATION ISSUES

- Adequate Flows: 1750 – 6,000 cfs. Over 6000 cfs is a safety threshold
- LAR Infrastructure
  - Submerged trails, bike paths, bathrooms
  - Bank damage
  - Electrical equipment damage - Discovery Park
- Continued and expanded advance notification of high flows

REGIONAL ENVIRONMENTAL ORGANIZATIONS INTERESTS

- Successful WCM Operations – Avoid need for new upstream dams to reduce flood risks
- Healthy fisheries, especially for salmon and steelhead, related to temperature/ cold water pool & flow regimens.

REGIONAL ENVIRONMENTAL ORGANIZATIONS RESERVOIR OPERATIONS ISSUES

- Once all authorized improvements done to Folsom Dam, WCM ops control floods exceeding 1/200 frequency
- Water stored in flood space, in exchange for draw down of conservation space when warranted (Conditional Storage)
- WCM rules for early & aggressive release and forecasting for big storms
- Rules optimized, but not open flexibility

REGIONAL ENVIRONMENTAL ORGANIZATIONS HEALTHY FISHERIES ISSUES

- Use WCM to improve cold water pool
- Con'd storage if "additional" water also used for:
  - USBR revised water right - LAR Flow Standard
  - Pulse releases provided Jan – May
- Understand fish stranding issue
- Authorized automatic shutters – Implement, unless effect achieved through other means
- Need Elephant Trunk

IN-BASIN PURVEYORS INTERESTS

- Enhanced water supplies for the protection of in-basin M&I and environmental uses, particularly through a proactive approach to the acquisition and use of high quality basin wetness data

IN-BASIN PURVEYORS ISSUES

- Folsom drawn down below M&I intake in back-to-back critically dry years.
- Investigate: Temporarily increase water held in storage, while carefully monitoring basin wetness & forecasts, until either the probability of significant near term precip. reaches level of concern for possible flooding, or water reaches level needed to diminish concern for drought.

IN-BASIN PURVEYORS ISSUES (cont.)

- Thorough understanding of risks & benefits associated with different levels of flood and water storage
- More instrumentation for and monitoring, collection & use of watershed wetness data
- USACE/ USBR engage in process for establishing new Delta flow standards, as relates to WCM Update

CVP/SWP/ELECTRIC UTILITIES INTERESTS

- Maximize water resources for all purposes
- CVP cost allocation implications related to WCM operations
- Informed decision-making on WCM through access to integrated input from other interests

CVP/SWP/ELECTRIC UTILITIES ISSUES

- Optimize end of May storage for cold water pool & higher carry-over for critically dry years
- Flexible rule curve depending on basin wetness & forecasting
- Minimize releases that by-pass penstocks
- Update shutters to improve cold water pool

CVP/SWP/ELECTRIC UTILITIES ISSUES (cont.)

- Track Delta standards discussion as relates to WCM, esp. as related to X-2 sensitivity analysis
- WCM affect on existing cost allocation & CVP Cost Reallocation Study
- Assumptions (e.g. hydrology; environmental) carried forward in other studies
  - Downstream environ. regulatory baseline coordination w/ CVP Cost Reallocation Study

ASSESSMENT FINDINGS

Shared Perspectives & Potential Tensions among Stakeholders

SHARED PERSPECTIVES AMONG ALL

- WCM Update potential (not guarantee) to benefit all, particularly through Con'd Storage (increased end-of-May storage), increased Folsom Lake levels, and managed flood releases.
- Need for understanding risks and benefits associated with combined use of:
  - Auxiliary spillway
  - Increased basin wetness data
  - NWS forecasting application
  - Incidental storage in upstream Reservoirs

SHARED PERSPECTIVES AMONG ALL

- Want better understanding:
  - What can be accomplished through basin wetness & forecasting tools
  - Effect of Folsom Dam raise and associated surcharge space on operations and impacts
- Informed decisions-making on WCM through access to integrated input from all interests
- WCM as opportunity to improve cold water pool

POTENTIAL TENSIONS

- Historic tension between flood management & water supply: Balance of neither releasing water “too late” nor “too early” in face of uncertainties.
- “Additional” water potentially gained from conditional storage is CVP Project water. Although outside the scope of the WCM, this raises issues/ tensions re: use of that water.

STAKEHOLDER ENGAGEMENT PLAN

STAKEHOLDER ENGAGEMENT PLAN

Three Different Needs Expressed

1. Periodic progress meetings and updates
2. More in-depth and frequent discussions
3. Focus on special topics - examples:
    - Basin wetness data: instrumentation, monitoring, collections and use
    - Improvement to cold water pool

STAKEHOLDER ENGAGEMENT PLAN

1. Two – Three "Progress Meetings" a Year: All stakeholders invited
2. Three venues for in-depth and frequent discussions, designed to comply with FACA:
    - USACE Work Groups for governmental agencies (Water, power, other gov't agencies)
    - SAFCA work groups and discussions for NGO's (environmental and recreation organizations; others)
    - For Flood Organizations, SAFCA to integrate discussion of WCM into regional planning effort

STAKEHOLDER ENGAGEMENT PLAN

USACE Work Groups for Governmental Agencies

1. Technical Working Group: Discusses technical topics, including basin wetness
   Staff: Kyle Keer
2. Environmental Effects Working Group:
   Staff: Dan Artho

STAKEHOLDER ENGAGEMENT PLAN

SAFCA Forums for NGOs

(Environmental; Recreation Interests; Others)

1. SAFCA reconvening Lower American River Task Force. Will be co-sponsored by Water Forum. Half of meeting dedicated to WCM; half to LAR Flow Standard
2. SAFCA available for more in-depth discussions for topics not fully covered at LAR TF

SAFCA's Role with Environmental, Recreation, Regional Flood, other NGOs

SAFCA has the responsibility to provide in-depth information on WCM to these groups and to share stakeholder perspectives with PASS Task Force, USACE Technical Working Group, USACE Environmental Effects Working Group, and other WCM meetings with USACE, USBR and DWR, and to advocate for the perspectives with which they agree.

COLD WATER POOL ISSUE

- Perspective of WCM Update Agencies: Other than incidental gains, WCM does not have responsibility for improving cold water pool.
- USBR and SAFCA will work with stakeholder group on cold water pool issues. Interested stakeholders invited. Stay tuned for specifics.

QUESTIONS & DISCUSSION

Stakeholder Assessment & Engagement Plan

CURRENT PROJECT ACTIVITIES

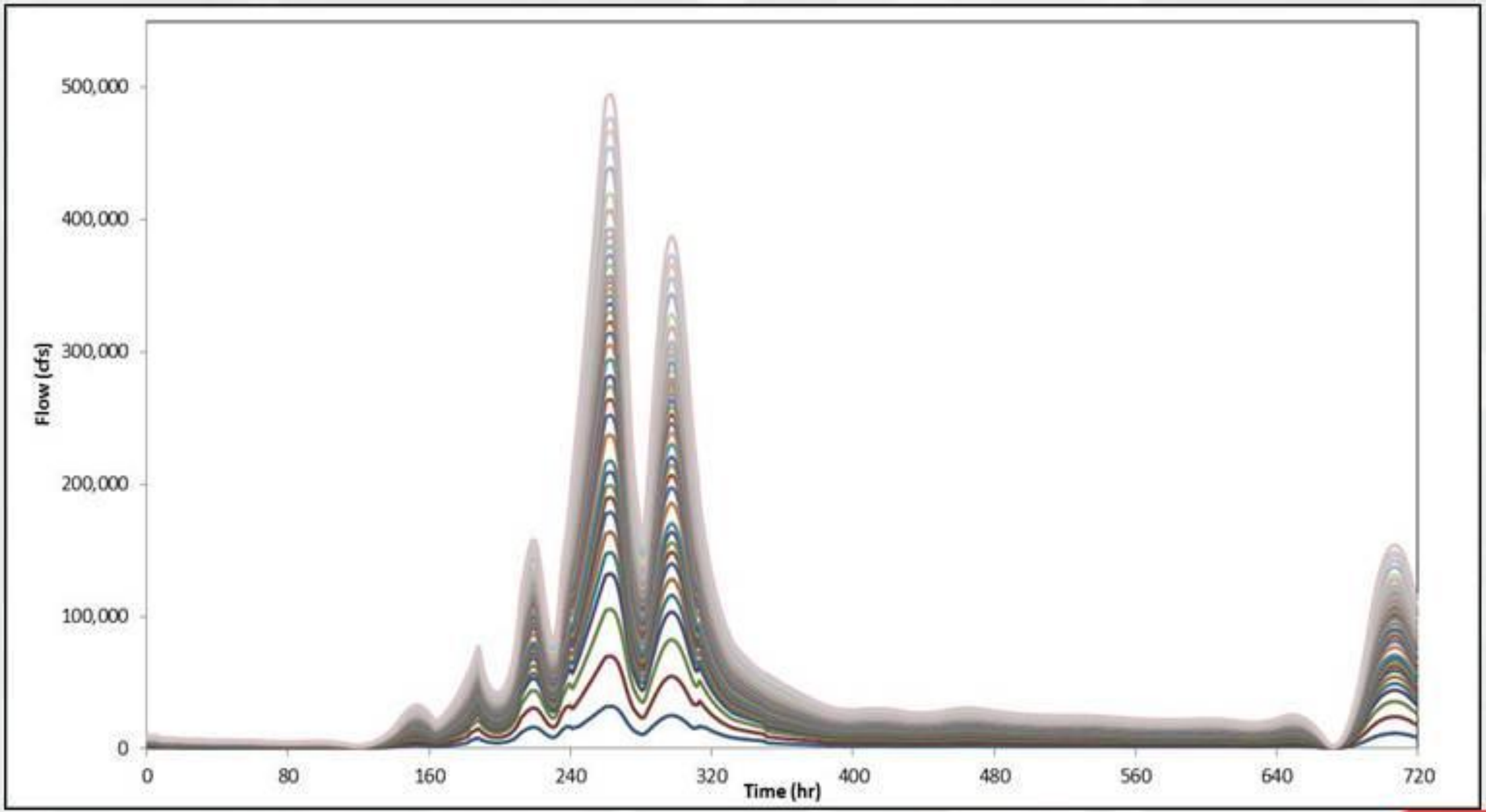
- Development of ResSim models to evaluate existing conditions, future without project conditions, and with project conditions.
- Development of methods for:
  - Developing a basin wetness index.
  - Incorporating forecasts in the operational decision process.
  - Integrating HEC-ResSim and CalSim II output for water supply assessments.

RESSIM MODEL DEVELOPMENT PROCESS

- Build model with a reservoir operation set (ROS)(i.e., existing conditions and future auxiliary spillway).
- Test model to confirm that it meets project flood protection objectives (1%, 0.5%, and PMF).
- District Quality Control (DQC) Review.
- Revise model, as needed, until objectives are met (iterative).

HYDROLOGY UPDATE

Unregulated Events, 1986 Pattern



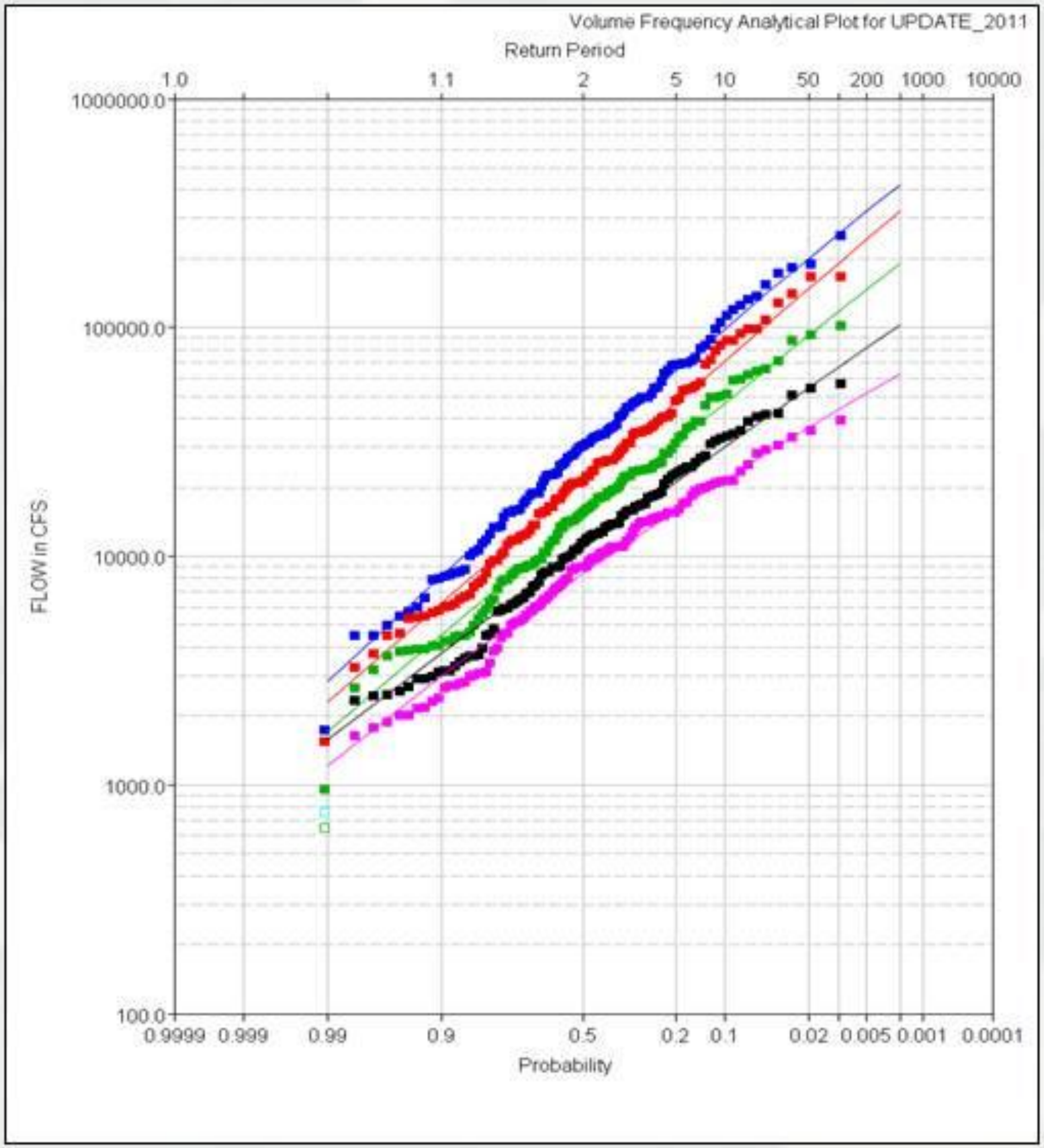
HYDROLOGY UPDATE

1.0% Chance Exceedence Event

	1 Day	**3 Day**	**7 Day**
	cfs	**cfs**	**cfs**
1997	276,000	196,000	113,000
2006	267,000	188,000	112,000
2011	257,000	191,000	117,000
Δ%	-3.4	**1.6**	**4.5**

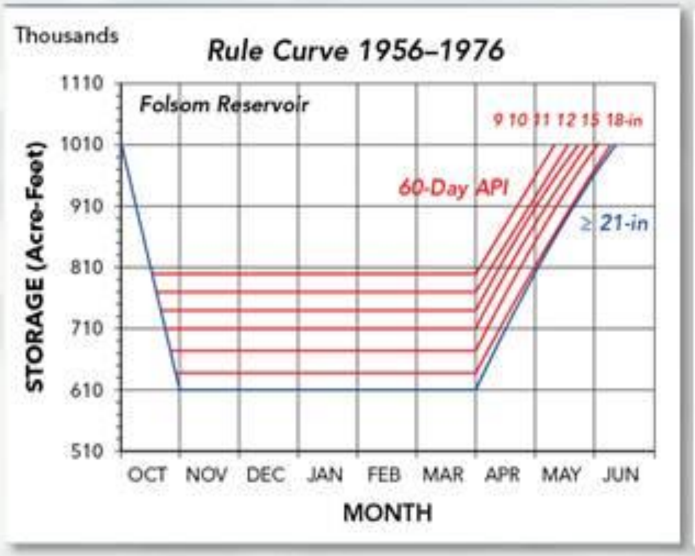
0.5% Chance Exceedence Event

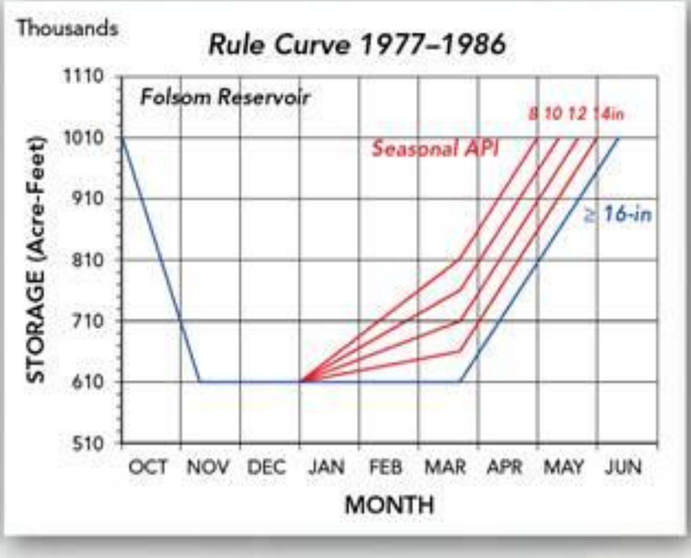
	1 Day	**3 Day**	**7 Day**
	cfs	**cfs**	**cfs**
1997	349,000	247,000	137,000
2006	337,000	237,000	138,000
2011	322,000	242,000	146,000
Δ%	-4.5	**2.1**	**5.8**

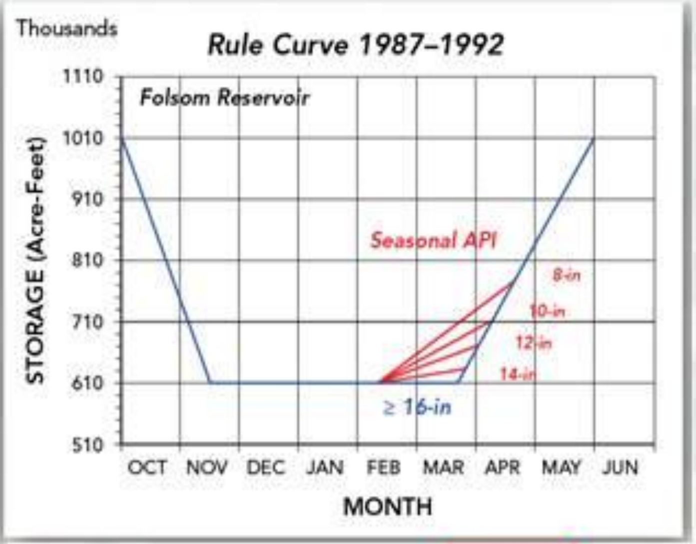


INCORPORATING BASIN WETNESS & FORECASTS IN RESSIM MODELS

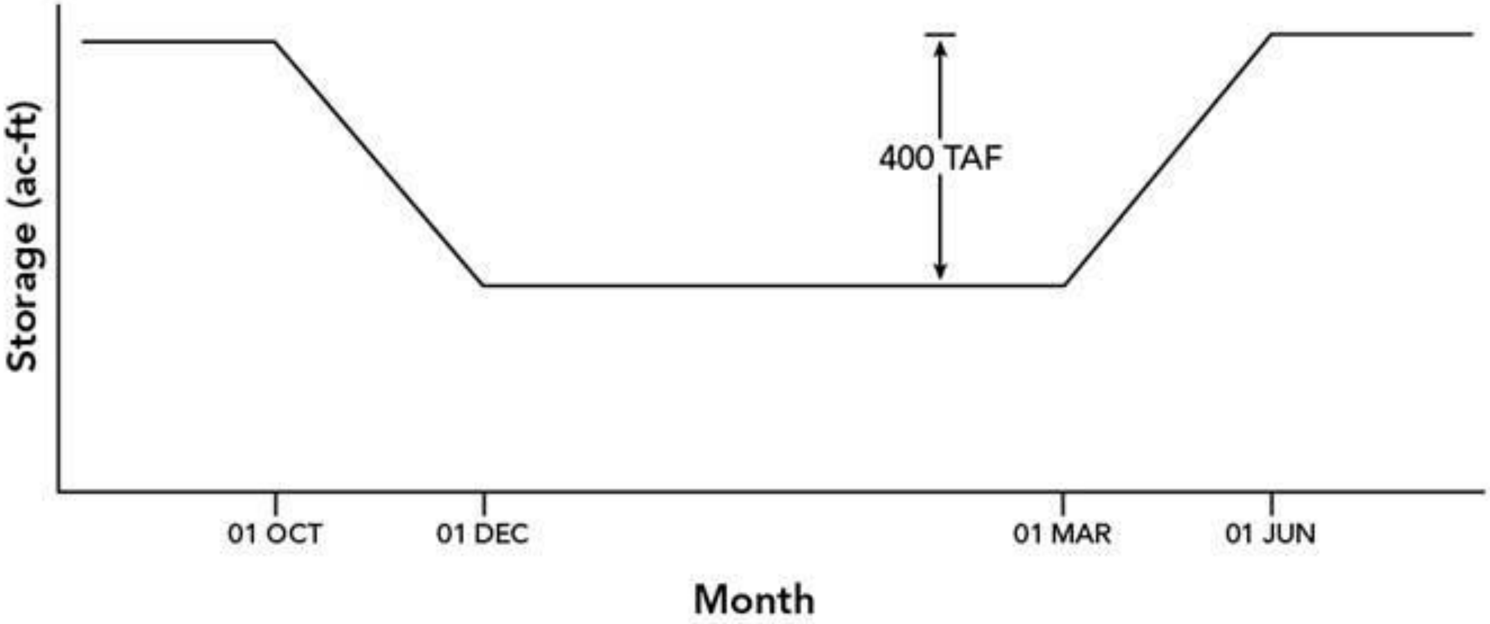
- Index could be based on basin precipitation, reservoir inflow, or projected snowmelt runoff.
- Index had been utilized in the past:



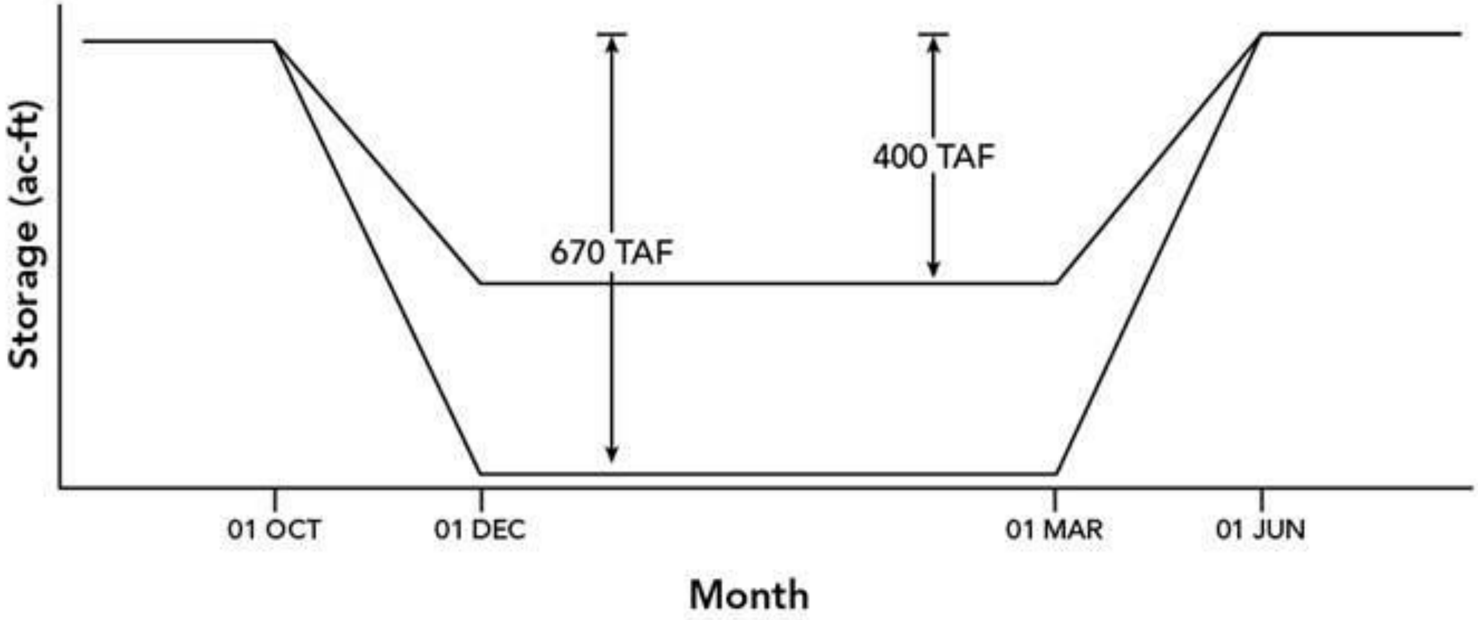




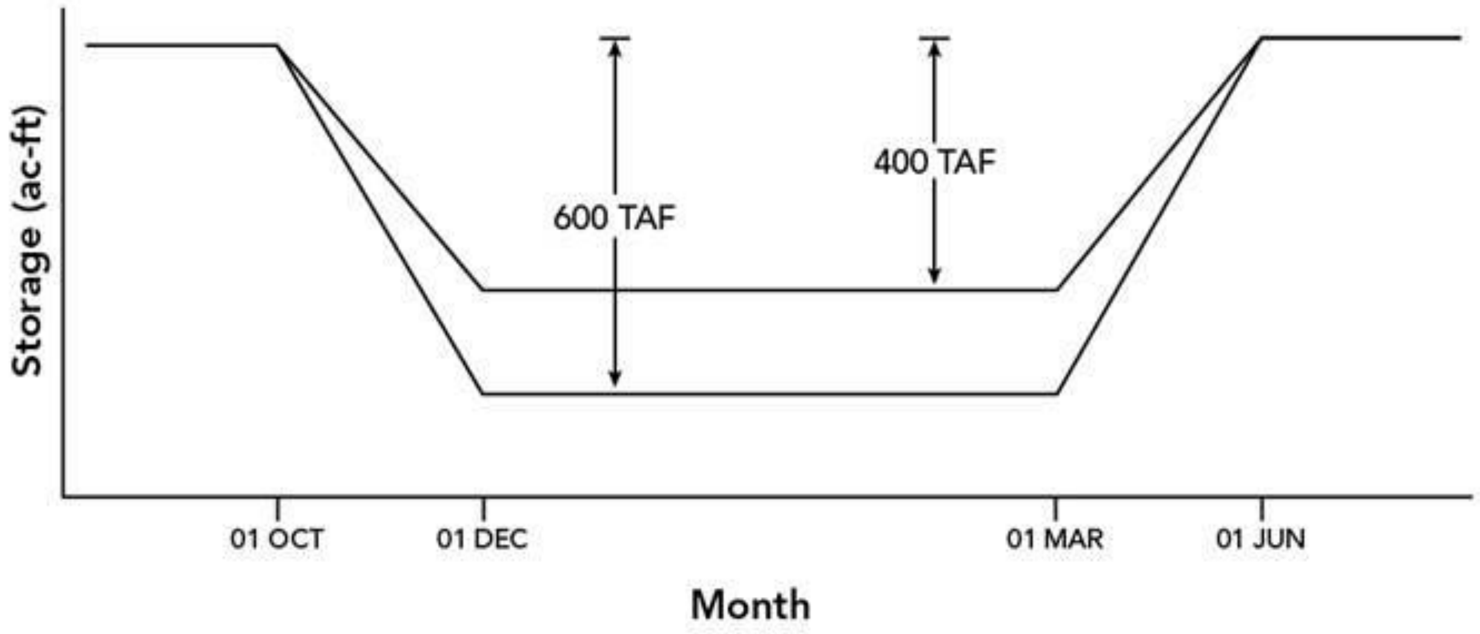
400-FIXED WCD



400/670 WCD

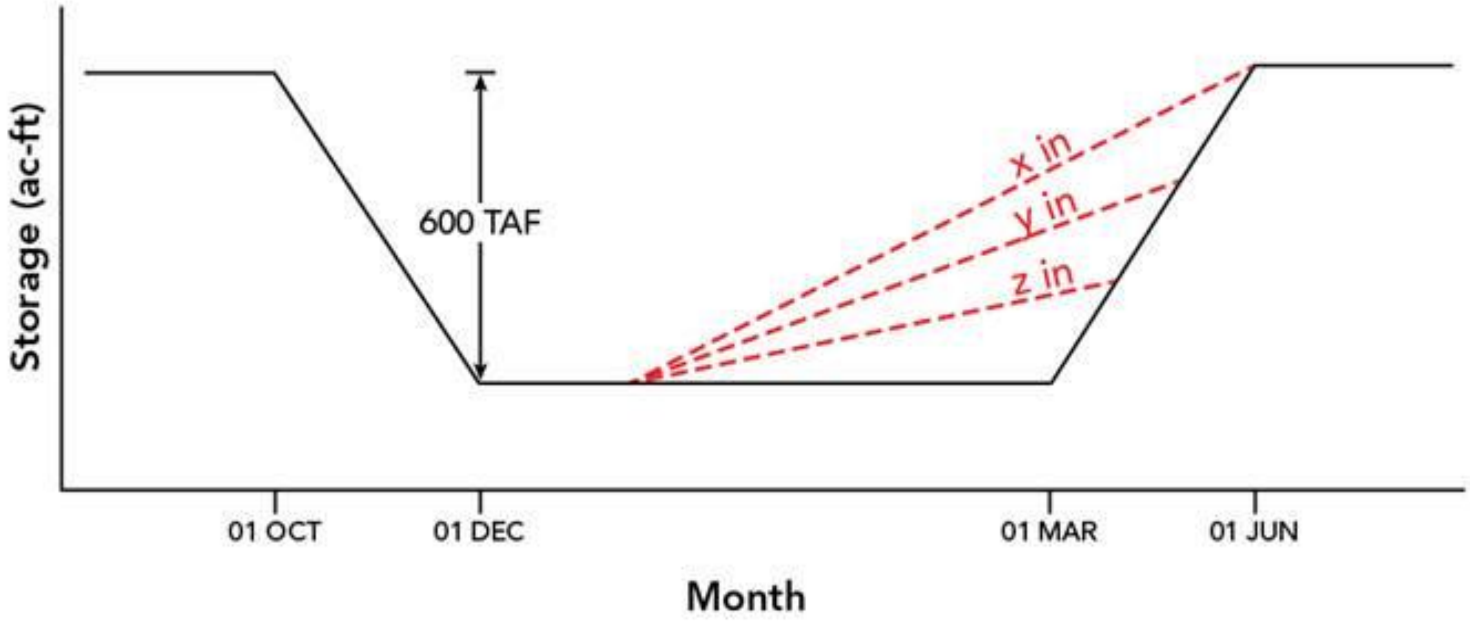


400/600 WCD



BASIN WETNESS INDEX

TOP OF CONSERVATION ADJUSTMENT



BASIN WETNESS INDEX

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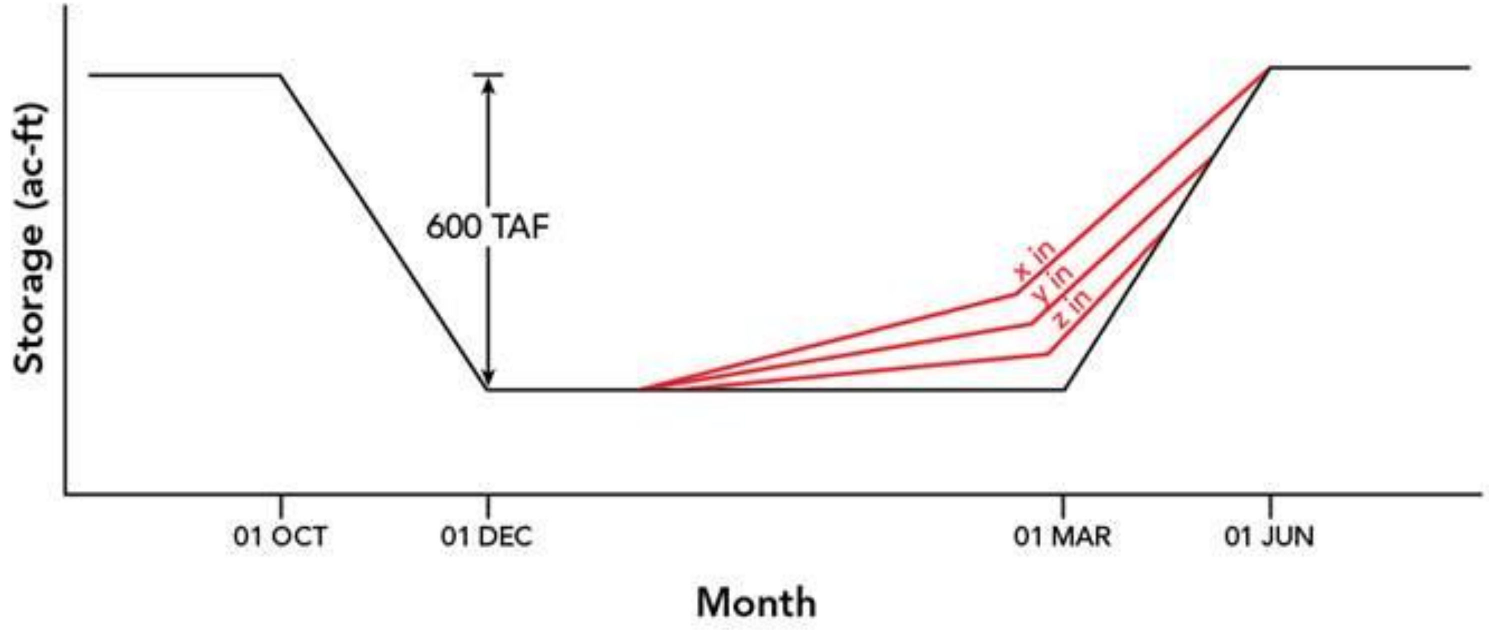

BASIN WETNESS INDEX

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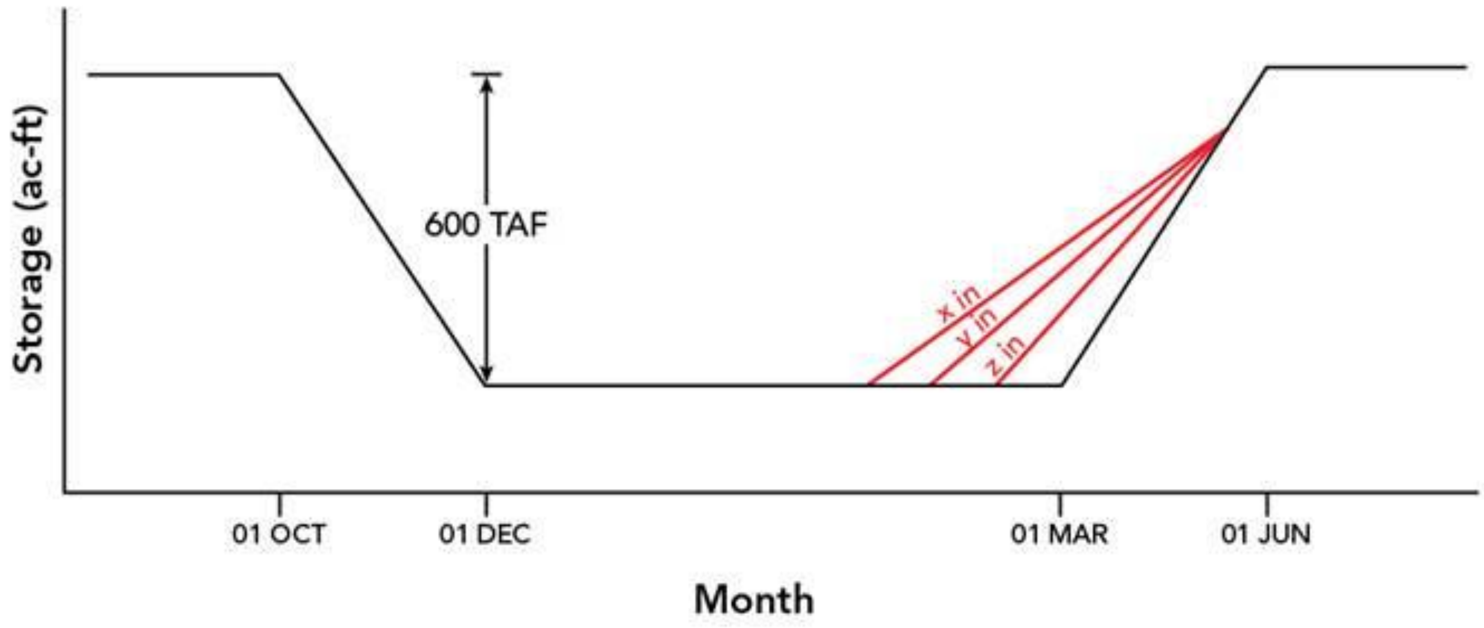
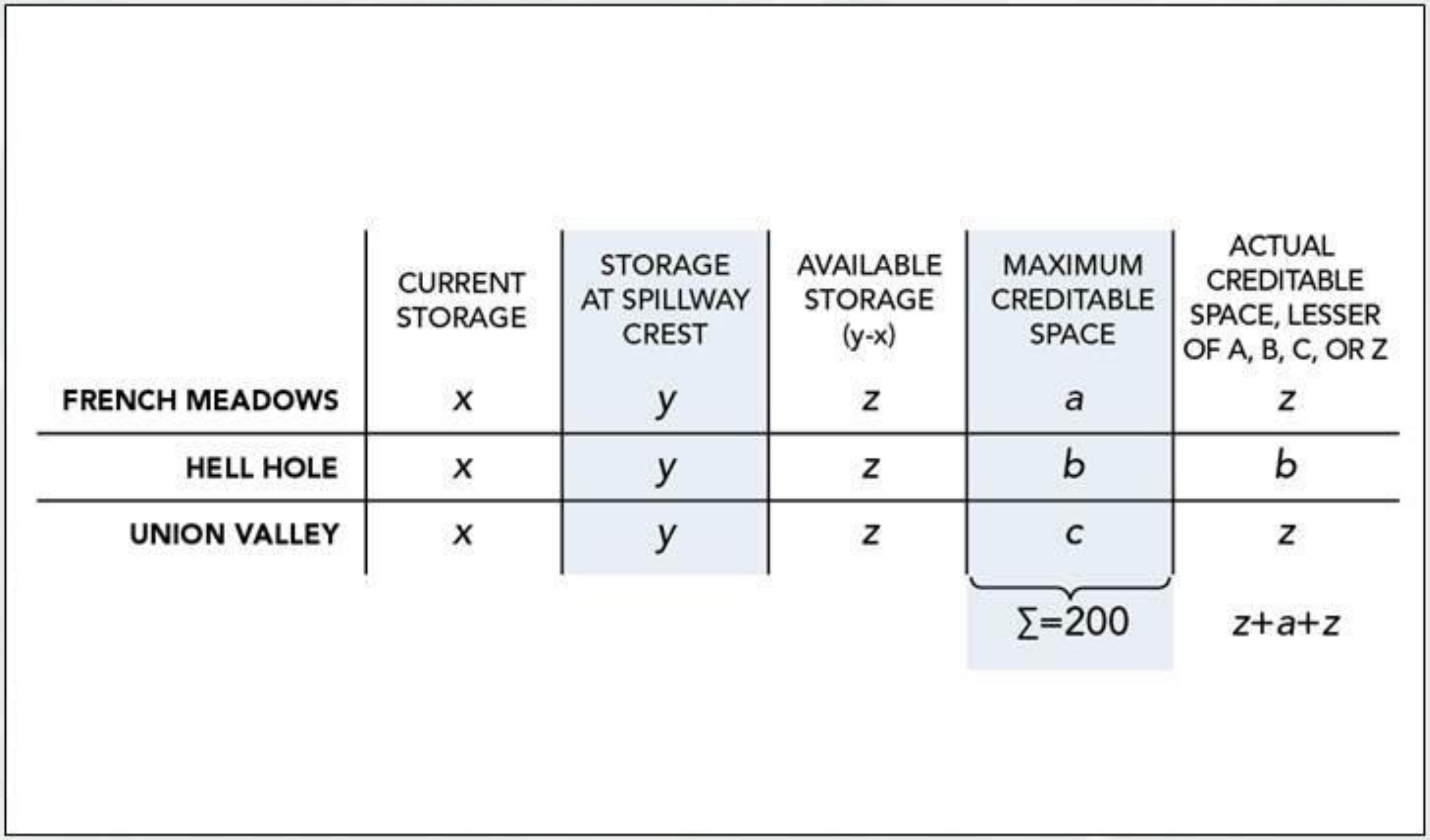


CREDITABLE FLOOD CONTROL TRANSFER SPACE

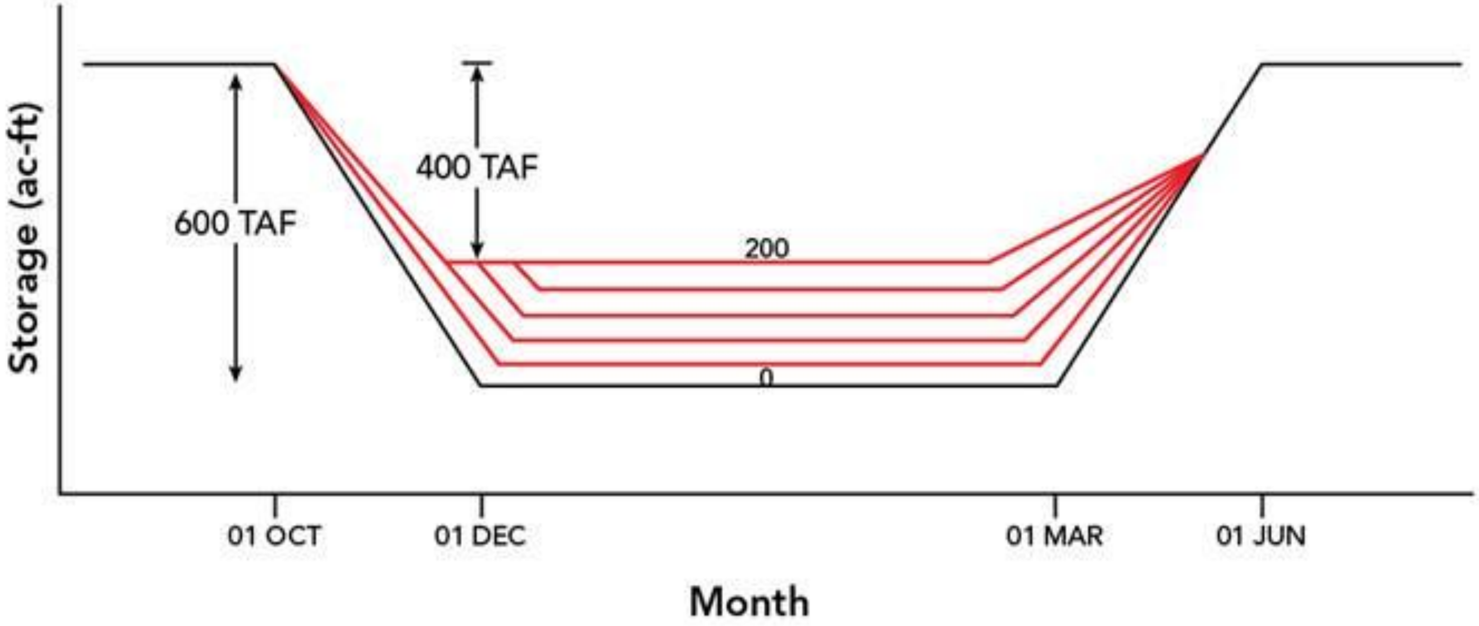
TOP OF CONSERVATION ADJUSTMENT



	CURRENT STORAGE	STORAGE AT SPILLWAY CREST	AVAILABLE STORAGE (y-x)	MAXIMUM CREDITABLE SPACE	ACTUAL CREDITABLE SPACE, LESSER OF A, B, C, OR Z
FRENCH MEADOWS	*x*	*y*	*z*	*a*	*z*
HELL HOLE	*x*	*y*	*z*	*b*	*b*
UNION VALLEY	*x*	*y*	*z*	*c*	*z*
				∑=200	*z+a+z*

CREDITABLE FLOOD CONTROL TRANSFER SPACE

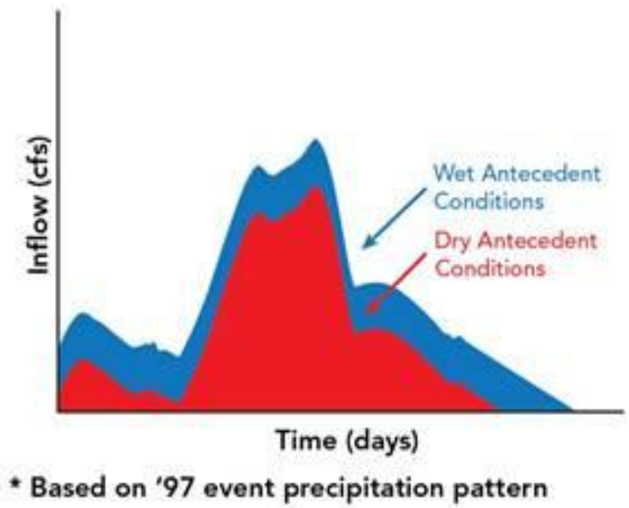
TOP OF CONSERVATION ADJUSTMENT



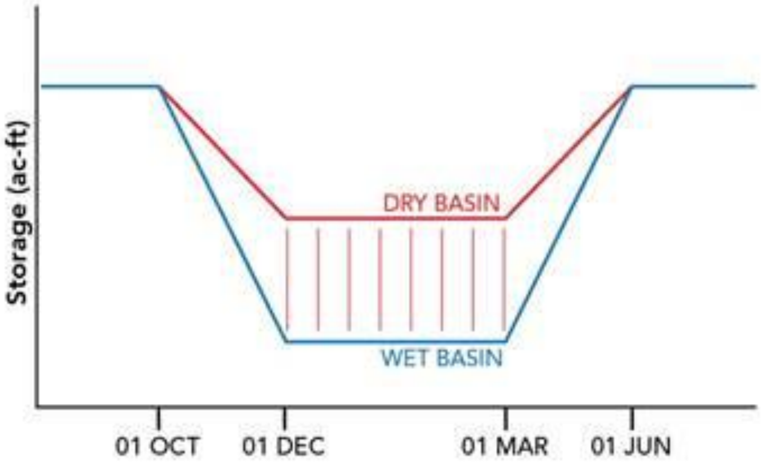
CREDITABLE FLOOD CONTROL TRANSFER SPACE

TOP OF CONSERVATION ADJUSTMENT

200-Yr Inflow Hydrograph Sensitivity Analysis Dry vs. Wet Condition

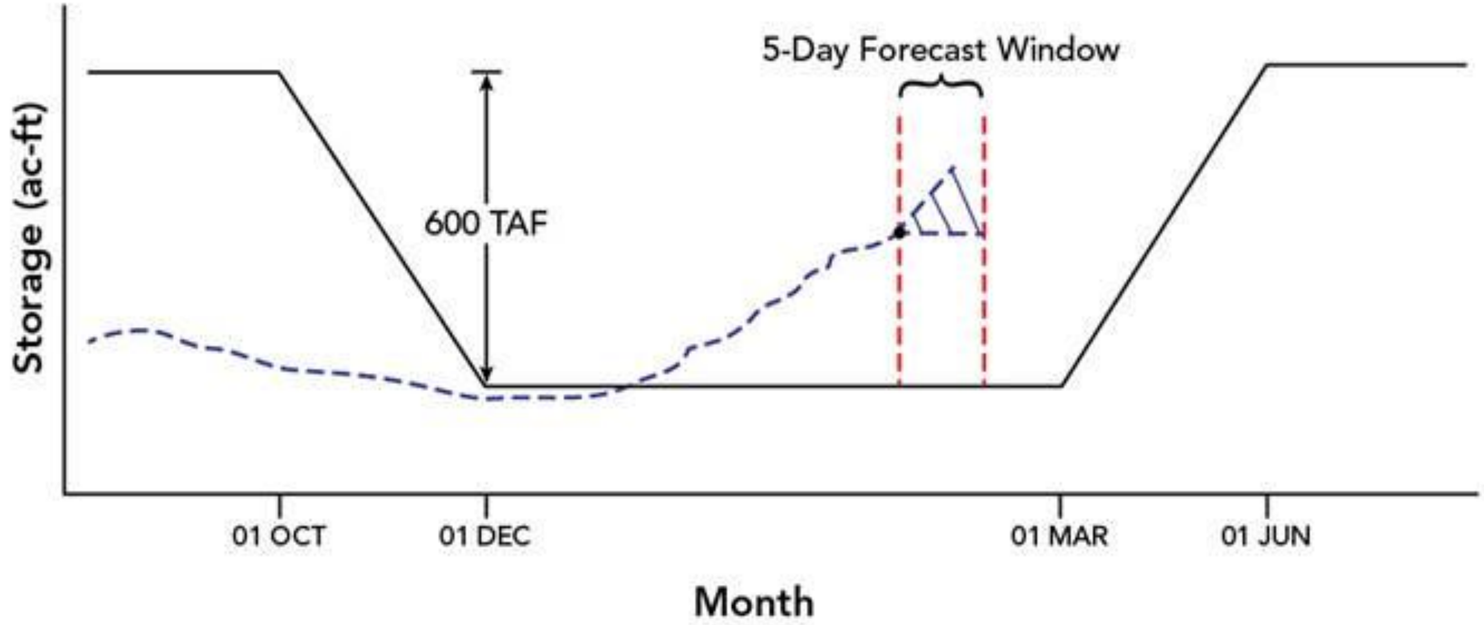


* Based on '97 event precipitation pattern



FORECASTS

TOP OF CONSERVATION POOL ADJUSTMENT



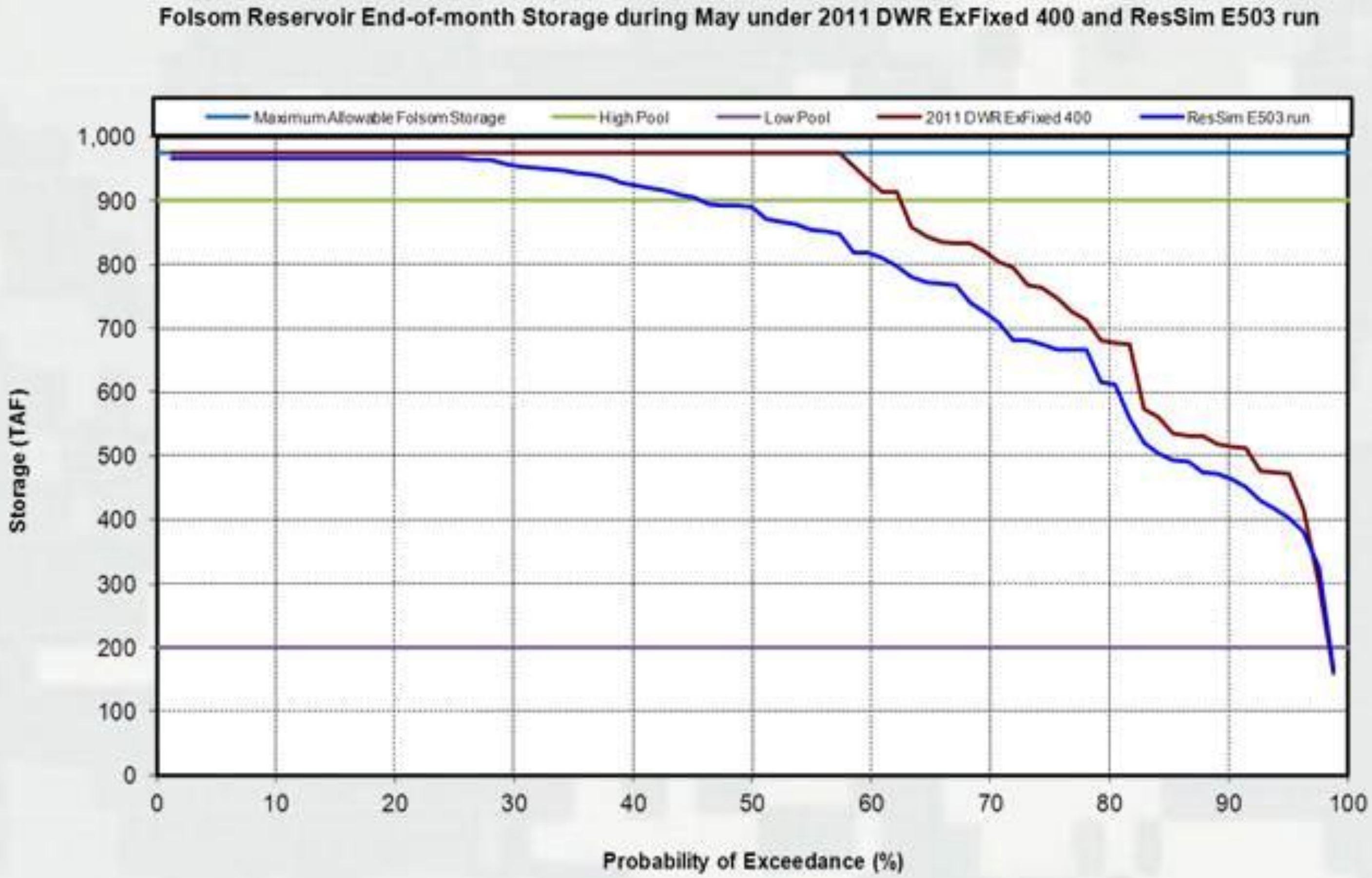
WATER SUPPLY EVALUATION
TIER 1

- Will operation set be likely to change water supply for system-wide beneficial uses?
- Approach includes comparison of HEC ResSim and CalSim II Period of Record Runs (WY 1921 – WY 2002).

WATER SUPPLY EVALUATION TIER 1 (cont.)

- Data products for Key System Metrics are compared (end of May Storage and Lower American River Flows).
- Assumption is that CalSim II output reflects prioritization of CVP and SWP beneficial uses.
- Similar output implies operation set reasonably able to satisfy water supply for project beneficial uses.

TIER 1 DATA COMPARISONS

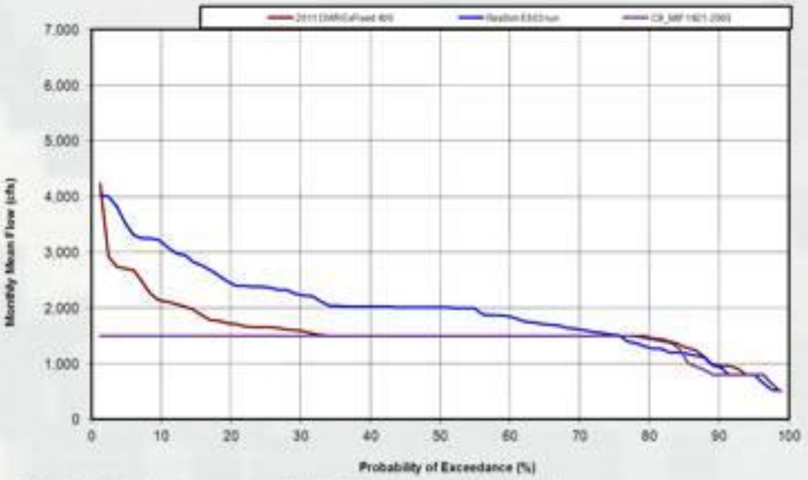

Folsom Reservoir End-of-month Storage during May under 2011 DWR ExFixed 400 and ResSim E503 run

Data Source : 2011_Fixed_400; CALSIM modeling performed by HDR (2011DRR_EX_Fixed400), Simulation period: Oct 1921 - Sep 2003
USACE ResSim E503ResSim (2012-12-19/E503/E503/rss/E503-POR/simulation.dss), Simulation period: 6 Oct 1921 - 30 Sep 2002
Minimum Release Requirement from DWR SWP Delivery Reliability Study Existing conditions Scenario

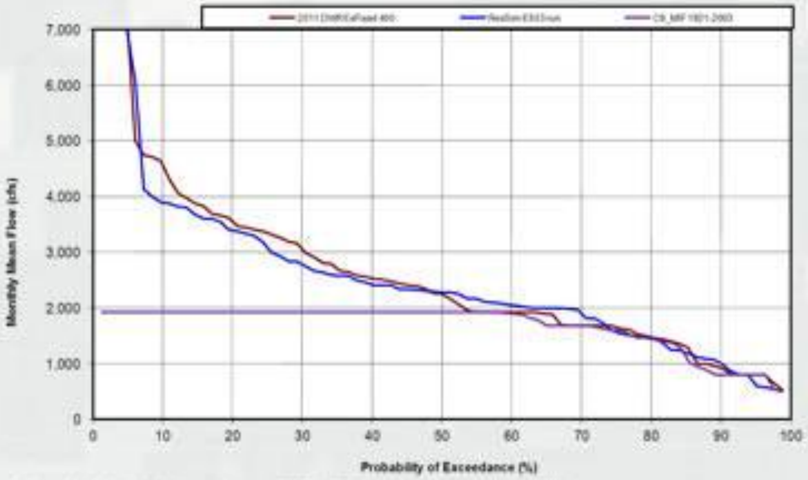
Originator: DK 1/22/13
QC: JF 1/23/13

TIER 1 DATA COMPARISONS

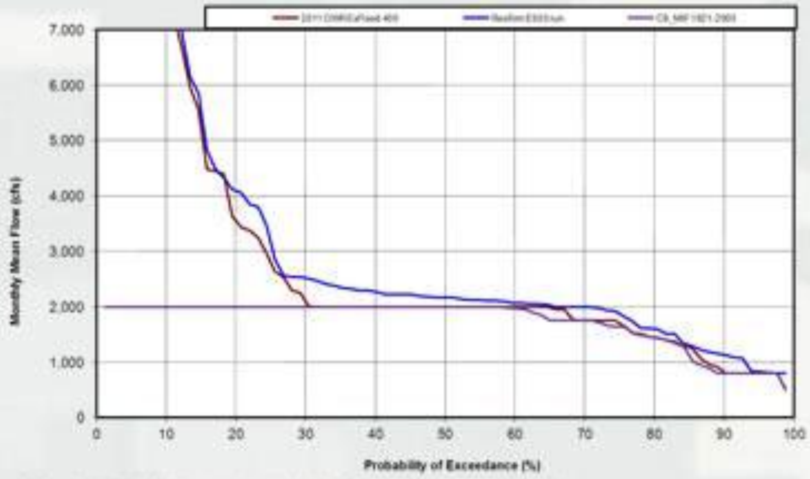
Lower American River Flow below Nimbus Dam during October under 2011 DWR ExFixed 400 and ResSim E503 run



Lower American River Flow below Nimbus Dam during November under 2011 DWR ExFixed 400 and ResSim E503 run



Lower American River Flow below Nimbus Dam during December under 2011 DWR ExFixed 400 and ResSim E503 run



NEXT STEPS

- Continue with details and model iterations-refinement.
- Real-time review and quality control of model builds and output data sets.
- Outreach and Coordination.

QUESTIONS & COMMENTS

Appendix G: Public Involvement, Part 2

Notice of Intent

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

CESPK-PD-R (1110-2-1150a)

OCT - 3 2012

MEMORANDUM FOR Commander, U.S. Army Records and Declassification Agency,
ATTN: AHRC-PDD-RP, Army Federal Register Liaison (Ms. Brenda Bowen),
Casey Building Room 102, 7701 Telegraph Road, Alexandria, VA 22315-3860

SUBJECT: Notice of Intent, Folsom Dam Water Control Manual Update, Folsom, California

The enclosed Notice of Intent is submitted to your office for publication in the Federal Register in compliance with the Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act of 1969, 42 U.S.C.§4321-4370(f), as amended. The project schedule identifies Friday, October 12, 2012, for publication in the Federal Register.

The U.S. Army Corps of Engineers, Sacramento District is submitting three original signed copies of the Notice of Intent to Prepare a Joint Environmental Impact Statement/Environmental Impact Report for the Folsom Dam Water Control Manual Update, Folsom, California. An electronic copy of the Notice of Intent is included on the enclosed CD-ROM.

Point of contact for this Memorandum is Ms. Lisa Eckert at (916) 557-6688 or Mr. Dan Artho at (916) 557-7723.

3 Encls

WILLIAM J. LEADY, P.E
COL, EN
Commanding

CF:
Commander, U.S. Army Corps of Engineers South Pacific Division, 333 Market Street, San Francisco, CA 94105 (w/encl)

BILLING CODE: 3720-58

DEPARTMENT OF DEFENSE

Department of the Army; Army Corps of Engineers

Notice of Intent to Prepare a Joint Environmental Impact Statement/Environmental Impact Report for the Folsom Dam Water Control Manual Update

AGENCY: Department of the Army, U.S. Army Corps of Engineers; DOD.

ACTION: Notice of Intent.

SUMMARY: The U.S. Army Corps of Engineers, Sacramento District (USACE) intends to prepare a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Folsom Dam Water Control Manual Update (Folsom WCM Update). USACE will serve as lead agency and the Bureau of Reclamation will be a cooperating agency for compliance with the National Environmental Policy Act (NEPA), and the Central Valley Flood Protection Board (CVFPB) will serve as lead agency for compliance with the California Environmental Quality Act (CEQA). The Folsom WCM Update is intended to improve the ability of Folsom Dam to utilize the new physical features to manage large flood events and meet dam safety requirements.

DATES: Written comments regarding the scope of the environmental analysis should be received by November 11, 2012.

ADDRESSES: Written comments and suggestions concerning this project and requests to be included on the project mailing list may be submitted to Tyler Stalker, U.S. Army Corps of Engineers, Sacramento District, Attn: Public Affairs Office (CESPK-PAO), 1325 J Street, Sacramento, CA 95814.

FOR FURTHER INFORMATION CONTACT: Tyler Stalker via telephone at (916) 557-5107, e-mail at Tyler.M.Stalker@usace.army.mil, or mail at (see **ADDRESSES**). Study information will also be posted periodically on the internet at http://www.spk.usace.army.mil/Missions/CivilWorks/JointFederalProject.aspx

SUPPLEMENTARY INFORMATION:

1. *Proposed Action.* The Folsom WCM Update will identify, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Reservoir to reduce flood risk to the Sacramento area by utilizing the auxiliary spillway currently under construction and by incorporating an improved understanding of the American River watershed upstream of Folsom Dam. The findings of the evaluation will be used to help define the Dam's new flood operations plan, with the intention of meeting flood risk management objectives and dam safety requirements in a manner that conserves as much water as possible and maximizes all authorized Folsom Dam project uses to the extent practicable.

2. *Alternatives.* The EIS/EIR will develop new operational rules to meet dam safety and flood risk management objectives that comply with Congressional direction to reduce Folsom Reservoir variable space allocation from the current operating range of 400,000-670,000 acre-feet (ac-ft) to 400,000-600,000 ac-ft. In addition, the incorporation of improved forecasting capabilities and basin wetness parameters as part of flood management operations will be evaluated. A number of flood management operation alternatives are expected to be developed and the effect of those alternatives on Folsom Dam and Reservoir's other authorized purposes will be analyzed in the EIS/EIR.

3. *Scoping Process.*

a. Two public scoping meetings will be held to present an overview of the Folsom WCM Update and the EIS/EIR process, and to afford all interested parties with an opportunity to provide comments regarding the scope of analysis and potential alternatives. The public scoping meetings will be held at the following locations, dates, and times:

Sacramento Library Galleria	Folsom Community Center
828 I Street, Sacramento, CA	52 Natoma Street, Folsom, CA
October 15th, 2012	October 22nd, 2012
4pm to 7pm	4pm to 7pm

b. Potentially significant issues to be analyzed in depth in the EIS/EIR include project-specific, system-wide, and cumulative effects on authorized purposes of the Folsom Dam project and the environmental resources associated with those purposes. Effects analyzed will include: water supply for irrigation, municipal, and industrial uses; fish and wildlife resources; power generation; water quality; recreation; special status species; soils and levee safety; and cultural resources.

c. USACE will consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service to comply with the Endangered Species Act, the Fish and Wildlife Coordination Act, and the requirements of the current Biological Opinions that affect the operations of Folsom Dam. USACE will consult with the State Historic Preservation Officer to comply with the National Historic Preservation Act. USACE will coordinate with the U.S. Bureau of Indian Affairs to establish consultation requirements with tribes having trust assets and tribal interests that could be affected by the WCM Update's outcome.

d. A 45-day public review period will be provided for individuals, interested parties, and agencies to review and comment on the draft EIS/EIR. All interested parties are encouraged to respond to this notice and provide a current address if they wish to be notified of the draft EIS/EIR circulation.

4. *Availability.* The draft EIS/EIR is scheduled to be available for public review and comment in 2015.

3 OCT 12
Date:

For
William J. Leady, P.E.
Colonel, U.S. Army
District Engineer

LTC EN
Dpty CDR

Appendix G: Public Involvement, Part 3

Scoping Meeting Summary Report

Folsom Dam Water Control Manual Update

Public Scoping Meetings
Summary Report

March 2013

US Army Corps of Engineers®
Sacramento District

General Information About This Document

What's in this document?

This document is a summary report of the stakeholder engagement process and subsequent public scoping meetings held for the Folsom Dam Water Control Manual Update. The report describes the communications program that was implemented to engage interested stakeholders, partners, and the general public into the environmental process.

If there are any further questions regarding either this summary report or the project, please contact the U.S. Army Corps of Engineers, Sacramento District.
Submit concerns or questions to:

Tyler Stalker
USACE Public Affairs Office
1325 J Street
Sacramento, CA 95814
Phone: 916-557-5107
Fax: 916-557-7853
Tyler.M.Stalker@usace.army.mil

David Martasian
DWR Division of Flood Management
3464 El Camino Avenue, Room 200
Sacramento, CA 95821
Phone: 916-574-1448
Fax: 916-574-1478
Folsom_scoping@water.ca.gov

Table of Contents

List of Abbreviations

ac-ft	Acre-Feet
CEQA	California Environmental Quality Act
cfs	Cubic Feet Per Second
Corps	U.S. Army Corps of Engineers
CVFPB	Central Valley Flood Protection Board
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
DFG	Department of Fish and Game
DWR	Department of Water Resources
EIS/EIR	Environmental Impact Statement/ Environmental Impact Report
FEMA	Federal Emergency Management Agency
JFP	Joint Federal Project
NEPA	National Environmental Policy Act
PMF	Probable Maximum Flood
Reclamation	U.S. Bureau of Reclamation (USBR)
ROS	Reservoir Operating Scenarios
SAFCA	Sacramento Area Flood Control Agency
SWP	State Water Project
SWRCB	State Water Resources Control Board
USEPA	U.S. Environmental Protection Agency
WCM Update	Folsom Dam Water Control Manual Update

Chapter 1 Public Scoping Meetings

1.1 Public Scoping Meetings Introduction

Two public scoping meetings with identical formats and materials for the WCM Update were held from 4:00 p.m. to 7:00 p.m. on Monday, October 15, 2012 at the Sacramento Library Galleria (828 I Street, Sacramento) and on Monday, October 22, 2012 at the Folsom Community Center (52 Natoma Street, Folsom). Roles of the participating agencies are as follows:

- Corps Sacramento District—as the lead National Environmental Policy Act (NEPA) agency;
- Reclamation – as a Federally-participating agency
- DWR on behalf of the Central Valley Flood Protection Board (CVFPB)—as the lead California Environmental Quality Act (CEQA) agency; and,
- SAFCA—as a responsible CEQA agency

1.2 Promotion of the Public Scoping Meetings

The public scoping meetings were advertised in the *Sacramento Bee's* Friday, October 5 edition, as well as the *Folsom Telegraph's* Wednesday, October 10 edition. Mail and e-mail announcements were also sent to stakeholders and Folsom residents. In addition, a Notice of Preparation (NOP) was submitted to the State Clearinghouse on October 12 and a Notice of Intent was filed with the Federal Register on October 16. A copy of the newspaper advertisements, notices, e-mail announcements, and mailing lists are included in Appendix A.

1.3 Purpose and Goals of the Public Scoping Meetings

The purpose of the scoping meetings was to present an overview of the WCM Update, the basis of alternative development, the involved agencies' decisionmaking processes, and to solicit information from the public on the range of issues relevant to the scope and content of the Joint Environment Impact Statement/Environmental Impact Report (EIS/EIR). The purpose of the WCM Update effort is to develop, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Reservoir that would reduce flood risk to the Sacramento area by utilizing its existing and authorized physical features, specifically after completion of the Joint Federal Project (JFP) new auxiliary spillway. The findings of the evaluation will be used to help define the Dam's new flood operations plan, with the intention of meeting flood risk management objectives in a manner that conserves as much water as possible and maximizes all authorized Folsom Dam project uses to the extent practicable.

The public scoping meetings were scheduled to take place during the public scoping process and comment period for the joint EIS/EIR that will be prepared for the WCM Update. The meetings provided the public the opportunity to ask questions about the WCM Update and provide comments as part of the formal record. All public scoping comments will be included in the Draft EIS/EIR.

1.4 Format of the Public Scoping Meetings

The scoping meetings format allowed the attendees to arrive, view displays, and talk with project staff members and record comments, all at their convenience. This format afforded a comfortable, low-conflict context for imparting and receiving information. At the meetings, attendees had the opportunity to view WCM Update information boards along with display boards describing the history of Folsom Dam and Reservoir. Aerial photography and graphics depicting the federally authorized projects in the American River Watershed were also on display. Display boards were positioned throughout the room to allow attendees to peruse the material at their discretion.

As a result of the public outreach employed to promote the scoping meetings, 17 community members attended, including representatives from Assemblywoman Alyson Huber’s office and Assemblywoman Beth Gaines’s office. Each attendee was welcomed at the sign-in table where they were asked to sign-in and was provided a comment card.

The formal comment period concluded on November 15 and all interested commenters were able to provide comments at the meetings and/or in writing during the comment period. However, as indicated in the Scoping Guidance provided by the Council on Environmental Quality (1981), scoping is a process, not an event or a meeting. It continues throughout the planning for an EIS. The scope of an EIS occasionally may need to be modified later if a new issue surfaces; and the lead agency has the responsibility to assess each significant effect even if one is found after scoping. In order to provide opportunities for new issues to be identified as early as possible, a robust public outreach effort is being pursued through the duration of the WCM Update process to address these issues to the extent feasible.

Chapter 2 Public Scoping Meetings Proceedings

2.1 Welcome

A number of key staff members were present at each scoping meeting to address any questions or concerns raised by attendees. Each participant was asked to sign-in and encouraged to submit a comment card either that evening, via US mail, or via e-mail before the closing date of the comment period, November 15, 2012. See Appendix D for a list of the scoping meeting attendees.

2.2 Displays

The display boards and exhibits presented at the scoping meeting are described below (copies of the display boards and other graphics can be found in Appendix B). All meeting displays facilitated a good understanding of the WCM Update and all of its elements.

2.2.1 Local Study Area Board

This board provided a map of the local study area. The Folsom Dam and Reservoir is located in Folsom, California, with the local area of analysis focusing on the Lower American River watershed which includes the Folsom Reservoir. The EIS/EIR will evaluate proposed updates to the WCM for Folsom Dam from a local and regional perspective.

2.2.2 Regional Study Area Board

This board provided a map of the regional study area. The regional area of analysis reflects the Central Valley Project (CVP) and State Water Project (SWP) facilities and service areas as Folsom Dam and Reservoir are operated by Reclamation as part of the CVP system.

2.2.3 Folsom Dam and Reservoir Board

This board described the Folsom Dam and Reservoir as a multiuse facility for flood damage reduction, fish and wildlife, water quality, water supply, hydroelectricity, recreation, and navigation. The Dam and Reservoir are primarily operated to maximize flood control and water supply storage benefits.

2.2.4 Flood Risk Management Board

This board provided a map of Sacramento's 200-year floodplain (excluding Natomas). It further described Sacramento as one of the most at risk communities in the nation for flooding; therefore, there is a need for reduction of the flood risk through interim and permanent flood damage reduction measures. The board also described future structural improvements planned to address dam safety issues that could result from hydrologic (flood), seismic (earthquake), and static (seepage) events and explained the non-federal sponsor's goal; to increase the level of protection at Folsom Dam to safely pass the 200-year flood event with the incorporation of all authorized modifications within the American River Watershed.

2.2.5 Purpose of the Update Board

This board described the purpose of the WCM Update, which is to develop, evaluate, and recommend changes to the flood management operations of Folsom Dam and Reservoir in order to reduce flood risk to the Sacramento area by utilizing its existing and authorized physical features, specifically the JFP auxiliary spillway, which is currently under construction. Therefore, the WCM Update will need to be completed before the spillway is constructed to take advantage of the additional capabilities that the spillway will provide. In addition, the update analyzed operational alternatives and the effect of those alternatives on Folsom Dam and Reservoir's other authorized purposes (water supply, power generation, fish and wildlife protection, water quality, recreation, and navigation). Lastly, it defined Folsom Dam's new flood operations plan, intended to meet the flood risk management objectives in a manner that conserves as much water as possible and maximizes all project functions to the extent practicable.

2.2.6 Safety and Flood Risk Management Objectives Board

This board described objectives of the safety and flood risk management, including:

- Passing the Probable Maximum Flood (PMF) while maintaining 3 feet of freeboard below the top of Dam to stay within the Dam Safety constraints of the U.S. Department of Interior, Bureau of Reclamation.
- Managing a 1/100 annual chance flow (i.e. "the 100-year flood") to a maximum release of 115,000 cubic feet per second (cfs) as criteria set by SAFCA to support Federal Emergency Management Agency (FEMA) levee accreditation along the American River.
- Managing a 1/200 annual chance flow (i.e. "the 200-year flood"), as defined by criteria set by DWR locally preferred criteria, to a maximum release of 160,000 cfs, when taking

into account all of the authorized modifications within the American River Watershed (including future Folsom Dam Raise Project and Common Features Project).

2.2.7 Joint Federal Project Overview Board

This board explained the Folsom Dam JFP, an auxiliary spillway currently under construction to be implemented jointly by Reclamation and the Corps to address hydrologic Dam Safety and Flood Damage Reduction concerns related to the controlled release of water from Folsom Dam. The JFP will 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 when it arrives. The JFP has dual goals that simultaneously serve the specific missions of the Corps and Reclamation:

- The Flood Damage Reduction goal of the Corps and their non-Federal partners, CVFPB and SAFCA, is to reduce flood risk in the Sacramento area in conjunction with other elements of the regional flood control system
- The Safety of Dams goal of Reclamation is to pass a PMF of up to 314,000 cfs through the auxiliary spillway without causing failure of Folsom Dam.

This board noted that in order to fully realize the benefits of the new auxiliary spillway, the current Folsom Dam and Reservoir WCM must be updated.

2.2.8 Basis of Alternative Development Board

This board described alternatives that will be developed for new operational rules to meet dam safety and flood risk management objectives that comply with Congressional direction.

Alternatives will consist of the following components:

- Reduce the flood risk in the Sacramento area in conjunction with other elements of the regional flood control system as per the flood damage reduction goal of the Corps and their non-Federal partners, CVFPB and SAFCA;
- Reduce Folsom Reservoir variable space from the current operating range of 400,000-670,000 acre-feet (ac-ft) to 400,000-600,000 ac-ft. for flood storage purposes;
- Update existing outlets and utilize the JFP;
- Maintain the 3-2-4 shutter temperature control shutter configuration; and,
- Operation Rules: Rule curves that derive flood storage reserve requirements from some combination of the following:

  - Storage reserve in Folsom Reservoir
  - Basin Wetness
  - Weather Forecasting

A number of flood management operation alternatives are expected to be developed and the effect of those alternatives on Folsom Dam and Reservoir’s other authorized purposes will be analyzed in the EIS/EIR.

2.2.9 EIS/EIR Effects Assessment Board

This board explained that the environmental effects analyses will be centered around the effects that the flood management operations alternatives would have on the Folsom Dam and Reservoir’s authorized purposes, including (but not limited to):

- Flood control
- Water supply (Irrigation and M&I)
- Fish and wildlife
- Power generation
- Water Quality
- Navigation
- Recreation

The EIS/EIR effects analysis approach would include:

- Comparison of alternatives to baseline conditions
- Closer evaluations of effects in the Lower American River
- Screening level evaluations for more distant parts of the CVP and SWP followed by detailed evaluations as needed.

2.2.10 Agency Roles and Responsibilities Board

This board explained the relationship, roles, and responsibilities between the Corps, Reclamation, DWR, and SAFCA as they relate to the WCM Update. The Corps is responsible for preparing and submitting the Folsom Dam WCM Update and the NEPA Record of Decision that identifies the Study's recommended flood management operation alternative. Reclamation is a Federally-involved agency and a NEPA Cooperating Agency. The DWR on behalf of the CVFPB is responsible for signing the WCM Update for the State and will be the CEQA lead agency.

The four agencies will work together to provide oversight for the Folsom Dam WCM Update through a number of mutual arrangements, including participation on the Project Management Group, Technical Working Group, and Project Delivery Team.

2.2.11 EIS/EIR Process Board

This board explained that a joint EIS/EIR will be prepared in compliance with NEPA and CEQA and that the document will disclose to the public potential environmental effects and propsed measures to avoid or reduce significant environmental effects of all feasible alternatives considered. All public comments received will be considered prior to making a final decision on the action to be taken.

2.2.12 Study Tools Board

Preliminary reservoir operating scenarios (ROS) will be developed in direct coordination with the partner agencies using existing and future-without project conditions as parameters formulated that have the potential to accomplish the Study purpose. This preliminary array of ROS's will be simulated using the Corps' HEC-ResSim software. Each ROS will then be screened through as many as three tiers of acceptance criteria to arrive at an array of ROS's, or alternatives.

2.2.13 Modeling Goals and Process Board

This board explained the modeling goals from which reservoir operation alternatives will be developed and evaluated from a flood risk management performance and environmental effects analysis perspective:

- To develop Water Control and Emergency Spillway Release Diagrams for a comprehensive Water Control Plan

- To produce data to support the planning process and NEPA, CEQA, California Endangered Species Act, and Federal Endangered Species Act Requirements.

This board also explained the step-by-step modeling process:

- Identify alternatives
- Formulate operation rules for each model
- Simulate hypothethical and period of record hydrology to assess flood operations
- Use models to perform floodplain analysis (HEC-RAS and FLO-2D)

- Use CALSIM II Model to simulate CVP and SWP operations with each alternative
- Assess and refine

2.2.14 Scoping and Comment Process Board

This board explained the scoping and comment process. Scoping is done to gather public comments, insights and local information for the environmental document. Potential comments include:

- Any options that should be considered and evaluated
- Potential environmental issues and impacts
- Any local knowledge or information to assist with the environmental review that we may not be aware of
- When and how you would like to be informed of the project.

The board reiterated that comments are due by November 15, 2012 and that comments will be compiled in a scoping document (this document) and will be considered in the development of the EIS/EIR. Contact information for comment submittal was listed on the board.

2.3 Personnel on Hand

The following personnel (listed in alphabetical order by last name) helped set-up, conduct the meetings, and were available to answer questions from the public. Lisa Eckert, Corps Environmental Staff, was in charge of the scoping meetings.

2.3.1 Corps Staff

Dan Artho
Art Ceballos
Lisa Eckert
Hunter Merritt
Scott Parker
Tyler Stalker

2.3.2 Staff from Other Agencies and Consultants

Bureau of Reclamation

Mark Curney

Department of Water Resources/ Central Valley Flood Protection Board (DWR/CVFPB)

Vincent Heim
David Martasian

Boone Lek

SAFCA

Pete Ghelfi
Rick Johnson

HDR Engineering, Inc.

Linda Fisher
Kimberly Pallari
Michael Vecchio

◆

Chapter 3 Public Input

3.1 Written Comments Submitted

The Corps and DWR received 9 written comments during the public scoping comment period. See Appendix C for copies of the actual comments submitted. Comments were submitted at the scoping meetings, via e-mail transmission, and by US mail. Requests were also received by e-mail and phone to be added to the WCM Update mailing list.

3.2 Summary of Comments Received

Listed below is a summary of the comments received during the public comment period.

Date	Commenter	Comment Submission	Comment Summary	Path Forward
Levee Stability				
October 15, 2012	Renee Acosta, citizen	Public Scoping Meeting	Would like the surrounding levees to be fixed to prevent flooding.	This will be further addressed in the Soils and Levee Stability section of the Draft EIS/EIR
Permits and Approvals				
October 19, 2012	Trevor Cleak, Central Valley Regional Water Quality Control Board (CVRWQCB)	Via US Mail	Provided information regarding the permits and approvals that the project may need and that the CVRWQCB oversees.	The Folsom WCM Update will be in compliance with all Federal, state, and local policies and procedures.
Fisheries and Forecasting				
October 22, 2012	Erin Aquino-Carhart, Department of Fish and Game	Public Scoping Meeting	Requested that information regarding how water temperature and velocities from the	A complete analysis to address these comments will be included in the Fisheries, Special Status

	(DFG)		spillway will affect salmonids be included in the Joint EIS/EIR. Also asked if the WCM Update would look at fish passage and affects to the Delta.	Species, and Water Quality sections of the Draft EIS/EIR
October 22, 2012	Gary Estes, citizen	Public Scoping Meeting	Stated the benefits of conditional storage based on forecast. Asked if water releases from Folsom Dam would be restricted due to potential fish stranding.	Forecasting technology will be considered in Study alternatives. The potential for fish habitat alteration will be addressed in the Hydrology and Hydraulics, Fisheries, and Special Status Species sections of the Draft EIS/EIR.
Distribution List				
October 29, 2012	Arthur Murray, Caltrans District 3	Via e-mail	No specific comments but requested to be kept apprised of the project in the future.	Add to distribution list
Water Quality				
November 8, 2012	Patrick Morris, CVRWQCB	Via e-mail and US mail	Stated that adjustments to water management in Folsom Lake may influence mercury transport, methylmercury production, and methylmercury bioaccumulation in areas affected by Folsom Lake	Mercury concerns will be addressed in the Water Quality section of the Draft EIS/EIR.

			operations. Therefore, the CVRWQCB would like the WCM Update to evaluate the project's impacts on fish mercury levels, mercury transport, and methylmercury production and transport in Folsom Lake and adjacent water bodies.	
November 20, 2012	Tom Kelly, U.S. Environmental Protection Agency (USEPA)	Via e-mail and US mail	USEPA asked that the Corps work with the State Water Resources Control Board (SWRCB) and the CVRWQCB to develop a WCM Update and Joint EIS/EIR that incorporates reservoir management actions to reduce mercury methylation and reflects the applicable portions of the Total Maximum Daily Loads that is being developed by the SWRCB.	Mercury concerns will be addressed in the Water Quality section of the Draft EIS/EIR.
Water Supply				
November 9, 2012	Dan Corcoran, El Dorado Irrigation District	Via e-mail and US mail	EID asked that the WCM Update analysis consider not only the CVP and SWP service areas but each water purveyor's full service area.	Potential impacts to all water purveyors associated with Folsom Reservoir water supplies will be evaluated.

Cultural Resources and Tribal Coordination				
November 13, 2012	Marcos Guerrero, RPA, Auburn Rancheria	Via e-mail	Asked whether the WCM Update would include a comprehensive agreement for any unanticipated or inadvertent discoveries of Native American human remains.	A records search to determine existing conditions will be completed. Coordination with Tribes will occur to determine if a comprehensive agreement is necessary.

Chapter 4 Stakeholder Situational Assessment

4.1 Stakeholder Situation Assessment Introduction

As an additional part of the outreach effort for this WCM Update, in September 2012, the Corps, in conjunction with Reclamation, DWR, and SAFCA, sponsored a series of five discussions with stakeholders who have expressed an ongoing interest in the WCM Update. The discussions were facilitated by Susan Sherry with the Center for Collaborative Policy, Sacramento Chapter. The stakeholder meetings were focused into five categories of stakeholders: 1) flood management-organizations, 2) recreational users, 3) regional environmental organizations, 4) in-basin purveyors, and 5) electric power utilities/agencies as well as key CVP/SWP contractors and associations.

4.2 Goals of the Stakeholder Situational Assessment

The stakeholder discussions had three important goals:

- To engage the stakeholders in the policy and technical work of the Folsom Dam WCM Update;
- To understand the stakeholders' interests and concerns; and
- To receive comment from the stakeholders regarding how they might like to be involved in the project in the future.

4.3 Relationship of Situational Assessment to Public Scoping Efforts

The Stakeholder Situtational Assessment and the Public Scoping Meetings are part of the public outreach efforts for the WCM Update. The Corps and its partners are engaging the public in the WCM Update process by not only providing information about the WCM Update but also by soliciting valuable information from interested members of the public. Information from the Stakeholder Situational Assessment and the Public Scoping Meetings are being considered and incorporated into the WCM Update and the Draft EIS/EIR. Discussions with interested members of the public during the Stakeholder Situational Assessment and the Public Scoping Meetings, along with comments received during the public scoping period, have identified interests and concerns regarding the WCM Update. The Corps and its partners plan to continue their public outreach efforts through the duration of the WCM Update process to address these issues as much as possible.

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Appendix A Letters and Notices

Following are copies of the Stakeholder Discussion Invitation, Notice of Intent, Federal Register listing of the Notice of Intent, Notice of Preparation, Notice of Completion and Environmental Document Transmittal, public notices that were advertised in the *Sacramento Bee* and *Folsom Telegraph*, articles relating to the scoping meetings, and the scoping meetings invitation to all interested parties.

Date: <Month> <Day>, <Year>

To: <First Name> <Last Name>, <Organization>

From: Alicia Kirchner, Chief of Planning, US Army Corps of Engineers, Sacramento District

Subject: Invitation to Participate in the Stakeholder Situational Assessment for the Flood Management Operations Study for Folsom Dam

Dear <First Name>,

On August 18, the US Army Corps of Engineers hosted its first stakeholder workshop on the Flood Management Operation Study for Folsom Dam (Study). To follow up on the workshop and formally launch the stakeholder engagement process, I would like to invite you to participate in the Study's Stakeholder Situational Assessment. The Corps' has asked the Sacramento State's Center for Collaborative Policy (CCP) to conduct this assessment.

The assessment seeks to define the array of stakeholder interests, concerns and questions. CCP will interview a range of stakeholders representing local, regional, tribal and out-of region interests. After the interviews are complete, CCP will analyze the results, offer their findings and develop a series of recommendations, including recommendations on the most effective means for future stakeholder engagement in the Study. When the assessment is complete, we will be sharing the assessment findings and recommendations with the stakeholders.

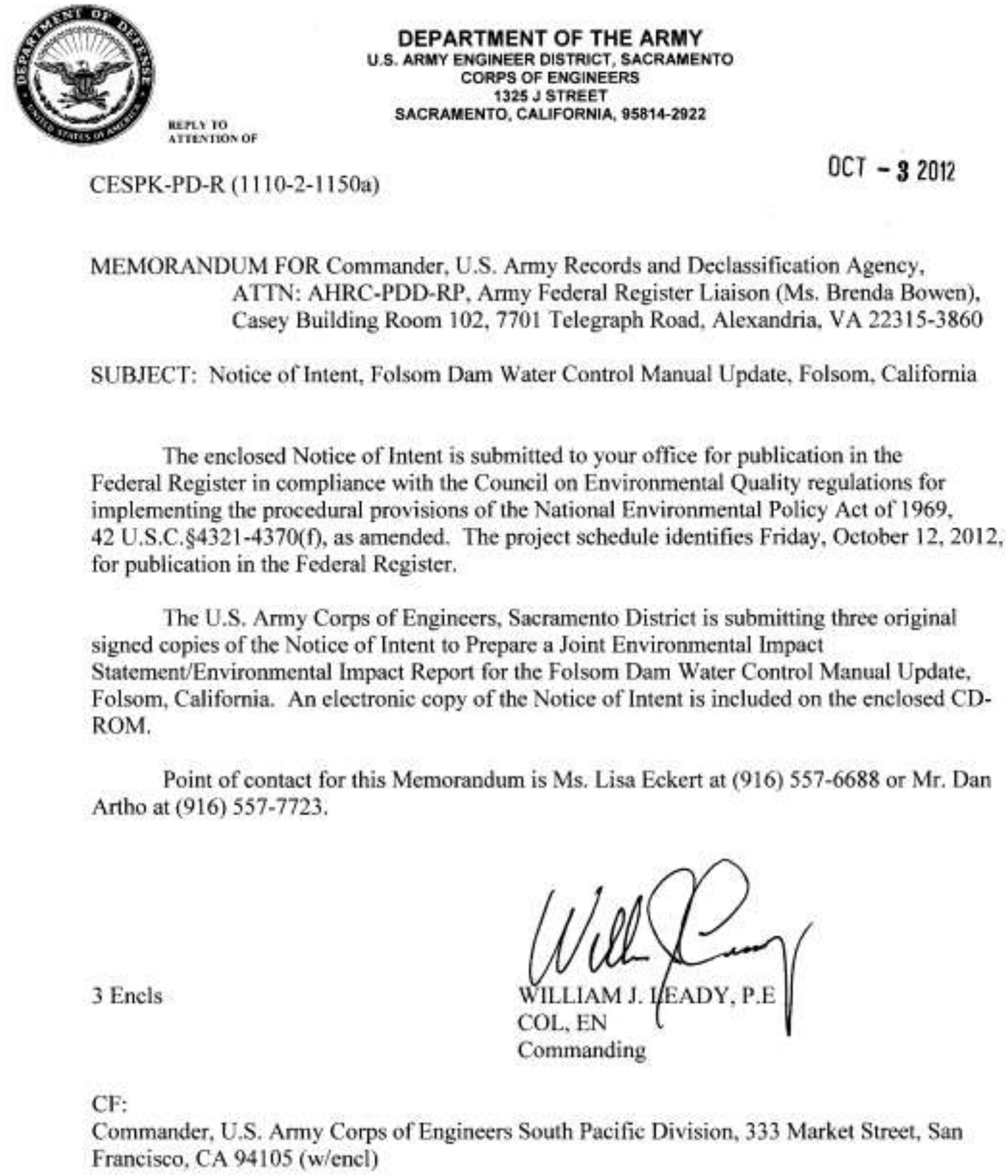
Between now and October 24, a scheduler from CCP will contact you directly to set up an interview and provide you with the name of the person who will be interviewing you. The interviews will last approximately 1 – 1.5 hours. CCP's preference is to conduct in-person interviews, but can do telephone interviews if necessary. In some cases, CCP will be doing in-person group interviews if the interviewees have identical or very similar interests.

Attached for your information is a Project Summary and Questions and Answers on the project you may find of value in preparing for the interview.

For specific questions on the assessment or the Study effort to date, please contact Angela De Paoli at 916-557-6782 or angela.depaoli@usace.army.mil . Thank you for your time; we look forward to working with you in the future.

Sincerely,

Alicia E Kirchner
Chief of Planning
US Army Corps of Engineers, Sacramento District



DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

CESPK-PD-R (1110-2-1150a)

OCT - 3 2012

MEMORANDUM FOR Commander, U.S. Army Records and Declassification Agency,
ATTN: AHRC-PDD-RP, Army Federal Register Liaison (Ms. Brenda Bowen),
Casey Building Room 102, 7701 Telegraph Road, Alexandria, VA 22315-3860

SUBJECT: Notice of Intent, Folsom Dam Water Control Manual Update, Folsom, California

The enclosed Notice of Intent is submitted to your office for publication in the Federal Register in compliance with the Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act of 1969, 42 U.S.C.§4321-4370(f), as amended. The project schedule identifies Friday, October 12, 2012, for publication in the Federal Register.

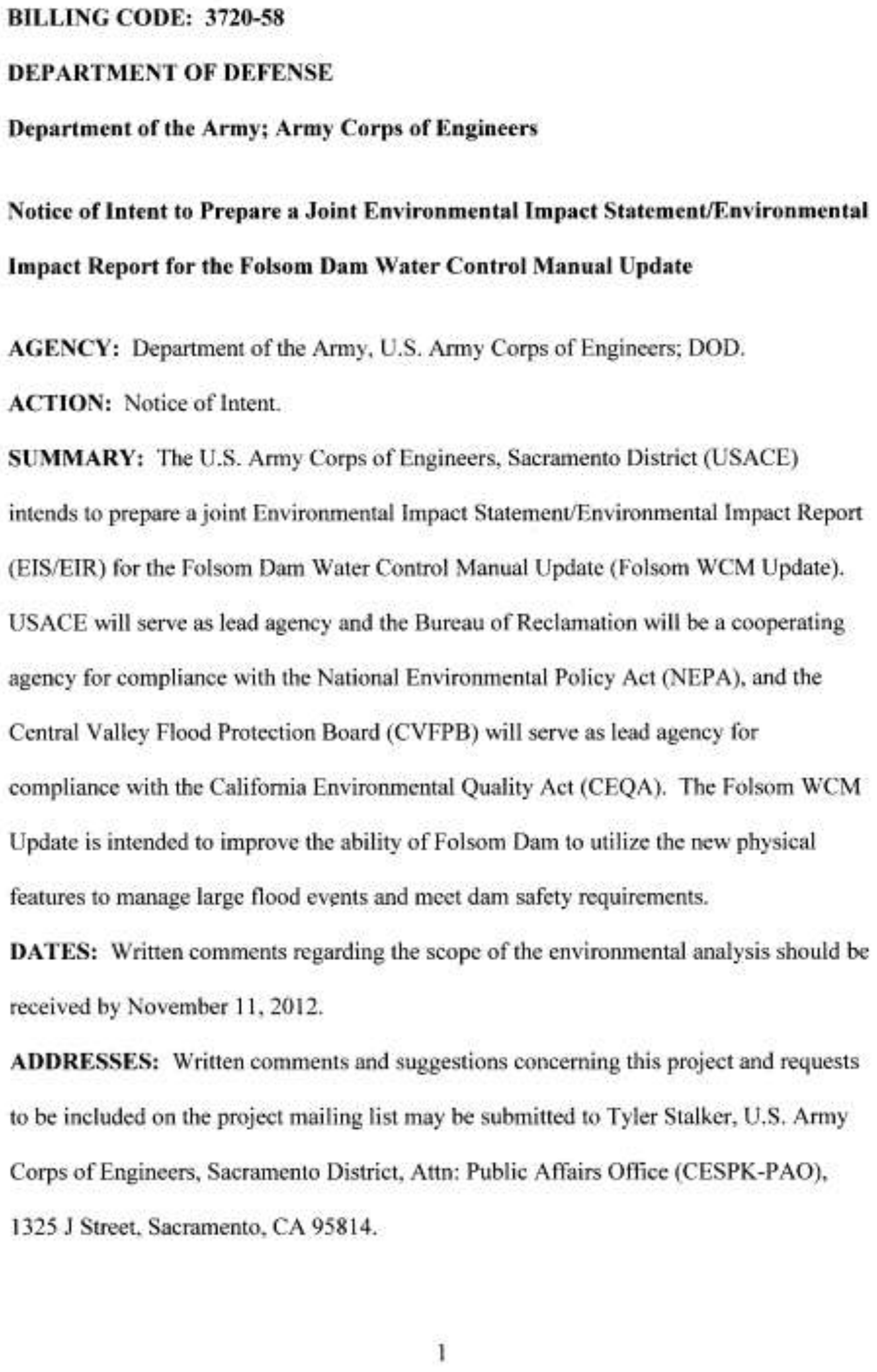
The U.S. Army Corps of Engineers, Sacramento District is submitting three original signed copies of the Notice of Intent to Prepare a Joint Environmental Impact Statement/Environmental Impact Report for the Folsom Dam Water Control Manual Update, Folsom, California. An electronic copy of the Notice of Intent is included on the enclosed CD-ROM.

Point of contact for this Memorandum is Ms. Lisa Eckert at (916) 557-6688 or Mr. Dan Artho at (916) 557-7723.

3 Encls

WILLIAM J. LEADY, P.E
COL, EN
Commanding

CF:
Commander, U.S. Army Corps of Engineers South Pacific Division, 333 Market Street, San Francisco, CA 94105 (w/encl)



BILLING CODE: 3720-58

DEPARTMENT OF DEFENSE

Department of the Army; Army Corps of Engineers

Notice of Intent to Prepare a Joint Environmental Impact Statement/Environmental Impact Report for the Folsom Dam Water Control Manual Update

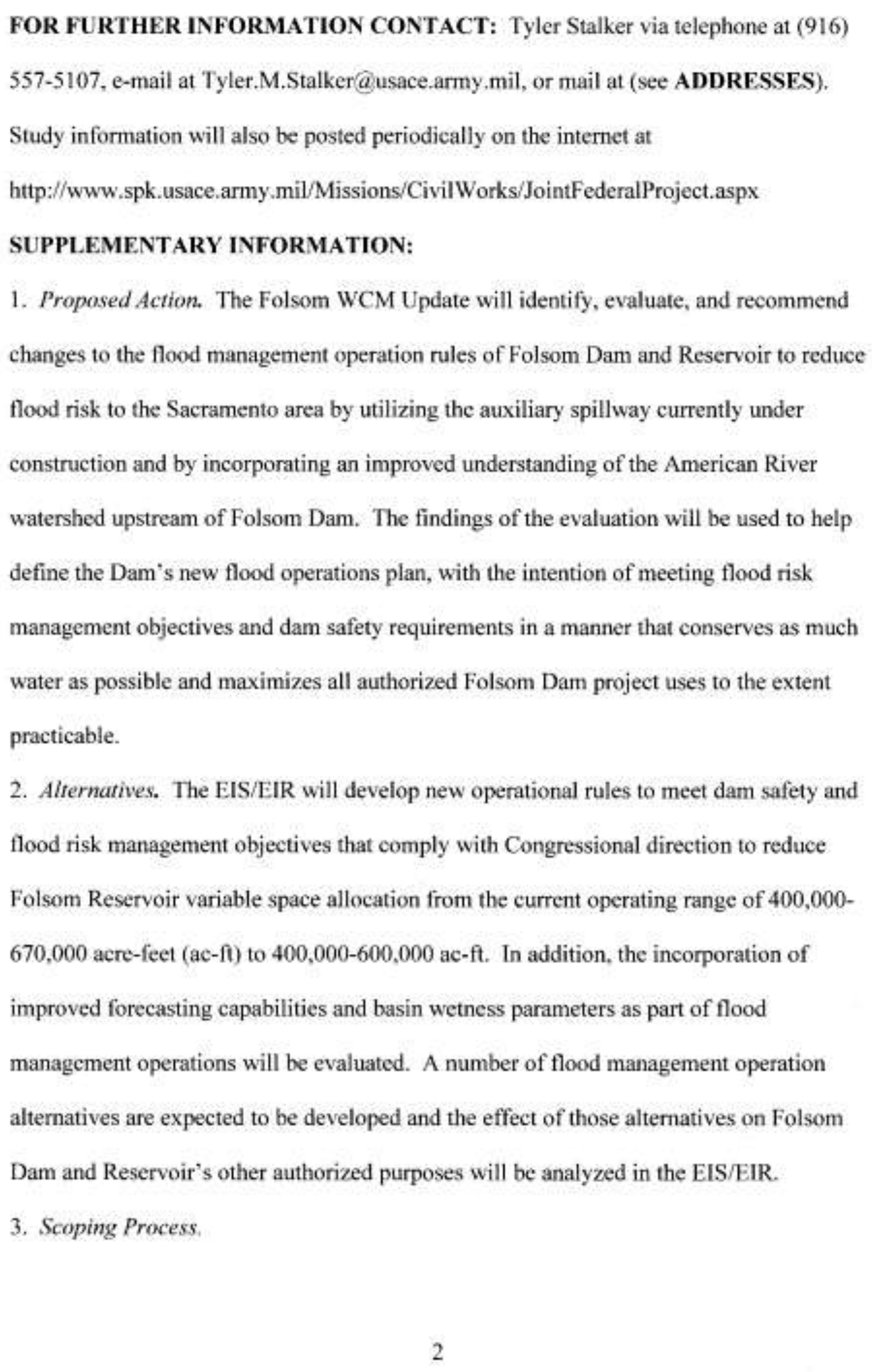
AGENCY: Department of the Army, U.S. Army Corps of Engineers; DOD.

ACTION: Notice of Intent.

SUMMARY: The U.S. Army Corps of Engineers, Sacramento District (USACE) intends to prepare a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Folsom Dam Water Control Manual Update (Folsom WCM Update). USACE will serve as lead agency and the Bureau of Reclamation will be a cooperating agency for compliance with the National Environmental Policy Act (NEPA), and the Central Valley Flood Protection Board (CVFPB) will serve as lead agency for compliance with the California Environmental Quality Act (CEQA). The Folsom WCM Update is intended to improve the ability of Folsom Dam to utilize the new physical features to manage large flood events and meet dam safety requirements.

DATES: Written comments regarding the scope of the environmental analysis should be received by November 11, 2012.

ADDRESSES: Written comments and suggestions concerning this project and requests to be included on the project mailing list may be submitted to Tyler Stalker, U.S. Army Corps of Engineers, Sacramento District, Attn: Public Affairs Office (CESPK-PAO), 1325 J Street, Sacramento, CA 95814.



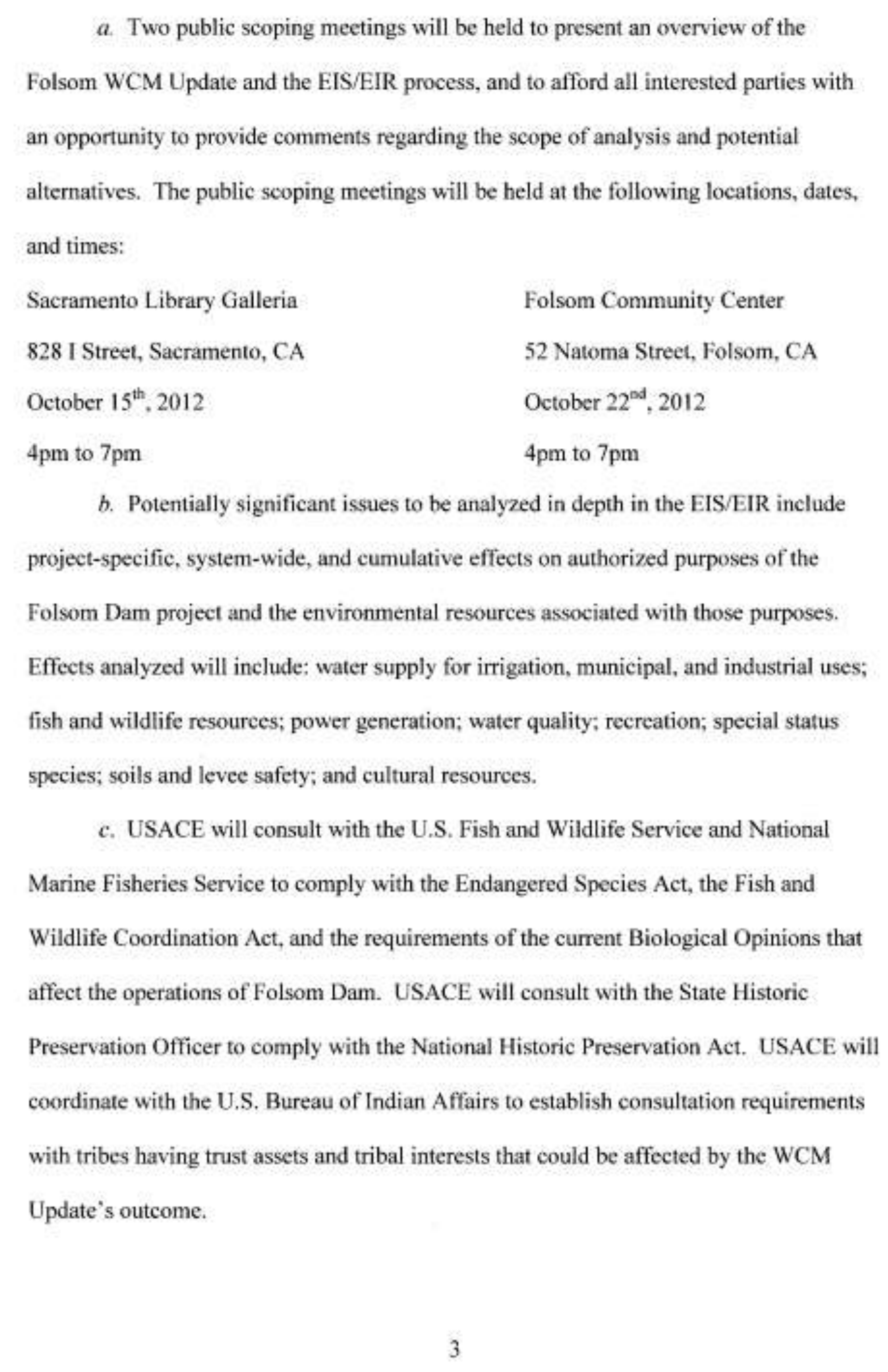
FOR FURTHER INFORMATION CONTACT: Tyler Stalker via telephone at (916) 557-5107, e-mail at Tyler.M.Stalker@usace.army.mil, or mail at (see **ADDRESSES**). Study information will also be posted periodically on the internet at http://www.spk.usace.army.mil/Missions/CivilWorks/JointFederalProject.aspx

SUPPLEMENTARY INFORMATION:

1. *Proposed Action.* The Folsom WCM Update will identify, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Reservoir to reduce flood risk to the Sacramento area by utilizing the auxiliary spillway currently under construction and by incorporating an improved understanding of the American River watershed upstream of Folsom Dam. The findings of the evaluation will be used to help define the Dam's new flood operations plan, with the intention of meeting flood risk management objectives and dam safety requirements in a manner that conserves as much water as possible and maximizes all authorized Folsom Dam project uses to the extent practicable.

2. *Alternatives.* The EIS/EIR will develop new operational rules to meet dam safety and flood risk management objectives that comply with Congressional direction to reduce Folsom Reservoir variable space allocation from the current operating range of 400,000-670,000 acre-feet (ac-ft) to 400,000-600,000 ac-ft. In addition, the incorporation of improved forecasting capabilities and basin wetness parameters as part of flood management operations will be evaluated. A number of flood management operation alternatives are expected to be developed and the effect of those alternatives on Folsom Dam and Reservoir's other authorized purposes will be analyzed in the EIS/EIR.

3. *Scoping Process.*



a. Two public scoping meetings will be held to present an overview of the Folsom WCM Update and the EIS/EIR process, and to afford all interested parties with an opportunity to provide comments regarding the scope of analysis and potential alternatives. The public scoping meetings will be held at the following locations, dates, and times:

Sacramento Library Galleria
828 I Street, Sacramento, CA
October 15th, 2012
4pm to 7pm

Folsom Community Center
52 Natoma Street, Folsom, CA
October 22nd, 2012
4pm to 7pm

b. Potentially significant issues to be analyzed in depth in the EIS/EIR include project-specific, system-wide, and cumulative effects on authorized purposes of the Folsom Dam project and the environmental resources associated with those purposes. Effects analyzed will include: water supply for irrigation, municipal, and industrial uses; fish and wildlife resources; power generation; water quality; recreation; special status species; soils and levee safety; and cultural resources.

c. USACE will consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service to comply with the Endangered Species Act, the Fish and Wildlife Coordination Act, and the requirements of the current Biological Opinions that affect the operations of Folsom Dam. USACE will consult with the State Historic Preservation Officer to comply with the National Historic Preservation Act. USACE will coordinate with the U.S. Bureau of Indian Affairs to establish consultation requirements with tribes having trust assets and tribal interests that could be affected by the WCM Update's outcome.

3

d. A 45-day public review period will be provided for individuals, interested parties, and agencies to review and comment on the draft EIS/EIR. All interested parties are encouraged to respond to this notice and provide a current address if they wish to be notified of the draft EIS/EIR circulation.

4. *Availability.* The draft EIS/EIR is scheduled to be available for public review and comment in 2015.

3 OCT 12
Date:

for
William J. Leady, P.E.
Colonel, U.S. Army
District Engineer

LTC EN
Dpty Cdr

Federal Register/Vol. 77, No. 200/Tuesday, October 16, 2012/Notices **63299**

In accordance with the one-year temporary policy established in the OMB Memorandum, DoD has taken steps to make payments under the contract as soon as practicable, with the goal of paying its contractors within 15 days. DoD strongly encourages all prime contractors to accelerate payments to small business subcontractors under existing contracts to the maximum extent practicable.

The Federal Acquisition Regulatory Council (FAR Council) has recommended that Federal agencies issue deviations to the FAR, which permit immediate incorporation of the policy outlined in OMB Memorandum M–12–16 in solicitations and resultant contracts. In accordance with this recommendation, DoD has begun using a new contract clause, pursuant to Class Deviation 2012–O0014, "Providing Accelerated Payment to Small Business Subcontractors." This class deviation requires prime contractors, upon receipt of accelerated payments from the Government, to make accelerated payments to small business subcontractors to the maximum extent practicable after receipt of a proper invoice and all proper documentation from the small business subcontractor, while also maintaining necessary DoD internal controls. The FAR Council has opened FAR case 2012–031 to undertake rulemaking and obtain public comments to further implement OMB's policy.

Manuel Quinones,

Editor, Defense Acquisition Regulations System.

[FR Doc. 2012–25367 Filed 10–15–12; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Department of the Army; Army Corps of Engineers

Notice of Intent To Prepare a Joint Environmental Impact Statement/Environmental Impact Report for the Folsom Dam Water Control Manual Update

AGENCY: Department of the Army, U.S. Army Corps of Engineers; DOD.

ACTION: Notice of intent.

SUMMARY: The U.S. Army Corps of Engineers, Sacramento District (USACE) intends to prepare a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Folsom Dam Water Control Manual Update (Folsom WCM Update). USACE will serve as lead agency and the Bureau of Reclamation will be a cooperating agency for compliance with the National Environmental Policy Act (NEPA), and the Central Valley Flood Protection Board (CVFPB) will serve as lead agency for compliance with the California Environmental Quality Act (CEQA). The Folsom WCM Update is intended to improve the ability of Folsom Dam to utilize the new physical features to manage large flood events and meet dam safety requirements.

DATES: Written comments regarding the scope of the environmental analysis should be received by November 11, 2012.

ADDRESSES: Written comments and suggestions concerning this project and requests to be included on the project mailing list may be submitted to Tyler Stalker, U.S. Army Corps of Engineers, Sacramento District, Attn: Public Affairs Office (CESPK–PAO), 1325 J Street, Sacramento, CA 95814.

FOR FURTHER INFORMATION CONTACT: Tyler Stalker via telephone at (916) 557–5107, email at *Tyler.M.Stalker@usace.army.mil*, or mail at (see **ADDRESSES**). Study information will also be posted periodically on the Internet at *http://www.spk.usace.army.mil/Missions/CivilWorks/JointFederalProject.aspx*

SUPPLEMENTARY INFORMATION:

1. *Proposed Action.* The Folsom WCM Update will identify, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Reservoir to reduce flood risk to the Sacramento area by utilizing the auxiliary spillway currently under construction and by incorporating an improved understanding of the American River watershed upstream of Folsom Dam. The findings of the evaluation will be used to help define the Dam's new flood operations plan, with the intention of meeting flood risk management objectives and dam safety requirements in a manner that conserves as much water as possible and maximizes all authorized Folsom Dam project uses to the extent practicable.

2. *Alternatives.* The EIS/EIR will develop new operational rules to meet dam safety and flood risk management objectives that comply with Congressional direction to reduce Folsom Reservoir variable space allocation from the current operating range of 400,000–670,000 acre-feet (ac-ft) to 400,000–600,000 ac-ft. In addition, the incorporation of improved forecasting capabilities and basin wetness parameters as part of flood management operations will be evaluated. A number of flood management operation alternatives are expected to be developed and the effect of those alternatives on Folsom Dam and Reservoir's other authorized purposes will be analyzed in the EIS/EIR.

3. *Scoping Process.*

a. Two public scoping meetings will be held to present an overview of the Folsom WCM Update and the EIS/EIR process, and to afford all interested parties with an opportunity to provide comments regarding the scope of analysis and potential alternatives. The public scoping meetings will be held at the following locations, dates, and times: Sacramento Library Galleria, 828 I Street, Sacramento, CA, October 15th, 2012, 4 p.m. to 7 p.m. and Folsom Community Center, 52 Natoma Street, Folsom, CA. October 22nd, 2012, 4 p.m. to 7 p.m.

b. Potentially significant issues to be analyzed in depth in the EIS/EIR include project-specific, system-wide, and cumulative effects on authorized purposes of the Folsom Dam project and the environmental resources associated with those purposes. Effects analyzed will include: Water supply for irrigation, municipal, and industrial uses; fish and wildlife resources; power generation; water quality; recreation; special status species; soils and levee safety; and cultural resources.

c. USACE will consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service to comply with the Endangered Species Act, the Fish and Wildlife Coordination Act, and the requirements of the current Biological Opinions that affect the operations of Folsom Dam. USACE will consult with the State Historic Preservation Officer to comply with the National Historic Preservation Act. USACE will coordinate with the U.S. Bureau of Indian Affairs to establish consultation requirements with tribes having trust assets and tribal interests that could be affected by the WCM Update's outcome.

d. A 45-day public review period will be provided for individuals, interested parties, and agencies to review and comment on the draft EIS/EIR. All interested parties are encouraged to respond to this notice and provide a current address if they wish to be notified of the draft EIS/EIR circulation.

4. *Availability.* The draft EIS/EIR is scheduled to be available for public review and comment in 2015.

Brenda S. Bowen,

Army Federal Register Liaison Officer.

[FR Doc. 2012–25307 Filed 10–15–12; 8:45 am]

BILLING CODE 3720–58–P

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY
EDMUND G. BROWN JR., GOVERNOR

CENTRAL VALLEY FLOOD PROTECTION BOARD
3310 El Camino Ave., Rm. 151
SACRAMENTO, CA 95821
(916) 574-0609 FAX: (916) 574-0682
PERMITS: (916) 574-0685 FAX: (916) 574-0682

NOTICE OF PREPARATION
AND NOTICE OF PUBLIC SCOPING MEETING
FOR THE
FOLSOM DAM WATER CONTROL MANUAL UPDATE ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT

Date: **October 12, 2012**

To: **Public Agencies and Interested Parties**

Project: **The Folsom Dam Water Control Manual Update**

The U.S. Army Corps of Engineers, Sacramento District (USACE) and the Central Valley Flood Protection Board (CVFPB) are preparing a Joint Environment Impact Statement/Environmental Impact Report (EIS/EIR) for the Folsom Dam Water Control Manual Update. The USACE will serve as the lead agency under the National Environmental Policy Act (NEPA), and the CVFPB will serve as the lead agency under the California Environmental Quality Act (CEQA).

The Folsom Dam Joint Federal Project (JFP), consisting of a new auxiliary spillway currently under construction, will improve the ability of Folsom Dam to manage large flood events. In order to fully realize the benefits of the new auxiliary spillway, the current Folsom Dam and Reservoir Water Control Manual must be updated.

Background

Folsom Dam and Reservoir is a multipurpose project (flood risk management, water supply, hydroelectricity, water quality, fish and wildlife preservation, and recreation) operated by the U.S. Bureau of Reclamation (Reclamation) as a part of the Central Valley Project (CVP). The USACE is responsible for prescribing operations pertaining to use of the storage allocated for flood risk management. The dam provides flood risk management benefits to the city of Sacramento and its surrounding areas by regulating runoff from approximately 1,860 square miles of drainage area. It has an authorized total storage capacity of 1,000,000 acre-feet, of which 400,000 acre-feet is allocated for flood storage. An interim agreement between Reclamation and the Sacramento Area Flood Control Agency (SAFCA) authorizes flood management operations at Folsom Reservoir through 2018 to use a variable space allocation with a current operating range of 400,000-670,000 acre-feet, dependent upon incidental storage availability in three upstream reservoirs.

Purpose

The purpose of the Water Control Manual Update effort is to identify, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Reservoir that would reduce flood risk to the Sacramento area by utilizing the new auxiliary spillway and by incorporating an improved understanding of the American River watershed upstream of Folsom Dam. The findings of the evaluation will be used to help define the dam's new flood operations plan, with the intention of meeting flood risk management objectives in a manner that conserves as much water as possible and maximizes all authorized Folsom Dam project uses to the extent practicable.

Area of Analysis

The Folsom Dam and Reservoir is located in Folsom, California. The EIS/EIR will evaluate proposed updates to the water control manual for Folsom Dam from a local and regional perspective. The local area of analysis focuses on the Lower American River watershed, including Folsom Reservoir. The regional area of analysis reflects the Central Valley Project (CVP) and State Water Project (SWP) facilities and service areas because Folsom Dam and Reservoir is part of the CVP system.

Proposed Action and Alternatives

Through the Water Control Manual Update effort, USACE, in partnership with Reclamation, CVFPB, and SAFCA, will, at a minimum, develop new operational rules to meet dam safety and flood risk management objectives that comply with Congressional direction to reduce Folsom Reservoir variable space allocation from the current operating range of 400,000-670,000 acre-feet (ac-ft) to 400,000-600,000 ac-ft. In addition, the incorporation of improved forecasting capabilities and basin wetness parameters as part of flood management operations will be evaluated.

A number of flood management operation alternatives are expected to be developed and the effect of those alternatives on Folsom Dam and Reservoir's other authorized purposes (water supply, power generation, fish and wildlife protection, water quality, recreation, and navigation) will be analyzed in the EIS/EIR. The EIS/EIR will describe the project-specific, system-wide, and cumulative effects on the other authorized purposes of the Folsom Dam project (water supply for irrigation, municipal, and industrial uses; fish and wildlife preservation; power generation; water quality; and recreation). The EIS/EIR will also evaluate cumulative effects of the proposed action and alternatives when considered in conjunction with other related past, present, and reasonably foreseeable future projects, including other USACE, CVFPB, and Department of Water Resources projects.

On the basis of preliminary evaluation, the CVFPB has determined that the proposed alternatives that will be evaluated in the EIS/EIR could have potentially significant environmental effects on the following resources areas:

- Special Status Species
- Fisheries and Aquatic Resources
- Vegetation and Wildlife
- Hydropower
- Hydrology/Water Quality
- Recreation
- Cultural Resources
- Mandatory Findings of Significance

The USACE and the CVFPB will consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service to comply with the Endangered Species Act, the Fish and Wildlife Coordination Act, and the requirements of the current Biological Opinions that affect the operations of Folsom Dam. The USACE and the CVFPB will consult with the State Historic Preservation Officer to comply with the National Historic Preservation Act. The USACE and the CVFPB will coordinate with the U.S. Bureau of Indian Affairs to establish consultation requirements with tribes having trust assets and tribal interests that could be affected by the Water Control Manual Update's outcome. The CVFPB will also consult with the California Department of Fish and Game to comply with the California Endangered Species Act.

<u>Scoping and Public Involvement Process</u>

Pursuant to Section 15083, Title 14, Chapter 3, California Code of Regulations, public scoping meetings will be conducted on October 15th and 22nd, 2012 to solicit public input.

The purpose of the scoping meetings is to present information about the proposed action and alternatives, the USACE and CVFPB's decision-making processes, and to listen to the views of the public on the range of issues relevant to the scope and content of the EIS/EIR. The scoping meeting locations, dates, and times are as follows:

Sacramento Library Galleria
828 I Street, Sacramento, CA
October 15th, 2012
4pm to 7pm

Folsom Communities Center
52 Natoma Street, Folsom, CA
October 22nd, 2012
4pm to 7pm

For questions about the proposed action, alternatives, and the EIS/EIR or to receive a copy of the notice, please contact Mr. David Martasian at 916-574-1442. This notice is also available to view and download on the CVFPB's website at http://www.cvfpb.ca.gov/PublicNotices/

Due to the time limits mandated by state law, written comments and suggestions concerning the proposed action and alternatives must be received or postmarked by November 12, 2012. Please submit comments at the earliest possible date to:

Attn: David Martasian
Central Valley Flood Protection Board
3464 El Camino Ave, Room 200, Sacramento CA 95821
Or by email to Folsom_Scoping@water.ca.gov

The draft EIS/EIR is scheduled to be available for public review and comment in 2015. A 45-day public review period will be provided for individuals, interested parties, and agencies to review and comment on the draft EIS/EIR. All interested parties are encouraged to respond to this notice and provide a current address if they wish to be notified of the draft EIS/EIR circulation.

Jay S. Punia

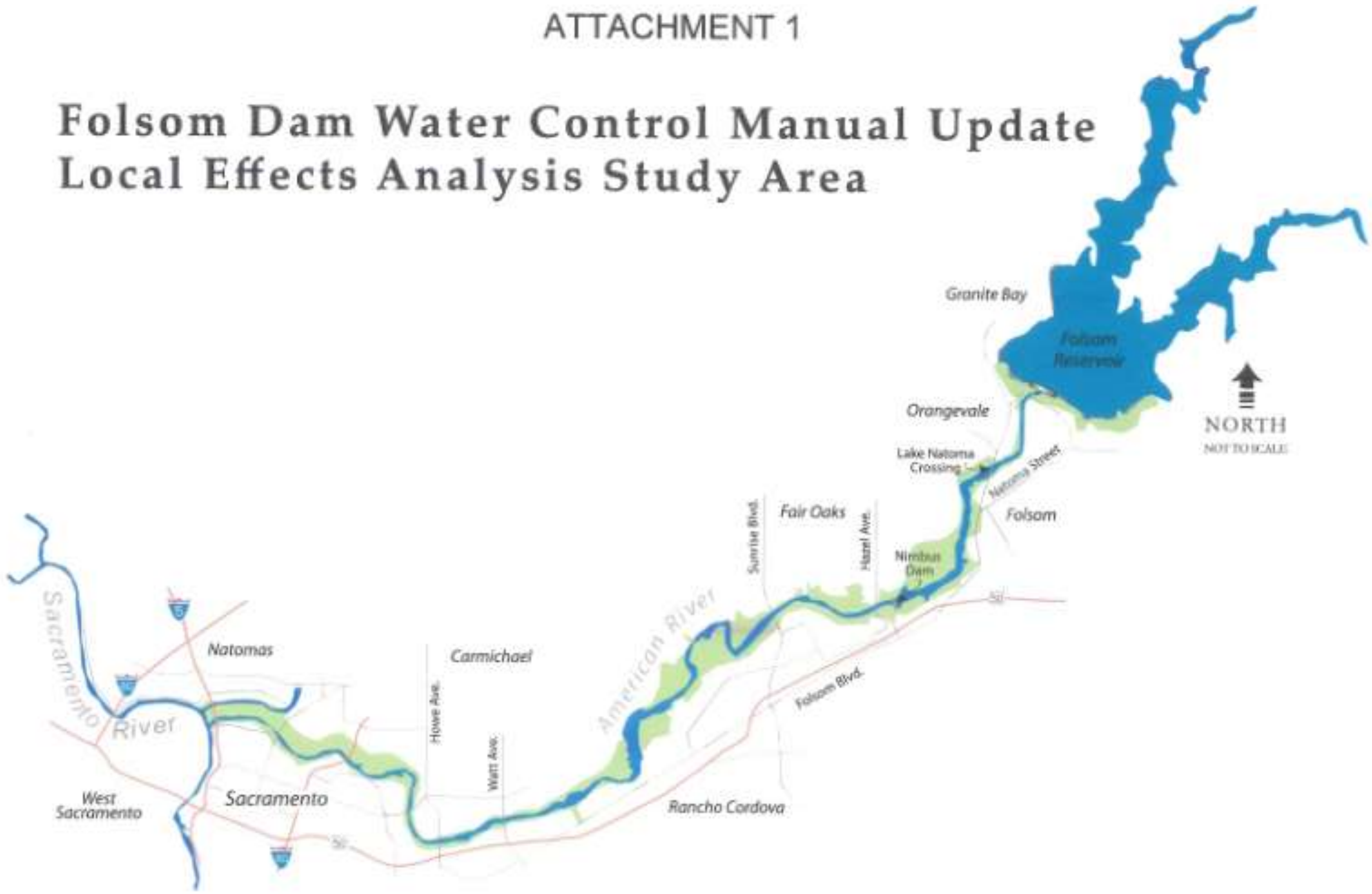
Date: 10/11/2012

Jay S. Punia
Executive Officer
Central Valley Flood Protection Board

Attachment 1 – Local Study Area of Analysis
Attachment 2 – Regional Study Area of Analysis

ATTACHMENT 1

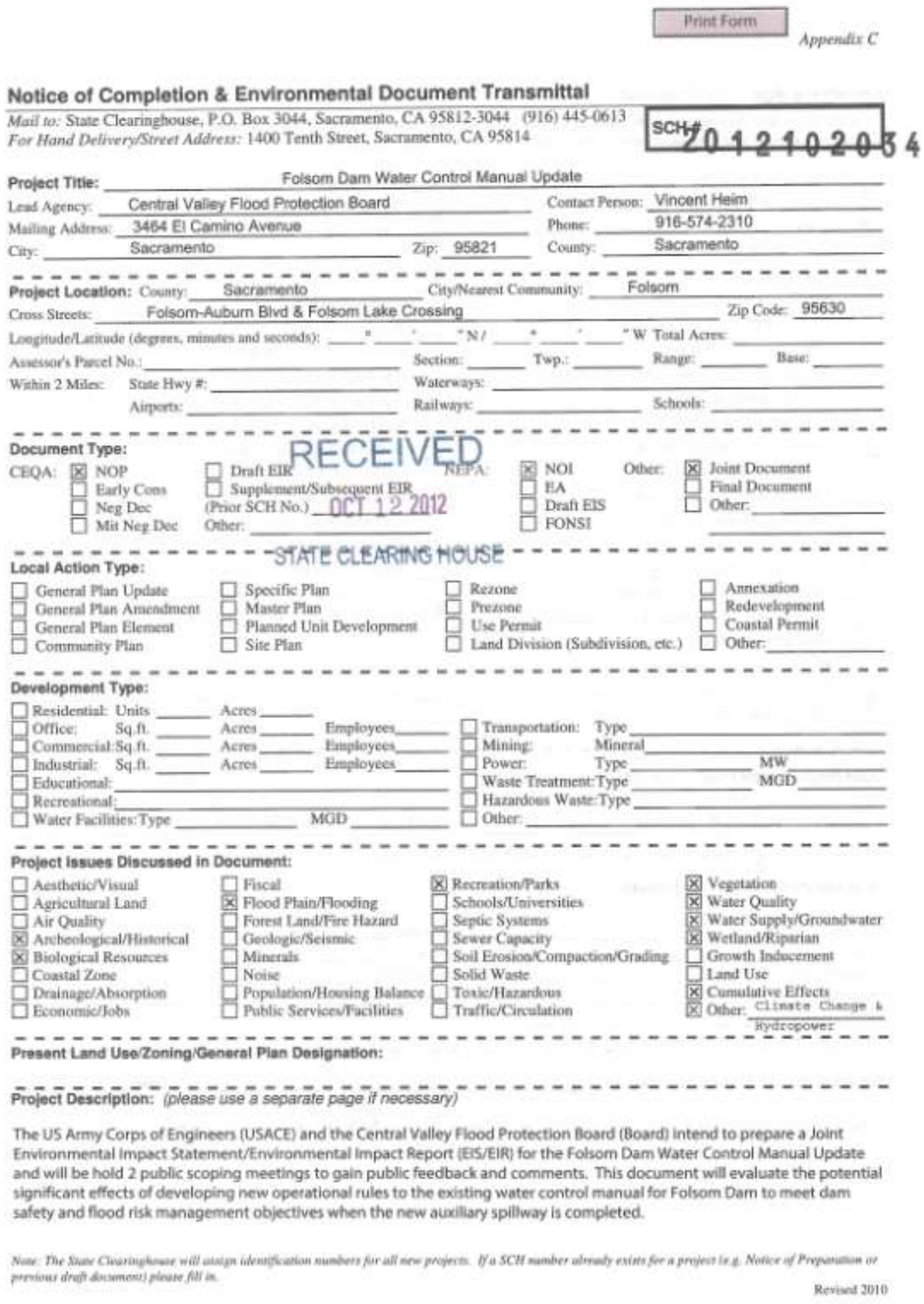
Folsom Dam Water Control Manual Update
Local Effects Analysis Study Area



ATTACHMENT 2

REGIONAL STUDY AREA

The regional area of analysis reflects the Central Valley Project (CVP) and State Water Project (SWP) facilities and service areas because Folsom Dam and Reservoir is operated by the U.S. Bureau of Reclamation (Reclamation) as part of the CVP system.



Print Form

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044   (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH# 2012102034

Project Title: Folsom Dam Water Control Manual Update
Lead Agency: Central Valley Flood Protection Board
Contact Person: Vincent Heim
Mailing Address: 3464 El Camino Avenue
Phone: 916-574-2310
City: Sacramento
Zip: 95821
County: Sacramento

Project Location: County: Sacramento
City/Nearest Community: Folsom
Cross Streets: Folsom-Auburn Blvd & Folsom Lake Crossing
Zip Code: 95630
Longitude/Latitude (degrees, minutes and seconds): ____° ____′ ____″ N / ____° ____′ ____″ W Total Acres: ____
Assessor's Parcel No.: ____ Section: ____ Twp.: ____ Range: ____ Base: ____
Within 2 Miles: State Hwy #: ____ Waterways: ____
Airports: ____ Railways: ____ Schools: ____

RECEIVED
OCT 12 2012
STATE CLEARING HOUSE

Document Type:

CEQA:
- ☒ NOP
- ☐ Early Cons
- ☐ Neg Dec
- ☐ Mit Neg Dec
- ☐ Draft EIR
- ☐ Supplement/Subsequent EIR
- (Prior SCH No.) ____
- Other: ____

NEPA:
- ☒ NOI
- ☐ EA
- ☐ Draft EIS
- ☐ FONSI

Other:
- ☒ Joint Document
- ☐ Final Document
- ☐ Other: ____

Local Action Type:
- ☐ General Plan Update
- ☐ General Plan Amendment
- ☐ General Plan Element
- ☐ Community Plan
- ☐ Specific Plan
- ☐ Master Plan
- ☐ Planned Unit Development
- ☐ Site Plan
- ☐ Rezone
- ☐ Prezone
- ☐ Use Permit
- ☐ Land Division (Subdivision, etc.)
- ☐ Annexation
- ☐ Redevelopment
- ☐ Coastal Permit
- ☐ Other: ____

Development Type:
- ☐ Residential: Units ____ Acres ____
- ☐ Office: Sq.ft. ____ Acres ____ Employees ____
- ☐ Commercial: Sq.ft. ____ Acres ____ Employees ____
- ☐ Industrial: Sq.ft. ____ Acres ____ Employees ____
- ☐ Educational: ____
- ☐ Recreational: ____
- ☐ Water Facilities: Type ____ MGD ____
- ☐ Transportation: Type ____
- ☐ Mining: Mineral ____
- ☐ Power: Type ____ MW ____
- ☐ Waste Treatment: Type ____ MGD ____
- ☐ Hazardous Waste: Type ____
- ☐ Other: ____

Project Issues Discussed in Document:
- ☐ Aesthetic/Visual
- ☐ Agricultural Land
- ☐ Air Quality
- ☒ Archeological/Historical
- ☒ Biological Resources
- ☐ Coastal Zone
- ☐ Drainage/Absorption
- ☐ Economic/Jobs
- ☐ Fiscal
- ☒ Flood Plain/Flooding
- ☐ Forest Land/Fire Hazard
- ☐ Geologic/Seismic
- ☐ Minerals
- ☐ Noise
- ☐ Population/Housing Balance
- ☐ Public Services/Facilities
- ☒ Recreation/Parks
- ☐ Schools/Universities
- ☐ Septic Systems
- ☐ Sewer Capacity
- ☐ Soil Erosion/Compaction/Grading
- ☐ Solid Waste
- ☐ Toxic/Hazardous
- ☐ Traffic/Circulation
- ☒ Vegetation
- ☒ Water Quality
- ☒ Water Supply/Groundwater
- ☒ Wetland/Riparian
- ☐ Growth Inducement
- ☐ Land Use
- ☒ Cumulative Effects
- ☒ Other: Climate Change & Hydropower

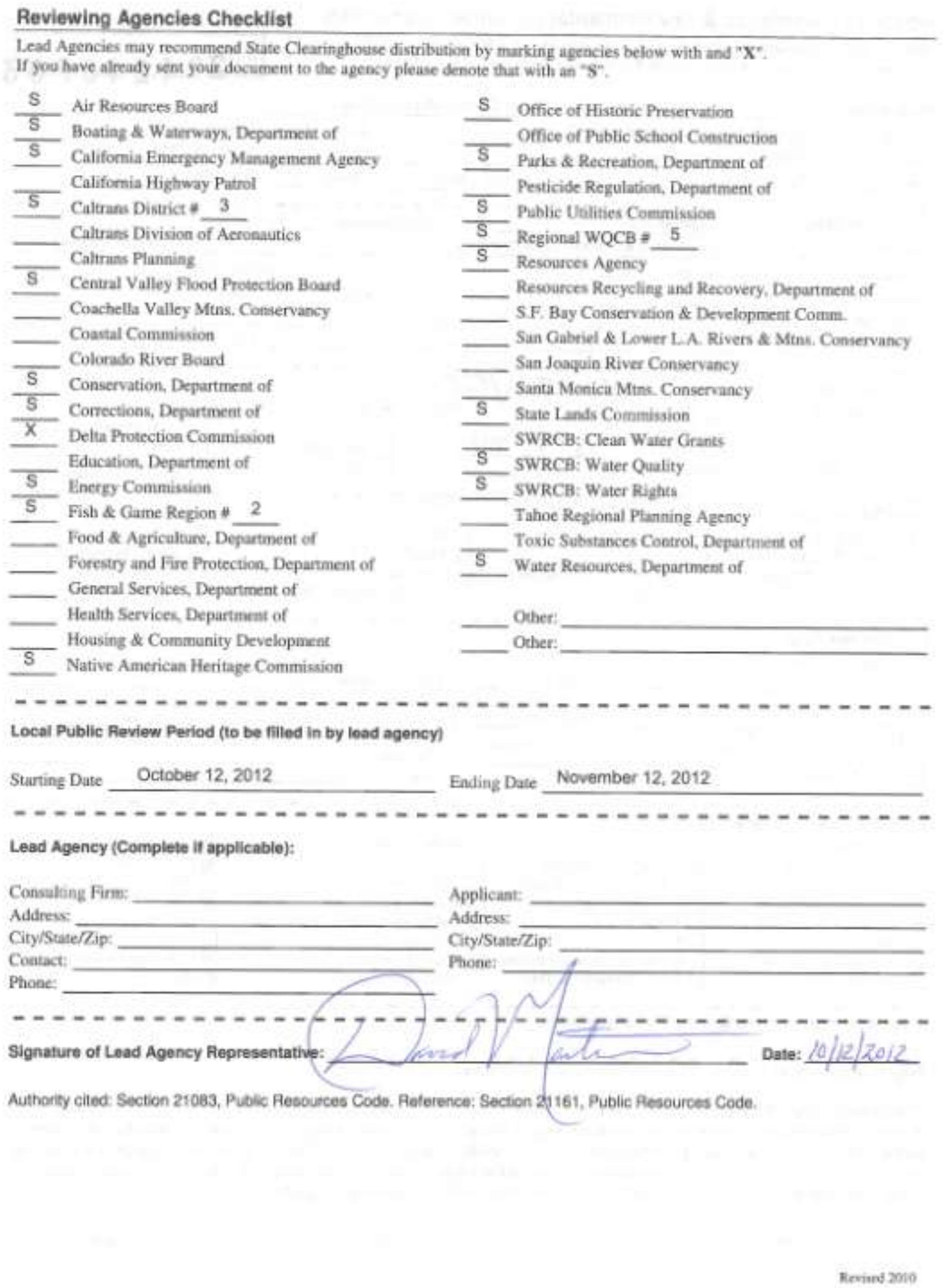
Present Land Use/Zoning/General Plan Designation:

Project Description: *(please use a separate page if necessary)*

The US Army Corps of Engineers (USACE) and the Central Valley Flood Protection Board (Board) intend to prepare a Joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Folsom Dam Water Control Manual Update and will be hold 2 public scoping meetings to gain public feedback and comments. This document will evaluate the potential significant effects of developing new operational rules to the existing water control manual for Folsom Dam to meet dam safety and flood risk management objectives when the new auxiliary spillway is completed.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Revised 2010



Reviewing Agencies Checklist

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X".
If you have already sent your document to the agency please denote that with an "S".

- S Air Resources Board
- S Boating & Waterways, Department of
- S California Emergency Management Agency
- ____ California Highway Patrol
- S Caltrans District # 3
- ____ Caltrans Division of Aeronautics
- ____ Caltrans Planning
- S Central Valley Flood Protection Board
- ____ Coachella Valley Mtns. Conservancy
- ____ Coastal Commission
- ____ Colorado River Board
- S Conservation, Department of
- S Corrections, Department of
- X Delta Protection Commission
- ____ Education, Department of
- S Energy Commission
- S Fish & Game Region # 2
- ____ Food & Agriculture, Department of
- ____ Forestry and Fire Protection, Department of
- ____ General Services, Department of
- ____ Health Services, Department of
- ____ Housing & Community Development
- S Native American Heritage Commission
- S Office of Historic Preservation
- ____ Office of Public School Construction
- S Parks & Recreation, Department of
- ____ Pesticide Regulation, Department of
- S Public Utilities Commission
- S Regional WQCB # 5
- S Resources Agency
- ____ Resources Recycling and Recovery, Department of
- ____ S.F. Bay Conservation & Development Comm.
- ____ San Gabriel & Lower L.A. Rivers & Mtns. Conservancy
- ____ San Joaquin River Conservancy
- ____ Santa Monica Mtns. Conservancy
- S State Lands Commission
- ____ SWRCB: Clean Water Grants
- S SWRCB: Water Quality
- S SWRCB: Water Rights
- ____ Tahoe Regional Planning Agency
- ____ Toxic Substances Control, Department of
- S Water Resources, Department of

____ Other: ____________________

____ Other: ____________________

Local Public Review Period (to be filled in by lead agency)

Starting Date October 12, 2012 Ending Date November 12, 2012

Lead Agency (Complete if applicable):

Consulting Firm: ____________________
Address: ____________________
City/State/Zip: ____________________
Contact: ____________________
Phone: ____________________

Applicant: ____________________
Address: ____________________
City/State/Zip: ____________________
Phone: ____________________

Signature of Lead Agency Representative: ____________________ **Date:** 10/12/2012

Authority cited: Section 21083, Public Resources Code. Reference: Section 21161, Public Resources Code.

Revised 2010

Sacramento Bee Advertisement

NO578 PUBLIC NOTICE

Notice of Preparation and Intent to Prepare an Environmental Impact Statement and Environmental Impact Report for the Folsom Dam Water Control Manual Update

The U.S. Army Corps of Engineers, Sacramento District (USACE) and the Central Valley Flood Protection Board (CVFPB) are preparing a Joint Environment Impact Statement/Environmental Impact Report (EIS/EIR) for the Folsom Dam Water Control Manual Update (WCM Update). The USACE will serve as the lead agency under the National Environmental Policy Act (NEPA), and the CVFPB will serve as the lead agency under the California Environmental Quality Act (CEQA). The Bureau of Reclamation (Reclamation) is acting as a NEPA cooperating agency and the Sacramento Area Flood Control Agency (SAFCA) is acting as a CEQA responsible agency.

Folsom Dam and Reservoir is a multipurpose project operated by the Reclamation as a part of the Central Valley Project (CVP). The USACE is responsible for prescribing operations pertaining to use of the storage allocated for flood risk management. The dam provides flood risk management benefits to the City of Sacramento and its surrounding areas by regulating runoff from approximately 1,860 square miles of drainage area.

The Folsom Dam Joint Federal Project (JFP), currently under construction, consists of a new auxiliary spillway with a spillway crest elevation 50 feet lower in elevation than the current gated spillways on the main dam. The JFP will improve the ability of Folsom Dam to manage large flood events by allowing more water to be safely released earlier in a storm event. In order to fully realize the benefits of the new auxiliary spillway, the current Folsom Dam and Reservoir Water Control Manual must be updated.

The purpose of the WCM Update effort is to identify, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Reservoir that would reduce flood risk to the Sacramento area by utilizing the new auxiliary spillway and by incorporating an improved understanding of the American River watershed upstream of Folsom Dam and by developing the technical information required to update the existing WCM. The findings of the evaluation will be used to help define the Dam's new flood operations plan, with the intention of meeting flood risk management objectives in a manner that conserves as much water as possible and maximizes all authorized Folsom Dam project uses to the extent practicable.

The USACE and the CVFPB will be holding two scoping meetings to provide the public with information on the array of measures currently being considered for the WCM Update and EIS/EIR. Staff from USACE, CVFPB, the Department of Water Resources (DWR), Reclamation, SAFCA, and other members of the project team will be on hand to address questions regarding the WCM Update. The public will be given the opportunity to provide written and verbal comments at the scoping meetings.

Scoping meetings will be held at the following locations:

Sacramento Library Galleria
828 I Street, Sacramento, CA
October 15th, 2012
4pm to 7pm

Folsom Community Center
52 Natoma Street, Folsom, CA
October 22nd, 2012
4pm to 7pm

A Notice of Intent (NOI) to prepare an EIS/EIR pursuant to NEPA will be published in the Federal Register and a Notice of Preparation (NOP) to prepare an EIS/EIR pursuant to CEQA will be submitted to the State Clearinghouse. The notices are available online at the Federal Register website (https://www.federalregister.gov/) and on the CVFPB's website at (http://www.cvfpb.ca.gov/PublicNotices/).

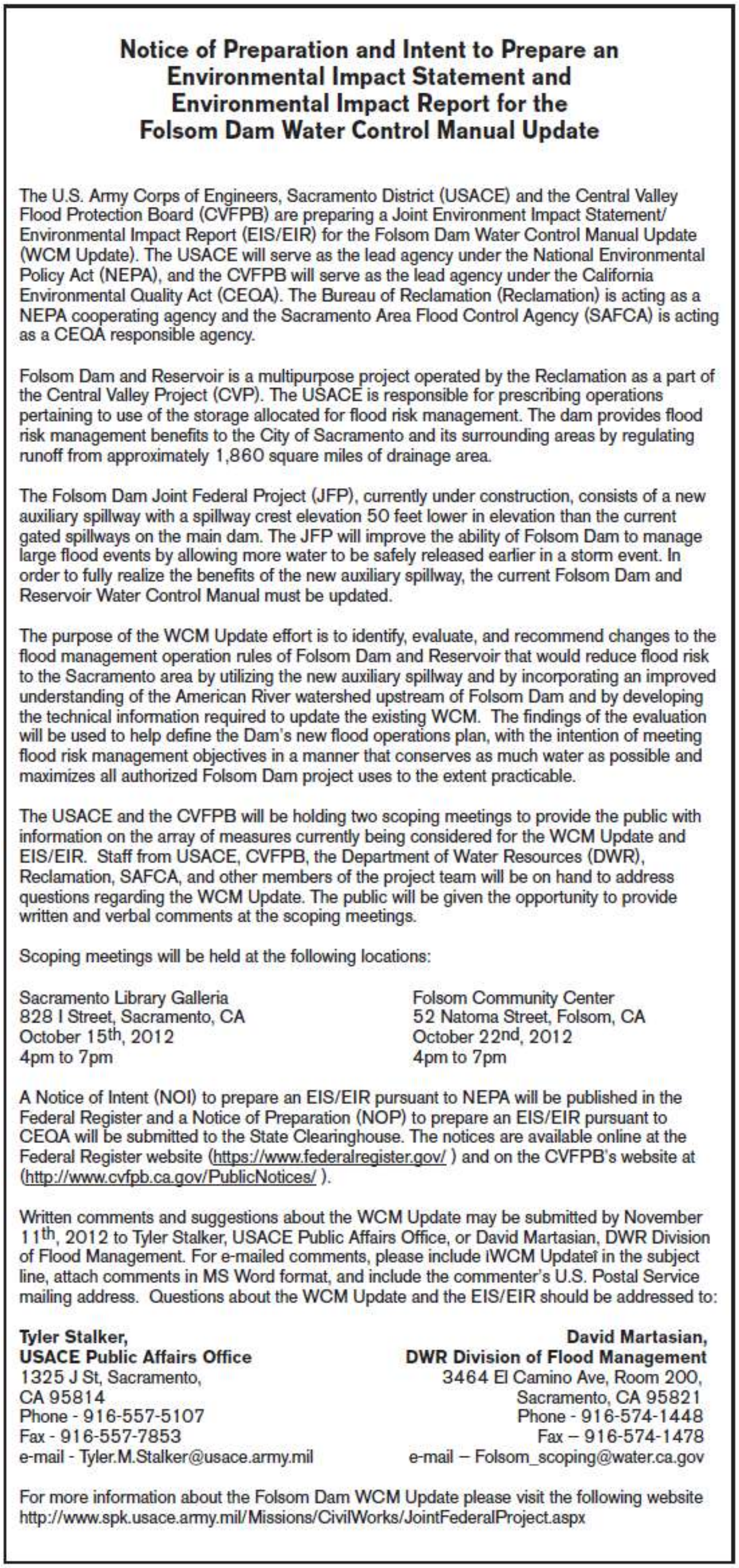
Written comments and suggestions about the WCM Update may be submitted by November 11th, 2012 to Tyler Stalker, USACE Public Affairs Office, or David Martasian, DWR Division of Flood Management. For e-mailed comments, please include "WCM Update" in the subject line, attach comments in MS Word format, and include the commenter's U.S. Postal Service mailing address. Questions about the WCM Update and the EIS/EIR should be addressed to:

Tyler Stalker,
USACE Public Affairs Office
1325 J St, Sacramento,
CA 95814
Phone - 916-557-5107
Fax - 916-557-7853
Tyler.M.Stalker@usace.army.mil

David Martasian,
DWR Division of Flood Mngmnt
3464 El Camino Ave, Room 200,
Sacramento, CA 95821
Phone - 916-574-1448
Fax – 916-574-1478
Folsom_scoping@water.ca.gov

For more information about the Folsom Dam WCM Update please visit the following website http://www.spk.usace.army.mil/Missions/CivilWorks/JointFederalProject.aspx

Folsom Telegraph Advertisement



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USACE Public Affairs Office
1325 J St, Sacramento,
CA 95814
Phone - 916-557-5107
Fax - 916-557-7853
e-mail - Tyler.M.Stalker@usace.army.mil

David Martasian,
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3464 El Camino Ave, Room 200,
Sacramento, CA 95821
Phone - 916-574-1448
Fax – 916-574-1478
e-mail – Folsom_scoping@water.ca.gov

For more information about the Folsom Dam WCM Update please visit the following website http://www.spk.usace.army.mil/Missions/CivilWorks/JointFederalProject.aspx

THE SACRAMENTO BEE sacbee.com

Comments sought about dam's operating rules

mweiser@sacbee.com

Published Thursday, Oct. 18, 2012

State and federal officials are looking for public input as they draft new operating rules for Folsom Dam, a vital flood-control structure for the Sacramento region.

A new billion-dollar spillway under construction at the dam is intended to boost the reservoir's flood control capacity. But to maximize the new spillway's capabilities, new operating rules are required.

Known as the dam's "water control manual," the rules govern how much water can be held behind the dam and how much can be released under different scenarios.

The U.S. Army Corps of Engineers and the Central Valley Flood Protection Board are updating the manual to account for the spillway and to consider new weather forecasting capabilities that may be incorporated into the manual for the first time.

The manual also has effects on river recreation, fisheries and water quality in the Sacramento region and beyond.

The agencies have scheduled a meeting from 4 to 7 p.m. Monday at the Folsom Community Center, 52 Natoma St., to present information on the project and hear public comments.

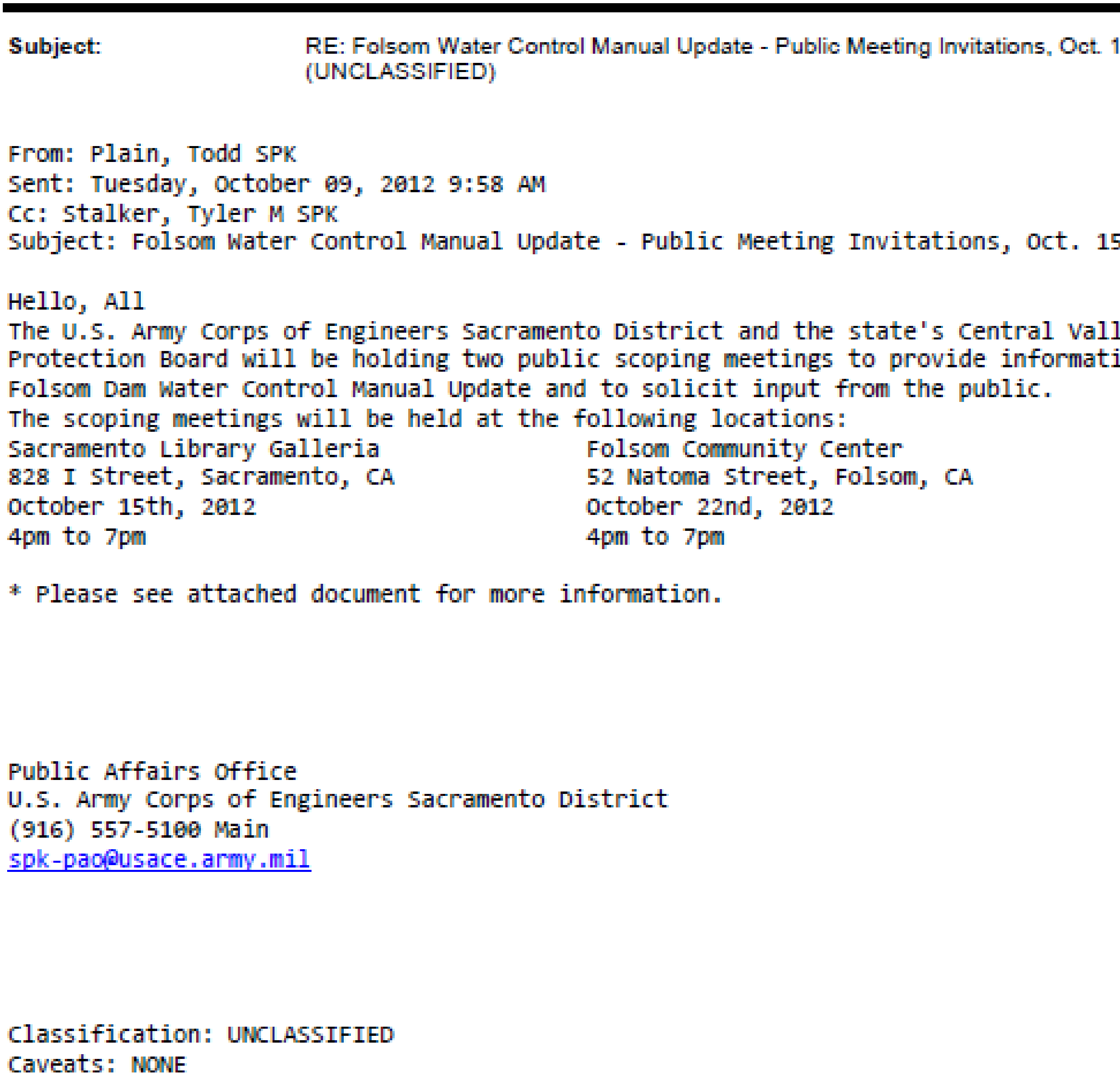
The meeting will help the agencies prepare an environmental impact study that will be released for further public comment later.

For more information, call David Martasian at (916) 574-1442 or visit http://ht.ly/eytDP.

Order Reprint

Call The Bee's Matt Weiser, (916) 321-1264.

- Read more articles by Matt Weiser



Subject: RE: Folsom Water Control Manual Update - Public Meeting Invitations, Oct. 1
(UNCLASSIFIED)

From: Plain, Todd SPK
Sent: Tuesday, October 09, 2012 9:58 AM
Cc: Stalker, Tyler M SPK
Subject: Folsom Water Control Manual Update - Public Meeting Invitations, Oct. 15

Hello, All
The U.S. Army Corps of Engineers Sacramento District and the state's Central Vall
Protection Board will be holding two public scoping meetings to provide informati
Folsom Dam Water Control Manual Update and to solicit input from the public.
The scoping meetings will be held at the following locations:

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828 I Street, Sacramento, CA
October 15th, 2012
4pm to 7pm

Folsom Community Center
52 Natoma Street, Folsom, CA
October 22nd, 2012
4pm to 7pm

* Please see attached document for more information.

Public Affairs Office
U.S. Army Corps of Engineers Sacramento District
(916) 557-5100 Main
spk-pao@usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA, 95814-2922

REPLY TO
ATTENTION OF

Environmental Resources Branch

TO ALL INTERESTED PARTIES:

The U.S. Army Corps of Engineers, Sacramento District (Corps) and the Central Valley Flood Protection Board (CVFPB) will be holding two public meetings to provide information on the Folsom Dam Water Control Manual Update (WCM Update) and to solicit input from the public. The Corps and the CVFPB intend to prepare a joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) to evaluate proposed changes to operations of Folsom Dam as a result of the WCM Update. The Corps will serve as lead agency for compliance with the National Environmental Policy Act (NEPA), and the CVFPB, with support from the State of California Department of Water Resources (DWR), will serve as lead agency for compliance with the California Environmental Quality Act (CEQA). The Bureau of Reclamation (Reclamation) is acting as a NEPA cooperating agency and the Sacramento Area Flood Control Agency (SAFCA) is acting as a CEQA responsible agency.

Folsom Dam and Reservoir is a multipurpose project operated by Reclamation as a part of the Central Valley Project (CVP). The Corps is responsible for prescribing operations pertaining to use of the storage allocated for flood risk management. The dam provides flood risk management benefits to the City of Sacramento and its surrounding areas by regulating runoff from approximately 1,860 square miles of drainage area.

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The WCM Update will identify, evaluate, and recommend changes to the flood management operation rules of Folsom Dam and Reservoir to reduce flood risk to the Sacramento area by utilizing the new auxiliary spillway and by incorporating an improved understanding of the American River watershed upstream of Folsom Dam. The findings of the evaluation will be used to help define the Dam's new flood operations plan, with the intention of meeting flood risk management objectives and dam safety requirements in a manner that conserves as much water as possible and maximizes all authorized Folsom Dam project uses to the extent practicable.

Your input on the above topics and any associated items that are important to you will be used to:

- Further determine the scope of the analysis in the EIS/EIR.
- Refine the range of alternatives to be evaluated in the EIS/EIR.

- Obtain local knowledge or information to assist in the environmental analysis.

Staff from the Corps, CVFPB, DWR, Reclamation, SAFCA, and other members of the project team will be on hand to accept comments and address questions regarding the WCM Update. The public will be given the opportunity to provide written and verbal comments at the scoping meetings.

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Tyler Stalker,
Corps Public Affairs Office
1325 J St, Sacramento,
CA 95814
Phone - 916-557-5107
Fax - 916-557-7853
e-mail - Tyler.M.Stalker@usace.army.mil

David Martasian,
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3464 El Camino Ave, Room 200,
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For more information please visit the Folsom Dam WCM Update website at http://www.spk.usace.army.mil/Missions/CivilWorks/JointFederalProject.aspx

Sincerely,

Alicia E. Kirchner
Chief, Planning Division

Mailing Lists

Jim Michaeals	7806 Folsom-Auburn Road Folsom, CA 95630
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Dawn Richmond	75 Hawthorne Street, San Francisco, CA 94105-3901
Jeff Wehling	75 Hawthorne Street, San Francisco, CA 94105-3901
John Ungvarsky	75 Hawthorne Street, San Francisco, CA 94105-3901
Mike Deis	P.O. Box 15830 Sacramento, CA 95852
Western Area Power Agency	114 Parkshore Drive, Folsom, CA 95630
Placer County - Planning	3091 County Center Drive, Auburn, CA 95603
Supervisor District 4	175 Fulweiler Avenue, Auburn, CA 95603
Keith B. Durkin	Peter J. Shields Library 100 NW Quad, Davis, CA 95616
Raynor Tsuneyoshi	2000 Evergreen Street, Suite 100, Sacramento, CA 95815
Sylvia Oey	P.O. Box 2815, Sacramento, CA 95812
Scott King	P.O. Box 2815, Sacramento, CA 95812
California Department of Transportation, District 3	P.O. Box 942874, Sacramento, CA 94274-0001
Honorable Roger Dickinson	915 L Street, Suite 110, Sacramento, CA 95814
Honorable Tom McClintock	428 Cannon HOB, Washington, DC 20515
Honorable Tom McClintock	8700 Auburn-Folsom Road, Suite 100, Granite Bay, CA 95746
Honorable Doug LaMalfa	State Capitol, Room 3070, Sacramento, CA 95814
Honorable Darrell Steinberg	State Capitol, Room 205, Sacramento, CA 95814
Honorable Alyson Huber	2729 Prospect Park Drive, Suite 130, Rancho Cordova, CA 95670
Honorable Ted Gaines	State Capitol, Room 3056, Sacramento, CA 95814
Honorable Beth Gaines	State Capitol, Room 4009, Sacramento, CA 95814
Honorable Richard Pan	State Capitol, PO Box 942849, Sacramento, CA 94249-0005
Honorable Dan Logue	State Capitol, Sacramento, CA 95814
Honorable Barbara Boxer	112 Hart Senate Office Building, Washington, DC 20510
Honorable Barbara Boxer	501 I Street, Suite 7-600, Sacramento, CA 95814
Honorable Diane Feinstein	331 Hart Senate Office Building, Washington, DC 20510
Honorable Diane Feinstein	One Post Street, Suite 2450, San Francisco, CA 95814
Honorable Dan Lungren	2313 Rayburn HOB, Washington, DC 20515
Honorable Dan Lungren	2339 Gold Meadow Way, Suite 220 Gold River, CA 95670
Honorable Dorris Matsui	222 Cannon Building, Washington, DC 20515
Honorable Dorris Matsui	501 I Street, Suite 12-600, Sacramento, CA 95814
Honorable Jerry Brown	Sacramento, CA 95814
Honorable Lois Wolk	State Capitol, Room 4032 Sacramento, CA 95814
Roger Niello	One Capitol Mall, Suite 300 Sacramento, CA 95814

Jill Ernst	P.O. Box 2451, Granite Bay, CA 95746
Mark Rackovan	50 Natoma Street, Folsom, CA 95630
Rich Lorenz	50 Natoma Street, Folsom, CA 95630
LIBRARY	300 Persifer Street, Folsom, CA 95630
Mayor Kerri Howell	50 Natoma Street, Folsom, CA 95630
County Sanitation Distrcit 1 CSD-1/Sacramento Regional County Sanitation District	10545 Armstrong Avenue, Mather, CA 95655
Russ Harrington	1521 I Street, Sacramento, CA 95814
Robert F. Stackhouse	1521 I Street, Sacramento, CA 95814
Elizabeth Torrez	827 7th Street Room 220, Sacramento, CA 95814
Department of Fish & Game	1416 9th Street, Sacramento, CA 95814
Kevin Thomas	1701 Nimbus Road, Rancho Cordova, CA 95670
Jay Rowan	1701 Nimbus Road, Rancho Cordova, CA 95670
Kenneth Kundargi	1701 Nimbus Road, Rancho Cordova, CA 95670
Department of Parks & Recreation	3149 16th Street, NW Washington, D.C. 20010
Nancy Opsahl	2000 State University Drive East, Sacramento, CA 95819-6039
El Dorado County	7455 Silva Valley Parkway, El Dorado Hills, CA 95762
El Dorado County	330 Fair Lane, Placerville, CA 95667
El Dorado County	2850 Fairlane Court, Building C, Placerville, CA 95667
El Dorado Irrigation District	2890 Mosquito Road, Placerville, CA 95667
Folsom Area Bicycle Advocates	1204 Forrest Street, Folsom, CA 95630
Folsom Auburn Trail Riders Action Coalition	P.O. Box 6356 Auburn, CA 95604-6356
Joseph P. Gagliardi	200 Wool Street, Folsom, CA 95630
Bill Watson	200 Wool Street, Folsom, CA 95630
Friends of the River	1418 20th Street, Suite A Sacramento, CA 95811
Govenor's Office of Emergency Services	3650 Schriever Ave, Mather, CA 95655
Northern California Marine Association	P.O. Box 1877, San Leandro, CA 94577
Northern California Power Agency	180 Cirby Way, Roseville, CA 95678
Water Resources Collections and Archives	PO Box 5900, Room 118, University of California, Riverside, CA 92517-5900
Regional Water Quality Control Board, Central Valley Region	11020 Sun Center Dr, Suite 200 Rancho Cordova, CA 95670
Roseville Public Library	225 Taylor Street, Roseville, CA 95678
Sacramento Area Bicycle Advocates	909 12th Street, Suite 116, Sacramento, CA 95814
Sacramento Central Library	828 I Street, Sacramento, CA 95814
Board of Supervisors	700 H Street, Sacramento, CA 95814
San Luis & Delta Mendota Water Authority	P.O. Box 2157, Los Banos, CA 93635
SMAQMD	777 12th Street, 3rd Floor, Sacramento, CA 95814
State Water Resources Control Board	P.O. Box 100, Sacramento, CA 95812
The Resources Agency	1416 Ninth Street, Suite 1311, Sacramento, CA 95814
U.S. Department of Interior	1849 C Street NW, Main Interior Bldg, Washington, D.C. 20240

Water Forum Office	600 J Street, Suite 260 Sacramento, CA 95814
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Angela Rivera	P.O. Box 1340 Shingle Springs, CA 95682
Eileen Moon	1239 East Main Street, Grass Valley, CA 95945
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Marcos Guererro	10720 Indian Hill Road, Auburn, CA 95603
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Chris Jennings	126 Chambersburg Way. Folsom, CA 95630
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George Qualley	6327 Merton Way, Sacramento, CA 95842
Neil Taylor	6345 Reservoir Drive, Granite Bay, CA 95746
David G. Waterhouse	640 Cambrian Ct., Sacramento, CA 95814
Folsom Church of Christ	P.O. Box 492, Folsom, CA 95630

Nicholas Fonseca	Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs CA 95682
Daniel Fonseca	Shingle Springs Band of Miwok Indians, P.O. Box 1340, Shingle Springs CA 95682
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Marcos Guerrero	United Auburn Indian Community of the Auburn Rancheria, 10720 Indian Hill Road, Auburn, CA 95603
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Grayson Coney	Tsi-Akim Maidu, 1239 East Main Street, Grass Valley, CA 95945

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CURRENT RESIDENT	1543 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1544 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1547 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1551 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1555 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1559 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1563 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1566 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1567 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1570 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1571 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1574 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1575 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1578 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1579 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1582 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1583 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1585 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1587 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1591 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1595 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1599 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1603 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1607 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1611 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1615 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1619 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1621 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1623 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1624 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1627 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1631 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1635 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1639 BALLOU CIR	FOLSOM, CA 95630

CURRENT RESIDENT	1643 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1647 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1651 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1655 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1659 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1663 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1667 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1671 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1675 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1676 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1679 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1680 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1683 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1687 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1688 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1691 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1692 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1695 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1696 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1699 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1700 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1703 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1704 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1707 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1708 BALLOU CIR	FOLSOM, CA 95630
CURRENT RESIDENT	1475 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1476 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1479 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1480 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1483 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1484 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1487 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1488 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1491 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1492 LEWIS WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1525 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1526 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1529 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1530 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1533 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1537 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1541 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1545 BORRASCA DR	FOLSOM, CA 95630

CURRENT RESIDENT	1549 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1553 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1557 BORRASCA DR	FOLSOM, CA 95630
CURRENT RESIDENT	1503 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1504 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1507 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1508 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1511 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1512 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1515 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1519 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1520 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1523 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1524 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1527 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1528 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1531 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1532 GUZZETTI WAY	FOLSOM, CA 95630
CURRENT RESIDENT	1711 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	1712 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	1715 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	1716 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	1720 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	1723 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	1724 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	1727 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	1728 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	1732 BALLOU CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	105 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	107 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	109 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	111 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	112 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	113 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	116 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	117 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	118 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	119 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	120 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	123 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	124 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	125 BRIGGS RANCH DR	FOLSOM, CA 95630

CURRENT RESIDENT	126 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	128 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	130 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	131 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	133 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	134 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	135 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	137 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	138 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	139 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	141 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	143 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	145 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	147 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	149 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	151 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	153 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	155 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	156 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	157 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	158 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	159 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	160 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	161 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	163 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	165 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	166 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	167 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	168 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	169 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	170 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	172 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	173 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	174 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	175 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	176 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	177 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	178 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	179 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	180 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	181 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	182 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	183 BRIGGS RANCH DR	FOLSOM, CA 95630

CURRENT RESIDENT	184 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	185 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	186 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	187 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	189 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	191 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	193 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	194 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	195 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	197 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	201 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	203 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	205 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	207 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	209 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	211 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	212 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	213 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	214 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	215 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	216 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	217 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	219 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	225 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	227 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	228 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	229 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	230 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	231 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	232 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	233 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	234 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	235 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	236 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	237 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	238 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	239 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	240 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	241 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	242 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	243 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	245 BRIGGS RANCH DR	FOLSOM, CA 95630
CURRENT RESIDENT	102 SINGER LN	FOLSOM, CA 95630

CURRENT RESIDENT	103 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	104 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	107 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	108 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	109 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	110 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	111 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	112 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	113 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	114 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	115 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	117 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	118 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	119 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	122 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	126 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	129 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	130 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	133 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	134 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	137 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	141 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	144 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	145 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	148 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	149 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	152 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	156 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	160 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	164 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	168 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	172 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	175 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	176 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	179 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	180 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	183 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	184 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	188 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	192 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	195 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	196 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	200 SINGER LN	FOLSOM, CA 95630

CURRENT RESIDENT	203 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	204 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	207 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	208 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	211 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	212 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	215 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	216 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	220 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	225 SINGER LN	FOLSOM, CA 95630
CURRENT RESIDENT	100 SHOWERS CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 SHOWERS CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 SHOWERS CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 SHOWERS CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 SKIDMORE CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 SKIDMORE CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 SKIDMORE CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 SKIDMORE CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 SKIDMORE CT	FOLSOM, CA 95630
CURRENT RESIDENT	106 SKIDMORE CT	FOLSOM, CA 95630
CURRENT RESIDENT	107 SKIDMORE CT	FOLSOM, CA 95630
CURRENT RESIDENT	106 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	107 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	110 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	111 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	114 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	115 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	118 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	119 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	122 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	126 WOODARD LN	FOLSOM, CA 95630
CURRENT RESIDENT	100 BOLI CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 BOLI CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 BOLI CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 BOLI CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 BOLI CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 YOST CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 YOST CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 YOST CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 YOST CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 YOST CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 YOST CT	FOLSOM, CA 95630
CURRENT RESIDENT	106 MANSEAU DR	FOLSOM, CA 95630

CURRENT RESIDENT	110 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	111 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	112 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	113 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	114 MANSEAU DR	FOLSOM, CA 95630
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CURRENT RESIDENT	116 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	117 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	118 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	119 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	120 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	122 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	124 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	125 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	126 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	128 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	130 MANSEAU DR	FOLSOM, CA 95630
CURRENT RESIDENT	102 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	106 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	107 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	108 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	109 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	110 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	111 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	112 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	113 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	114 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	115 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	116 MARVIN CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 HENSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 HENSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 HENSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 HENSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 HENSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 MCCORMICK CT	FOLSOM, CA 95630

CURRENT RESIDENT	106 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	107 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	108 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	109 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	110 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	111 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	112 MCCORMICK CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	104 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	106 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	108 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	110 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	112 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	114 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	115 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	116 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	119 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	120 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	121 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	122 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	124 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	125 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	126 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	128 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	130 LANDRUM CIR	FOLSOM, CA 95630
CURRENT RESIDENT	100 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	106 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	107 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	108 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	109 JUMPER CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	106 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	107 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	108 COBB CT	FOLSOM, CA 95630

CURRENT RESIDENT	109 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	110 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	111 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	112 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	113 COBB CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 FATH CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 FATH CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 FATH CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 FATH CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 FATH CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 FATH CT	FOLSOM, CA 95630
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CURRENT RESIDENT	108 FATH CT	FOLSOM, CA 95630
CURRENT RESIDENT	109 FATH CT	FOLSOM, CA 95630
CURRENT RESIDENT	110 FATH CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 DENURE CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 DENURE CT	FOLSOM, CA 95630
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CURRENT RESIDENT	104 DENURE CT	FOLSOM, CA 95630
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CURRENT RESIDENT	110 DENURE CT	FOLSOM, CA 95630
CURRENT RESIDENT	111 DENURE CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 BATHURST CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 BATHURST CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 BATHURST CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 BATHURST CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 BRUGLER CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 BRUGLER CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 BRUGLER CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 BRUGLER CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 BRUGLER CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 BRUGLER CT	FOLSOM, CA 95630
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CURRENT RESIDENT	107 BRUGLER CT	FOLSOM, CA 95630
CURRENT RESIDENT	108 BRUGLER CT	FOLSOM, CA 95630
CURRENT RESIDENT	109 BRUGLER CT	FOLSOM, CA 95630
CURRENT RESIDENT	110 BRUGLER CT	FOLSOM, CA 95630

CURRENT RESIDENT	100 BRUM CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 BRUM CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 BRUM CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 BRUM CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 BRUM CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 BLODGETT DR	FOLSOM, CA 95630
CURRENT RESIDENT	103 BLODGETT DR	FOLSOM, CA 95630
CURRENT RESIDENT	104 BLODGETT DR	FOLSOM, CA 95630
CURRENT RESIDENT	105 BLODGETT DR	FOLSOM, CA 95630
CURRENT RESIDENT	106 BLODGETT DR	FOLSOM, CA 95630
CURRENT RESIDENT	108 BLODGETT DR	FOLSOM, CA 95630
CURRENT RESIDENT	110 BLODGETT DR	FOLSOM, CA 95630
CURRENT RESIDENT	100 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	101 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	102 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	103 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	104 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	105 DARRINGTON DR	FOLSOM, CA 95630
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CURRENT RESIDENT	107 DARRINGTON DR	FOLSOM, CA 95630
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CURRENT RESIDENT	119 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	120 DARRINGTON DR	FOLSOM, CA 95630
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CURRENT RESIDENT	124 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	125 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	126 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	127 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	129 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	131 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	132 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	133 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	134 DARRINGTON DR	FOLSOM, CA 95630

CURRENT RESIDENT	135 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	136 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	137 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	139 DARRINGTON DR	FOLSOM, CA 95630
CURRENT RESIDENT	102 MC DERBY CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 MC DERBY CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 MC DERBY CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 MC DERBY CT	FOLSOM, CA 95630
CURRENT RESIDENT	106 MC DERBY CT	FOLSOM, CA 95630
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CURRENT RESIDENT	100 FLOOD CT	FOLSOM, CA 95630
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CURRENT RESIDENT	103 FLOOD CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 FLOOD CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 METZ CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 METZ CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 METZ CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 MORELAND CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 MORELAND CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 MORELAND CT	FOLSOM, CA 95630
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CURRENT RESIDENT	102 METZ CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 METZ CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 EVELAND CT	FOLSOM, CA 95630
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CURRENT RESIDENT	109 EVELAND CT	FOLSOM, CA 95630
CURRENT RESIDENT	110 EVELAND CT	FOLSOM, CA 95630

CURRENT RESIDENT	100 BURRILL DR	FOLSOM, CA 95630
CURRENT RESIDENT	102 BURRILL DR	FOLSOM, CA 95630
CURRENT RESIDENT	103 BURRILL DR	FOLSOM, CA 95630
CURRENT RESIDENT	105 BURRILL DR	FOLSOM, CA 95630
CURRENT RESIDENT	107 BURRILL DR	FOLSOM, CA 95630
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CURRENT RESIDENT	122 BURRILL DR	FOLSOM, CA 95630
CURRENT RESIDENT	123 BURRILL DR	FOLSOM, CA 95630
CURRENT RESIDENT	124 BURRILL DR	FOLSOM, CA 95630
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CURRENT RESIDENT	127 BURRILL DR	FOLSOM, CA 95630
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CURRENT RESIDENT	130 BURRILL DR	FOLSOM, CA 95630
CURRENT RESIDENT	132 BURRILL DR	FOLSOM, CA 95630
CURRENT RESIDENT	134 BURRILL DR	FOLSOM, CA 95630
CURRENT RESIDENT	100 FRICKE CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 FRICKE CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 FRICKE CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 FRICKE CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 FRICKE CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 ZANETTA CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 ZANETTA CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 ZANETTA CT	FOLSOM, CA 95630
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CURRENT RESIDENT	108 ZANETTA CT	FOLSOM, CA 95630
CURRENT RESIDENT	109 ZANETTA CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 POMINE CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 POMINE CT	FOLSOM, CA 95630

CURRENT RESIDENT	104 POMINE CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 POMINE CT	FOLSOM, CA 95630
CURRENT RESIDENT	106 POMINE CT	FOLSOM, CA 95630
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CURRENT RESIDENT	113 POMINE CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 DEELEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 DEELEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 DEELEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 DEELEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 DEELEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 MC HUGH CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 MC HUGH CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 MC HUGH CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 LUTTREL CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 LUTTREL CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 LUTTREL CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 SANBORN CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 SANBORN CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 SANBORN CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 SANBORN CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 SANBORN CT	FOLSOM, CA 95630
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CURRENT RESIDENT	107 SANBORN CT	FOLSOM, CA 95630
CURRENT RESIDENT	108 SANBORN CT	FOLSOM, CA 95630
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CURRENT RESIDENT	111 SANBORN CT	FOLSOM, CA 95630
CURRENT RESIDENT	112 SANBORN CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 GUERNSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 GUERNSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 GUERNSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 GUERNSEY CT	FOLSOM, CA 95630
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CURRENT RESIDENT	107 GUERNSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	108 GUERNSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	109 GUERNSEY CT	FOLSOM, CA 95630
CURRENT RESIDENT	110 GUERNSEY CT	FOLSOM, CA 95630

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CURRENT RESIDENT	102 WHELAN CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 WHELAN CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 WHELAN CT	FOLSOM, CA 95630
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CURRENT RESIDENT	111 WHELAN CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 STROUSE CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 STROUSE CT	FOLSOM, CA 95630
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CURRENT RESIDENT	110 STROUSE CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 PORTO DR	FOLSOM, CA 95630
CURRENT RESIDENT	102 PORTO DR	FOLSOM, CA 95630
CURRENT RESIDENT	101 HARGROVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 HARGROVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 HARGROVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	104 HARGROVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	105 HARGROVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	106 HARGROVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 ROCKY COVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 ROCKY COVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 ROCKY COVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 ROCKY COVE CT	FOLSOM, CA 95630
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CURRENT RESIDENT	112 ROCKY COVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	113 ROCKY COVE CT	FOLSOM, CA 95630

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CURRENT RESIDENT	116 ROCKY COVE CT	FOLSOM, CA 95630
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CURRENT RESIDENT	118 ROCKY COVE CT	FOLSOM, CA 95630
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CURRENT RESIDENT	121 ROCKY COVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	123 ROCKY COVE CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 SANTANA WAY	FOLSOM, CA 95630
CURRENT RESIDENT	103 SANTANA WAY	FOLSOM, CA 95630
CURRENT RESIDENT	105 SANTANA WAY	FOLSOM, CA 95630
CURRENT RESIDENT	107 SANTANA WAY	FOLSOM, CA 95630
CURRENT RESIDENT	109 SANTANA WAY	FOLSOM, CA 95630
CURRENT RESIDENT	100 SEAFARER CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 SEAFARER CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 SEAFARER CT	FOLSOM, CA 95630
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CURRENT RESIDENT	111 SEAFARER CT	FOLSOM, CA 95630
CURRENT RESIDENT	201 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	208 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	212 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	213 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	216 RANDALL DR	FOLSOM, CA 95630
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CURRENT RESIDENT	221 RANDALL DR	FOLSOM, CA 95630
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CURRENT RESIDENT	229 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	232 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	233 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	236 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	237 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	240 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	241 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	244 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	245 RANDALL DR	FOLSOM, CA 95630

CURRENT RESIDENT	249 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	252 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	253 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	256 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	257 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	260 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	261 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	264 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	267 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	268 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	271 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	272 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	275 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	276 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	279 RANDALL DR	FOLSOM, CA 95630
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CURRENT RESIDENT	283 RANDALL DR	FOLSOM, CA 95630
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CURRENT RESIDENT	296 RANDALL DR	FOLSOM, CA 95630
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CURRENT RESIDENT	303 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	310 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	311 RANDALL DR	FOLSOM, CA 95630
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CURRENT RESIDENT	319 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	320 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	321 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	322 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	323 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	324 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	325 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	326 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	328 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	620 RANDALL DR	FOLSOM, CA 95630
CURRENT RESIDENT	101 TIDEPOOL CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 TIDEPOOL CT	FOLSOM, CA 95630
CURRENT RESIDENT	103 TIDEPOOL CT	FOLSOM, CA 95630

CURRENT RESIDENT	104 TIDEPOOL CT	FOLSOM, CA 95630
CURRENT RESIDENT	100 MAINSAIL CT	FOLSOM, CA 95630
CURRENT RESIDENT	101 MAINSAIL CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 MAINSAIL CT	FOLSOM, CA 95630
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CURRENT RESIDENT	115 MAINSAIL CT	FOLSOM, CA 95630
CURRENT RESIDENT	102 WINDSTAR CIR	FOLSOM, CA 95630
CURRENT RESIDENT	104 WINDSTAR CIR	FOLSOM, CA 95630
CURRENT RESIDENT	105 WINDSTAR CIR	FOLSOM, CA 95630
CURRENT RESIDENT	106 WINDSTAR CIR	FOLSOM, CA 95630
CURRENT RESIDENT	108 WINDSTAR CIR	FOLSOM, CA 95630
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CURRENT RESIDENT	113 WINDSTAR CIR	FOLSOM, CA 95630
CURRENT RESIDENT	114 WINDSTAR CIR	FOLSOM, CA 95630
CURRENT RESIDENT	116 WINDSTAR CIR	FOLSOM, CA 95630
CURRENT RESIDENT	117 WINDSTAR CIR	FOLSOM, CA 95630
CURRENT RESIDENT	118 WINDSTAR CIR	FOLSOM, CA 95630
CURRENT RESIDENT	120 WINDSTAR CIR	FOLSOM, CA 95630
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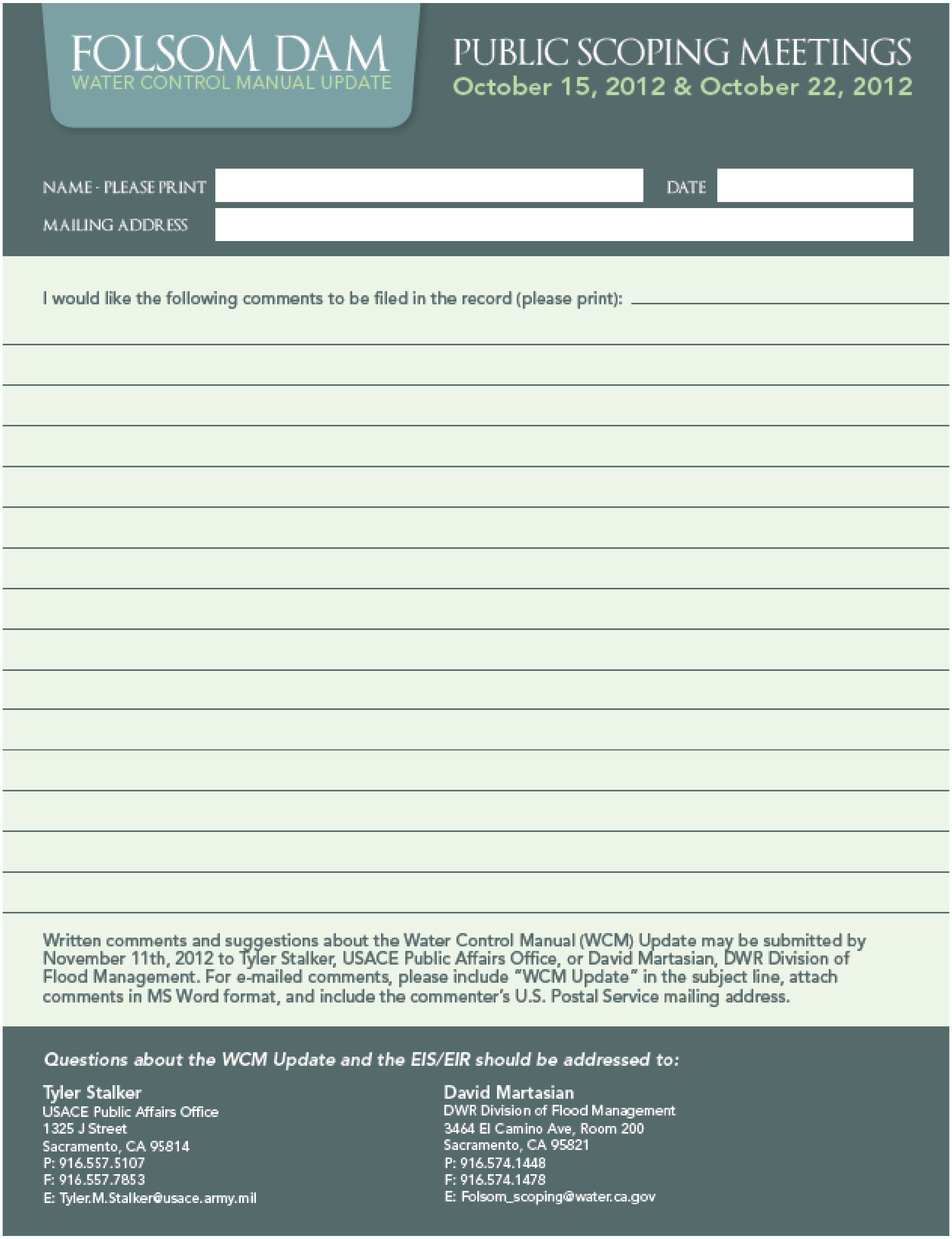
Appendix B Display Materials

The following materials were on display or available for reading at the scoping meeting. The first two pages are copies (front and back) of a comment form that was given out as attendees entered the meeting room. The rest of the pages contain reduced copies of the boards and exhibits that were displayed at the scoping meetings.



FOLSOM DAM
WATER CONTROL MANUAL UPDATE

PUBLIC SCOPING MEETINGS
October 15, 2012 & October 22, 2012

NAME - PLEASE PRINT

DATE

MAILING ADDRESS

I would like the following comments to be filed in the record (please print):

Written comments and suggestions about the Water Control Manual (WCM) Update may be submitted by November 11th, 2012 to Tyler Stalker, USACE Public Affairs Office, or David Martasian, DWR Division of Flood Management. For e-mailed comments, please include "WCM Update" in the subject line, attach comments in MS Word format, and include the commenter's U.S. Postal Service mailing address.

Questions about the WCM Update and the EIS/EIR should be addressed to:

Tyler Stalker
USACE Public Affairs Office
1325 J Street
Sacramento, CA 95814
P: 916.557.5107
F: 916.557.7853
E: Tyler.M.Stalker@usace.army.mil

David Martasian
DWR Division of Flood Management
3464 El Camino Ave, Room 200
Sacramento, CA 95821
P: 916.574.1448
F: 916.574.1478
E: Folsom_scoping@water.ca.gov

WELCOME

TO THE FOLSOM DAM

WATER CONTROL MANUAL UPDATE
PUBLIC SCOPING MEETING

LOCAL STUDY AREA

The Folsom Dam and Reservoir is located in Folsom, California. The Environmental Impact Statement/Environmental Impact Report (EIS/EIR) will evaluate proposed updates to the water control manual for Folsom Dam from a local and regional perspective. The local area of analysis focuses on the Lower American River watershed, including Folsom Reservoir.

FOLSOM DAM

WATER CONTROL MANUAL UPDATE

REGIONAL STUDY AREA

The regional area of analysis reflects the Central Valley Project (CVP) and State Water Project (SWP) facilities and service areas because Folsom Dam and Reservoir is operated by the U.S. Bureau of Reclamation (Reclamation) as part of the CVP system.

FOLSOM DAM AND RESERVOIR

Operated by the **U.S. Bureau of Reclamation** (Reclamation) as a part of the Central Valley Project (CVP)

Multiuse facility for: flood damage reduction, fish & wildlife, water quality, water supply, hydroelectricity, recreation, and navigation

Primarily operated to **maximize flood control** and **water supply storage** benefits

FOLSOM DAM

WATER CONTROL MANUAL UPDATE

FOLSOM DAM

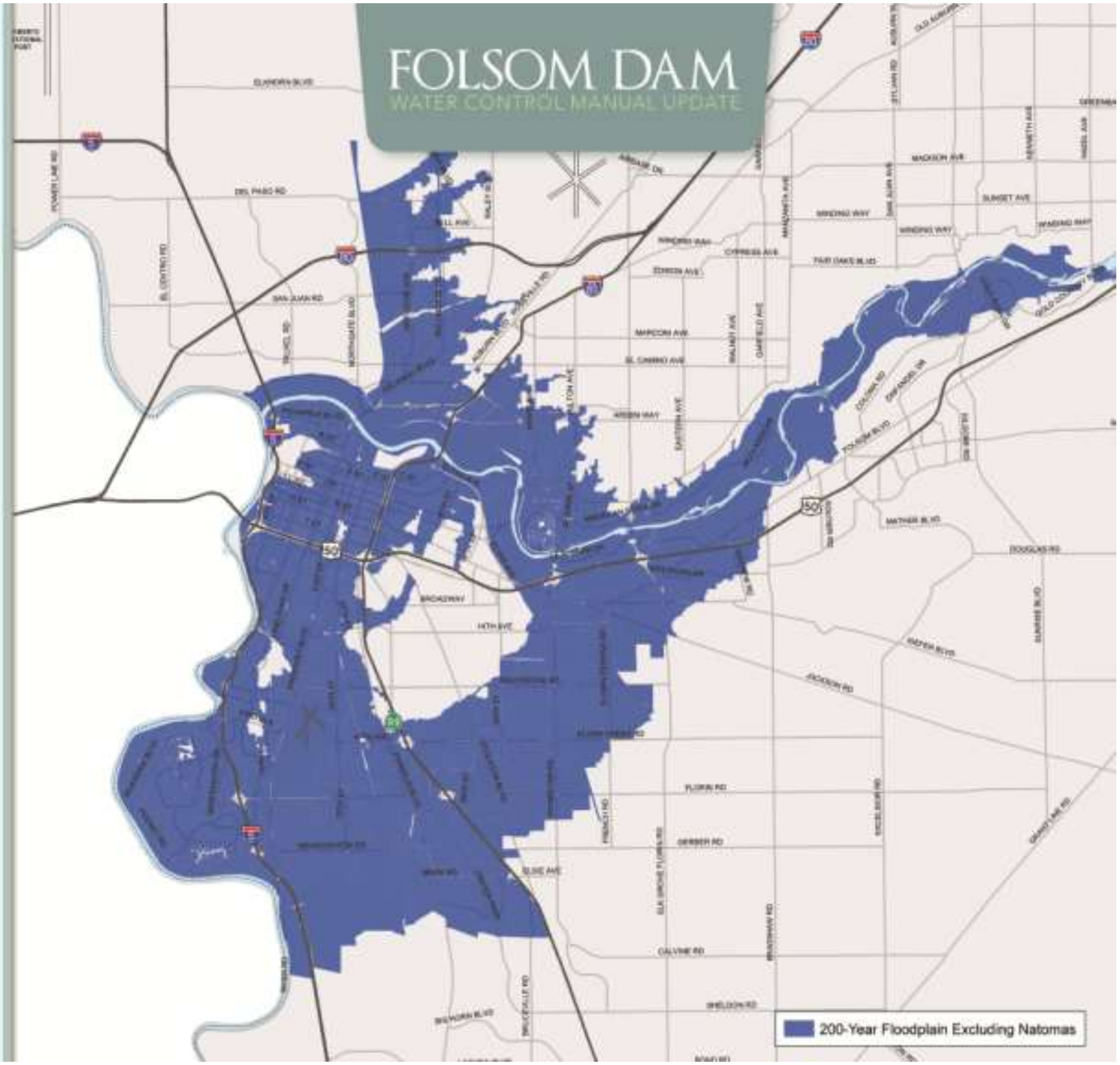
WATER CONTROL MANUAL UPDATE

FLOOD RISK MANAGEMENT

Sacramento is identified as one of the most at risk communities in the nation for flooding; therefore, there is a need to reduce this risk through interim and permanent flood damage reduction measures

Future structural improvements are planned to address dam safety issues that could result from hydrologic (flood), seismic (earthquake), and static (seepage) events

Non-Federal sponsor's goal is to increase the level of protection at Folsom Dam to safely pass the 200-year flood event with the incorporation of all authorized modifications within the American River Watershed



PURPOSE OF THE UPDATE

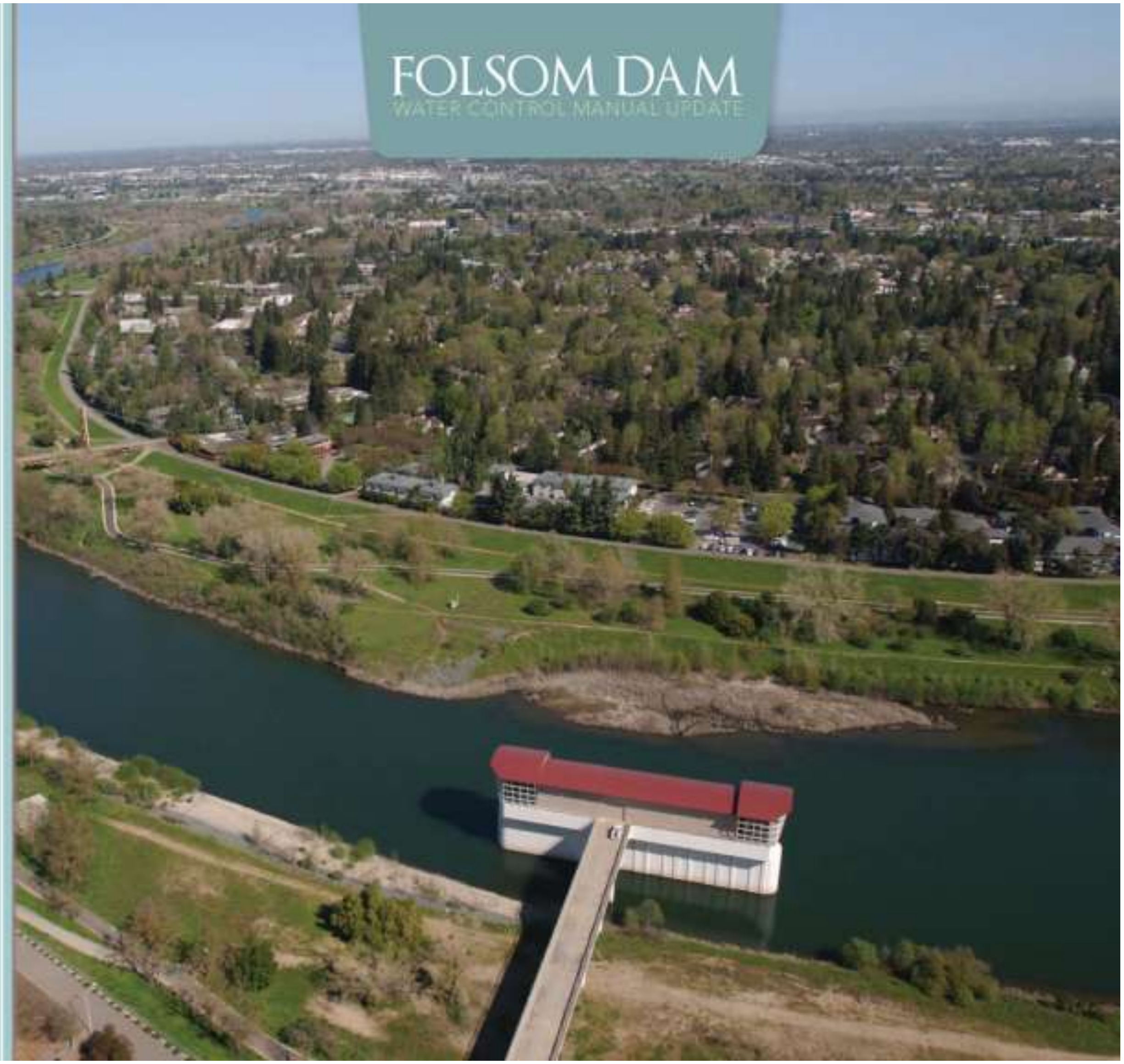
Develop, evaluate, and recommend changes to the flood management operations of Folsom Dam and Reservoir in order to reduce flood risk to the Sacramento area by utilizing its existing and authorized physical features, specifically after completion of the Joint Federal Project (JFP) new auxiliary spillway

Analyze operational alternatives and the effect of those alternatives on Folsom Dam and Reservoir's other authorized purposes (water supply, power generation, fish and wildlife protection, water quality, recreation, and navigation)

Define Folsom Dam's new flood operations plan, intended to meet the flood risk management objectives in a manner that conserves as much water as possible and maximizes all project functions to the extent practicable

FOLSOM DAM

WATER CONTROL MANUAL UPDATE

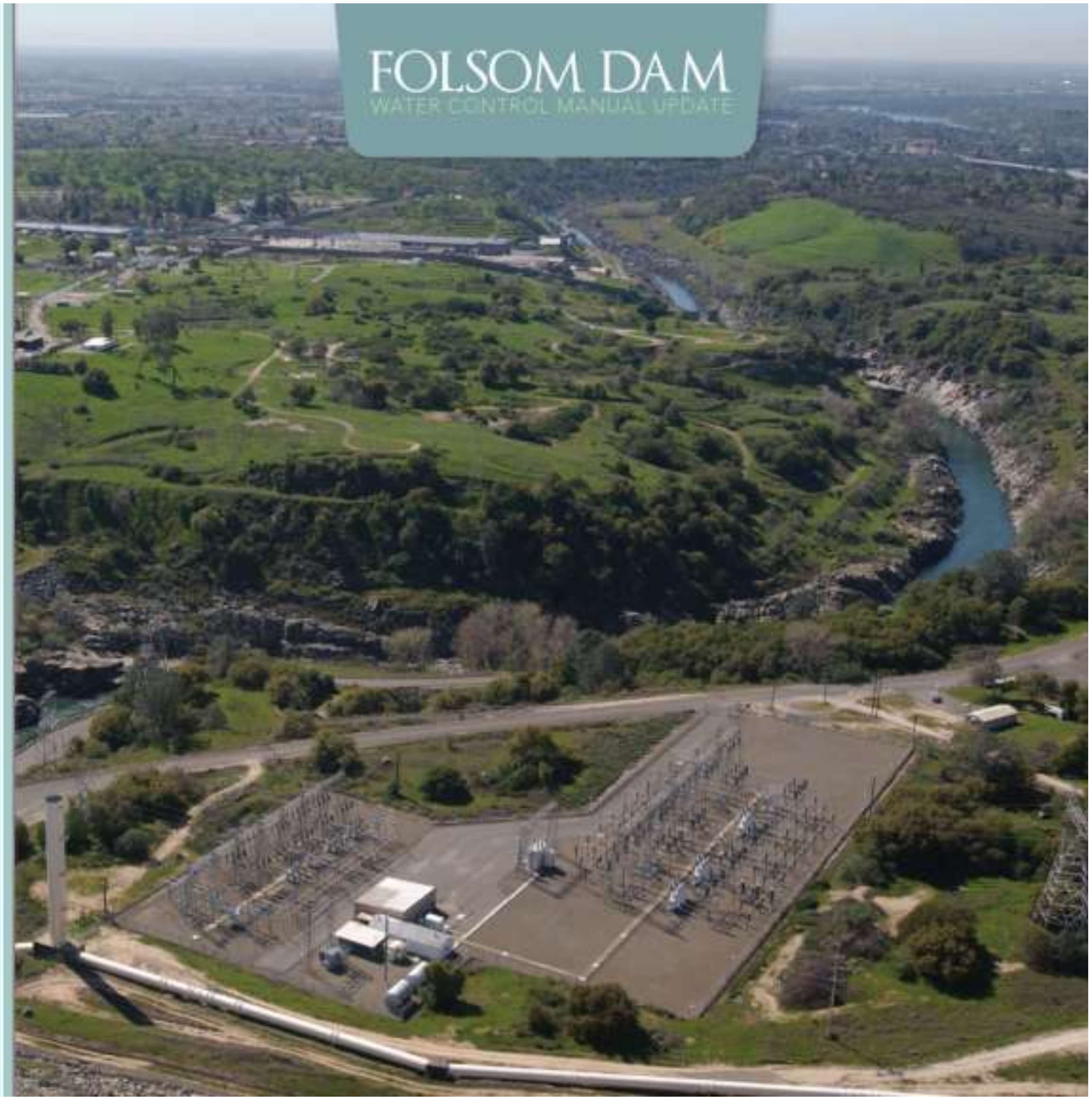


SAFETY & FLOOD RISK MANAGEMENT OBJECTIVES

Pass the Probable Maximum Flood (PMF) while maintaining 3 feet of freeboard below the top of Dam to stay within the Dam Safety constraints of the U.S. Department of Interior, Bureau of Reclamation

Manage a 1/100 annual chance flow (i.e. "the 100-year flood") to a maximum release of 115,000 cubic feet per second (cfs) as criteria set by the Sacramento Area Flood Control Agency (SAFCA) to support Federal Emergency Management Agency (FEMA) levee accreditation along the American River

Manage a 1/200 annual chance flow (i.e. "the 200-year flood"), as defined by criteria set by the State of California Department of Water Resources (DWR) locally preferred criteria, to a maximum release of 160,000 cfs, when taking into account all of the authorized modifications within the American River Watershed (including future Folsom Dam Raise Project and Common Features Project)



FOLSOM DAM

WATER CONTROL MANUAL UPDATE

FOLSOM DAM

WATER CONTROL MANUAL UPDATE

JOINT FEDERAL PROJECT OVERVIEW

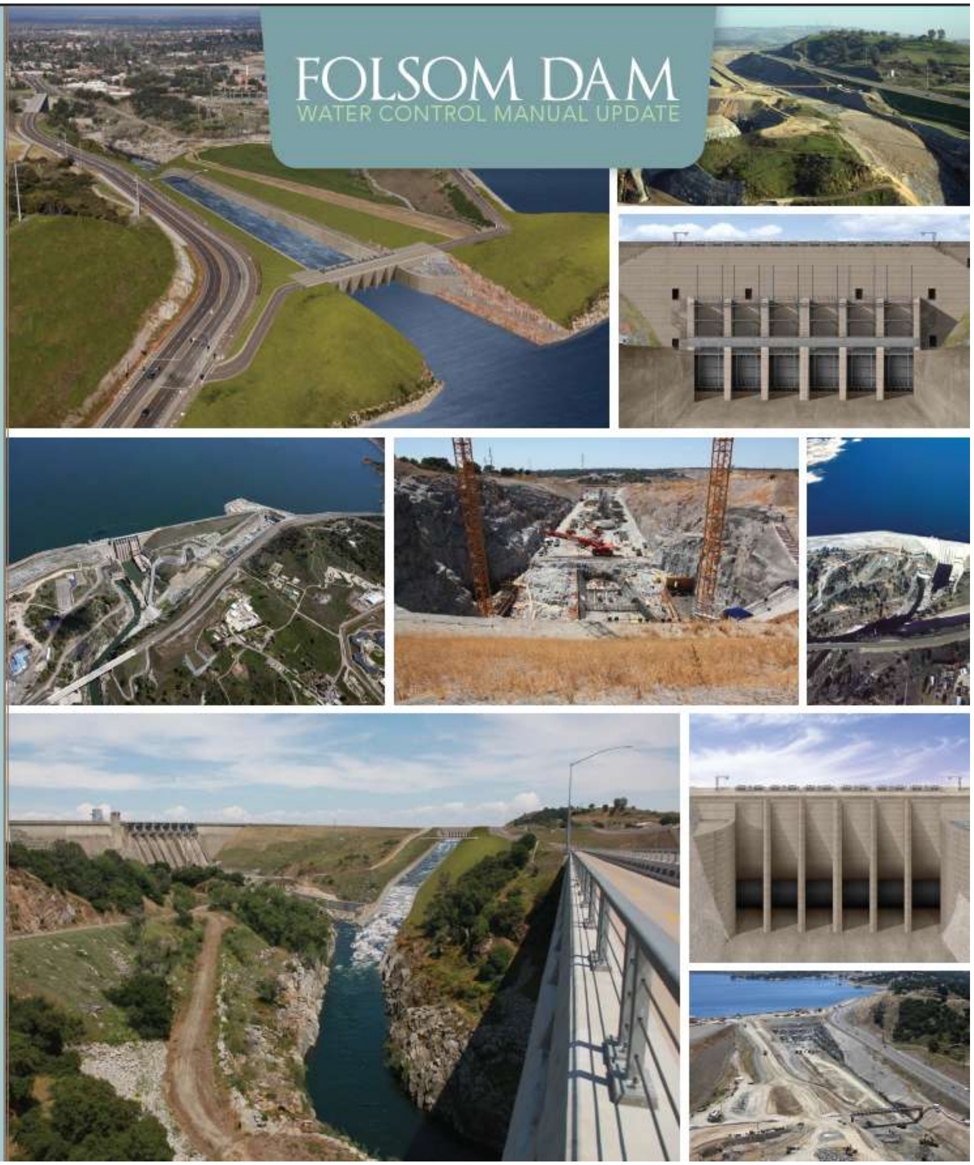
The Folsom Dam Joint Federal Project (JFP) is an **auxiliary spillway** currently under construction to be implemented jointly by Reclamation and the U.S. Army Corps of Engineers (Corps) to address hydrologic Dam Safety and Flood Damage Reduction concerns related to the controlled release of water from Folsom Dam.

The JFP will **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 when it arrives

The JFP has **dual goals** that simultaneously serve the specific missions of the Corps and Reclamation:

> The Flood Damage Reduction goal of the Corps and their non-Federal partners, CVFPB and SAFCA, is to reduce flood risk in the Sacramento area in conjunction with other elements of the regional flood control system
>
> The Safety of Dams goal of Reclamation is to pass a PMF of up to 314,000 cfs through the auxiliary spillway without causing failure of Folsom Dam

IN ORDER TO FULLY REALIZE THE BENEFITS OF THE NEW AUXILIARY SPILLWAY. THE CURRENT FOLSOM DAM AND RESERVOIR WATER CONTROL MANUAL MUST BE UPDATED.



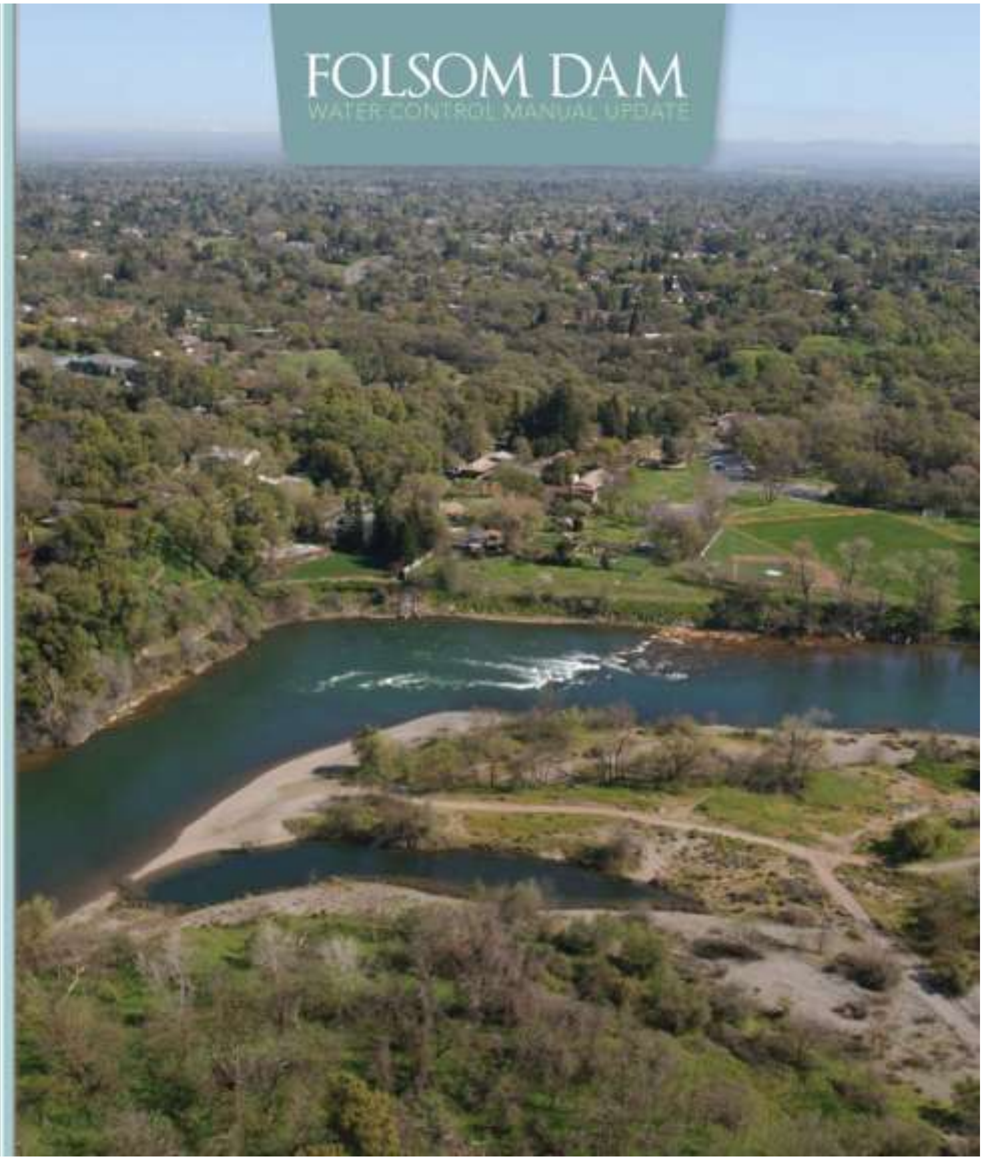
BASIS OF ALTERNATIVE DEVELOPMENT

Alternatives will be developed for new operational rules to **meet dam safety and flood risk management objectives** that comply with Congressional direction.

Alternatives will **consist of the following components:**

- The Flood Damage Reduction goal of the Corps and their non-Federal partners, CVFPB and SAFCA, is to reduce flood risk in the Sacramento area in conjunction with other elements of the regional flood control system
- Flood Storage: Folsom Reservoir variable space will be reduced from the current operating range of 400,000-670,000 acre-feet (ac-ft) to 400,000-600,000 ac-ft.
- Outlet Configuration: Existing outlets and the JFP will be utilized in the updated Water Control Manual
- Temperature Control Diagram Configuration: 3-2-4 shutter configuration
- Operation Rules: Rule curves that derive flood storage reserve requirements from some combination of the following:
  - Storage reserve in Folsom Reservoir
  - Basin Wetness
  - Weather Forecasting

A number of **flood management operation alternatives** are expected to be developed and the effect of those alternatives on Folsom Dam and Reservoir's other authorized purposes will be analyzed in the Environmental Impact Statement/Environmental Impact Report (EIS/EIR)



FOLSOM DAM

WATER CONTROL MANUAL UPDATE

FOLSOM DAM

WATER CONTROL MANUAL UPDATE

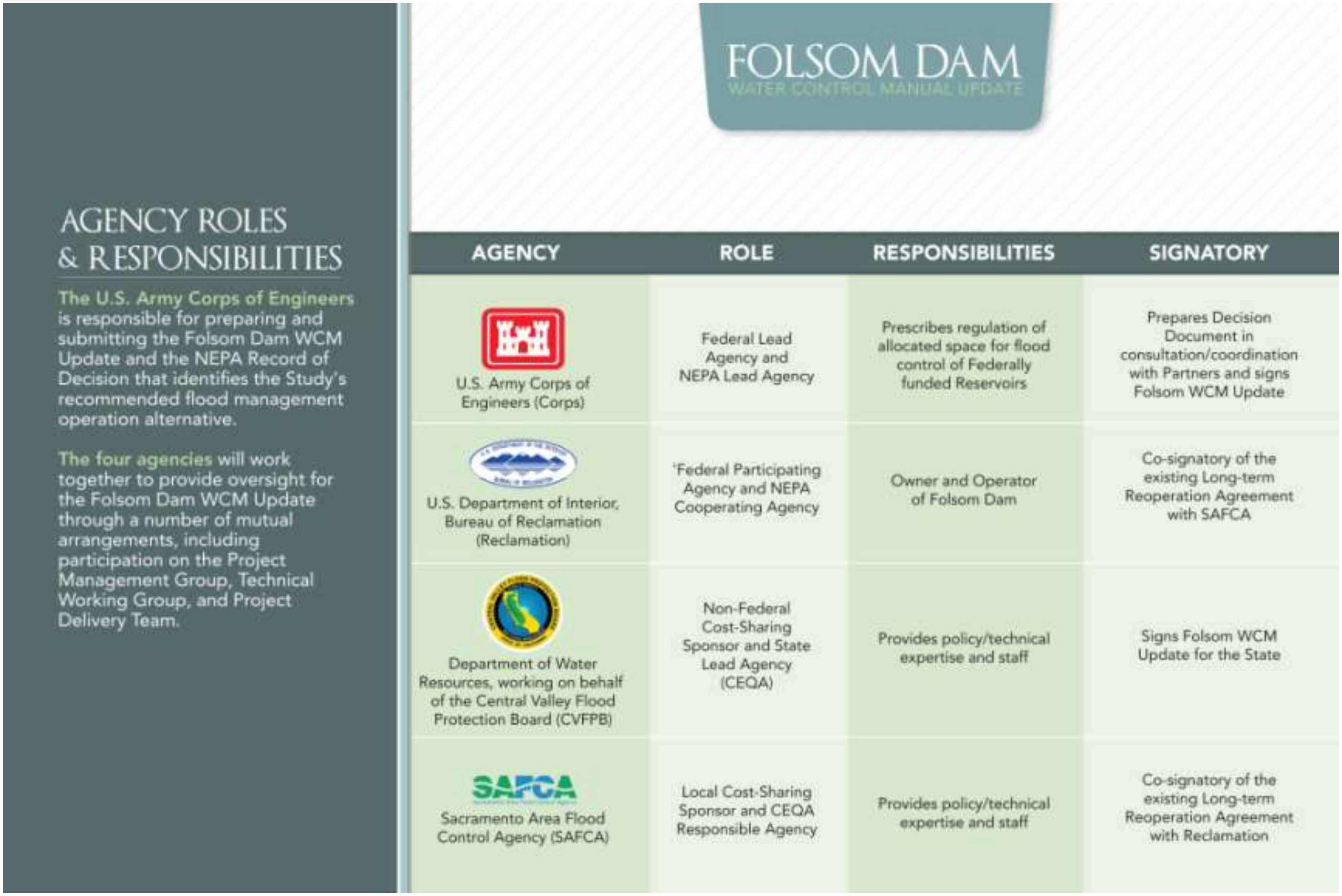
EIS/EIR EFFECTS ASSESSMENT

Environmental effects analyses will be **centered around the effects** that the flood management operations alternatives would have on the Folsom Dam and Reservoir's authorized purposes, including:

- Flood control
- Water supply (Irrigation and M&I)
- Fish and wildlife
- Power generation
- Water Quality
- Navigation
- Recreation

The **EIS/EIR effects analysis** approach would include:

- Comparison of alternatives to baseline conditions
- Closer evaluations of effects in the Lower American River
- Screening level evaluations for more distant parts of the CVP and SWP followed by detailed evaluations as needed



FOLSOM DAM

WATER CONTROL MANUAL UPDATE

AGENCY ROLES & RESPONSIBILITIES

The U.S. Army Corps of Engineers is responsible for preparing and submitting the Folsom Dam WCM Update and the NEPA Record of Decision that identifies the Study's recommended flood management operation alternative.

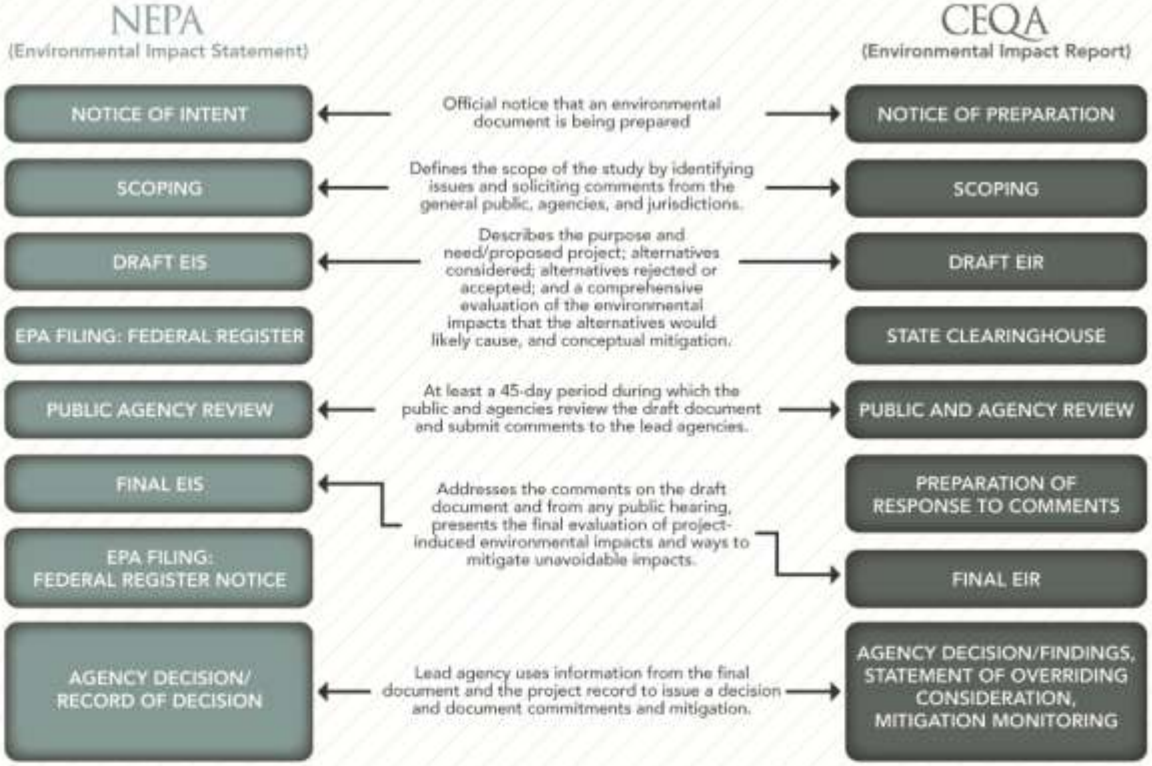
The four agencies will work together to provide oversight for the Folsom Dam WCM Update through a number of mutual arrangements, including participation on the Project Management Group, Technical Working Group, and Project Delivery Team.

AGENCY	ROLE	RESPONSIBILITIES	SIGNATORY
U.S. Army Corps of Engineers (Corps)	Federal Lead Agency and NEPA Lead Agency	Prescribes regulation of allocated space for flood control of Federally funded Reservoirs	Prepares Decision Document in consultation/coordination with Partners and signs Folsom WCM Update
U.S. Department of Interior, Bureau of Reclamation (Reclamation)	'Federal Participating Agency and NEPA Cooperating Agency	Owner and Operator of Folsom Dam	Co-signatory of the existing Long-term Reoperation Agreement with SAFCA
Department of Water Resources, working on behalf of the Central Valley Flood Protection Board (CVFPB)	Non-Federal Cost-Sharing Sponsor and State Lead Agency (CEQA)	Provides policy/technical expertise and staff	Signs Folsom WCM Update for the State
Sacramento Area Flood Control Agency (SAFCA)	Local Cost-Sharing Sponsor and CEQA Responsible Agency	Provides policy/technical expertise and staff	Co-signatory of the existing Long-term Reoperation Agreement with Reclamation

FOLSOM DAM
WATER CONTROL MANUAL UPDATE

EIS/EIR PROCESS

A joint Environmental Impact Statement/ Environmental Impact Report **(EIS/EIR)** will be prepared in compliance with the National Environmental Policy Act **(NEPA)** and California Environmental Quality Act **(CEQA)**. The EIS/EIR will disclose to the public potential environmental effects of all feasible alternatives considered and proposed measures to avoid or reduce significant environmental effects. **All public comments received will be considered prior to making a final decision on the action to be taken.**



NEPA (Environmental Impact Statement)		CEQA (Environmental Impact Report)
NOTICE OF INTENT	Official notice that an environmental document is being prepared	NOTICE OF PREPARATION
SCOPING	Defines the scope of the study by identifying issues and soliciting comments from the general public, agencies, and jurisdictions.	SCOPING
DRAFT EIS	Describes the purpose and need/proposed project; alternatives considered; alternatives rejected or accepted; and a comprehensive evaluation of the environmental impacts that the alternatives would likely cause, and conceptual mitigation.	DRAFT EIR
EPA FILING: FEDERAL REGISTER		STATE CLEARINGHOUSE
PUBLIC AGENCY REVIEW	At least a 45-day period during which the public and agencies review the draft document and submit comments to the lead agencies.	PUBLIC AND AGENCY REVIEW
FINAL EIS	Addresses the comments on the draft document and from any public hearing, presents the final evaluation of project-induced environmental impacts and ways to mitigate unavoidable impacts.	PREPARATION OF RESPONSE TO COMMENTS
EPA FILING: FEDERAL REGISTER NOTICE		FINAL EIR
AGENCY DECISION/ RECORD OF DECISION	Lead agency uses information from the final document and the project record to issue a decision and document commitments and mitigation.	AGENCY DECISION/FINDINGS, STATEMENT OF OVERRIDING CONSIDERATION, MITIGATION MONITORING

FOLSOM DAM

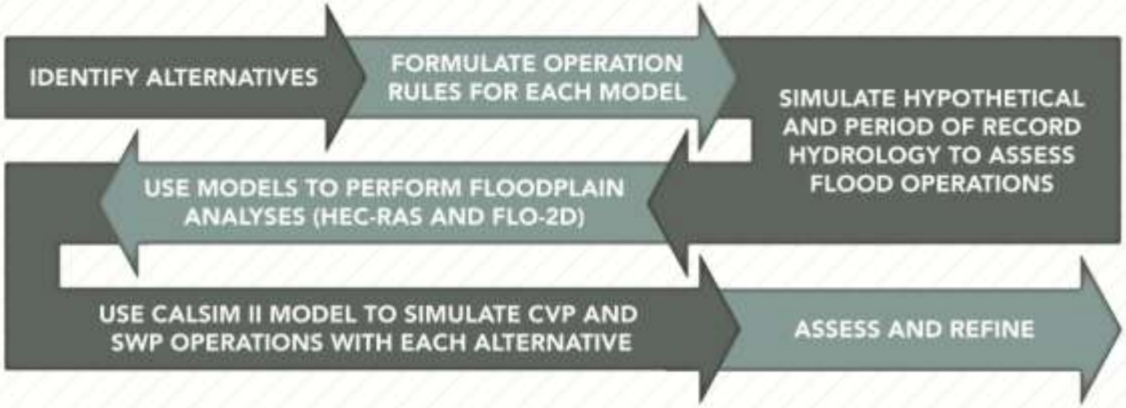
WATER CONTROL MANUAL UPDATE

MODELING GOALS

Develop Water Control and Emergency Spillway Release **Diagrams** for a comprehensive Water Control Plan

Produce data to support the planning process and NEPA, CEQA, California Endangered Species Act, and Federal Endangered Species Act requirements

MODELING PROCESS


IDENTIFY ALTERNATIVES

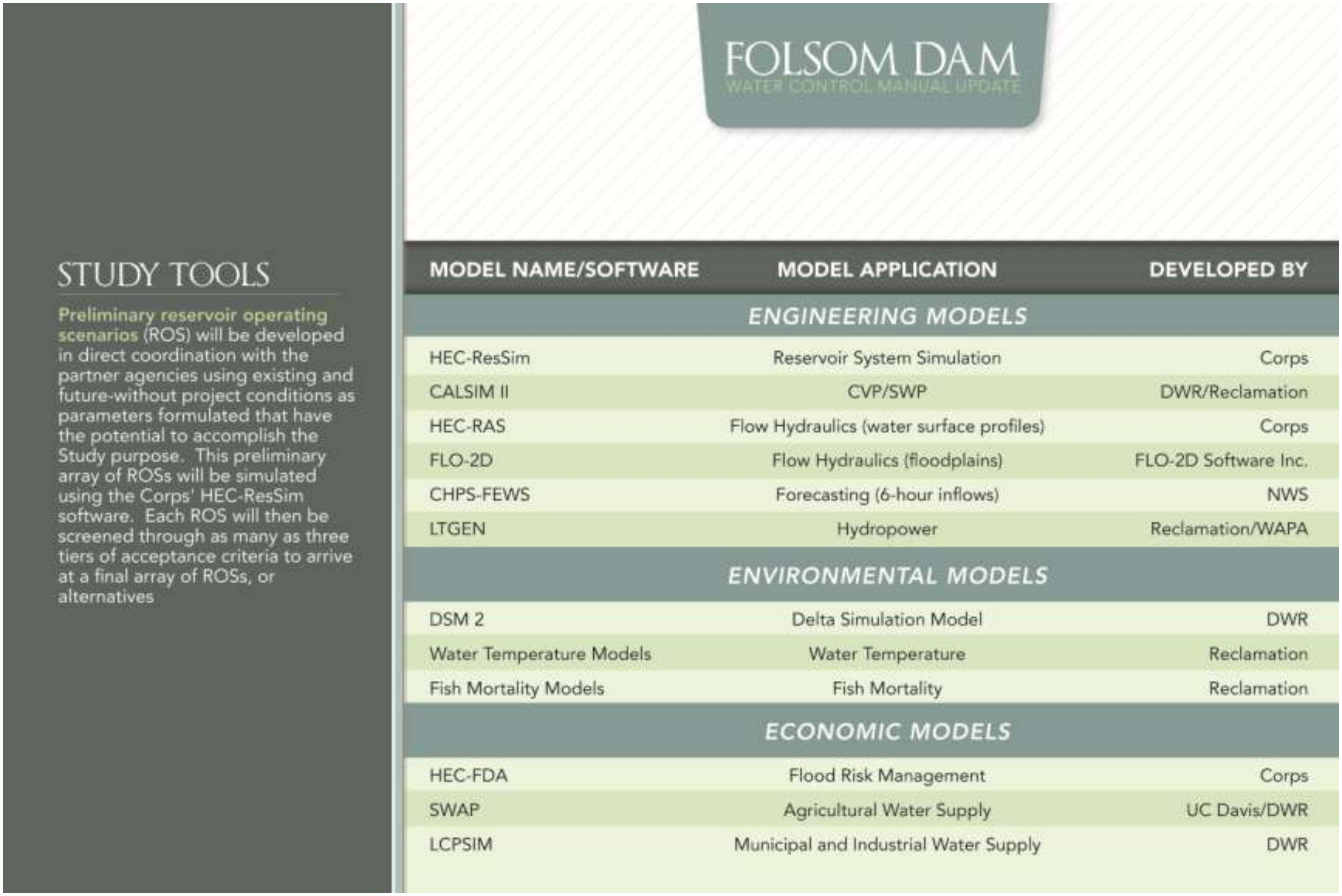
FORMULATE OPERATION RULES FOR EACH MODEL

SIMULATE HYPOTHETICAL AND PERIOD OF RECORD HYDROLOGY TO ASSESS FLOOD OPERATIONS

USE MODELS TO PERFORM FLOODPLAIN ANALYSES (HEC-RAS AND FLO-2D)

USE CALSIM II MODEL TO SIMULATE CVP AND SWP OPERATIONS WITH EACH ALTERNATIVE

ASSESS AND REFINE



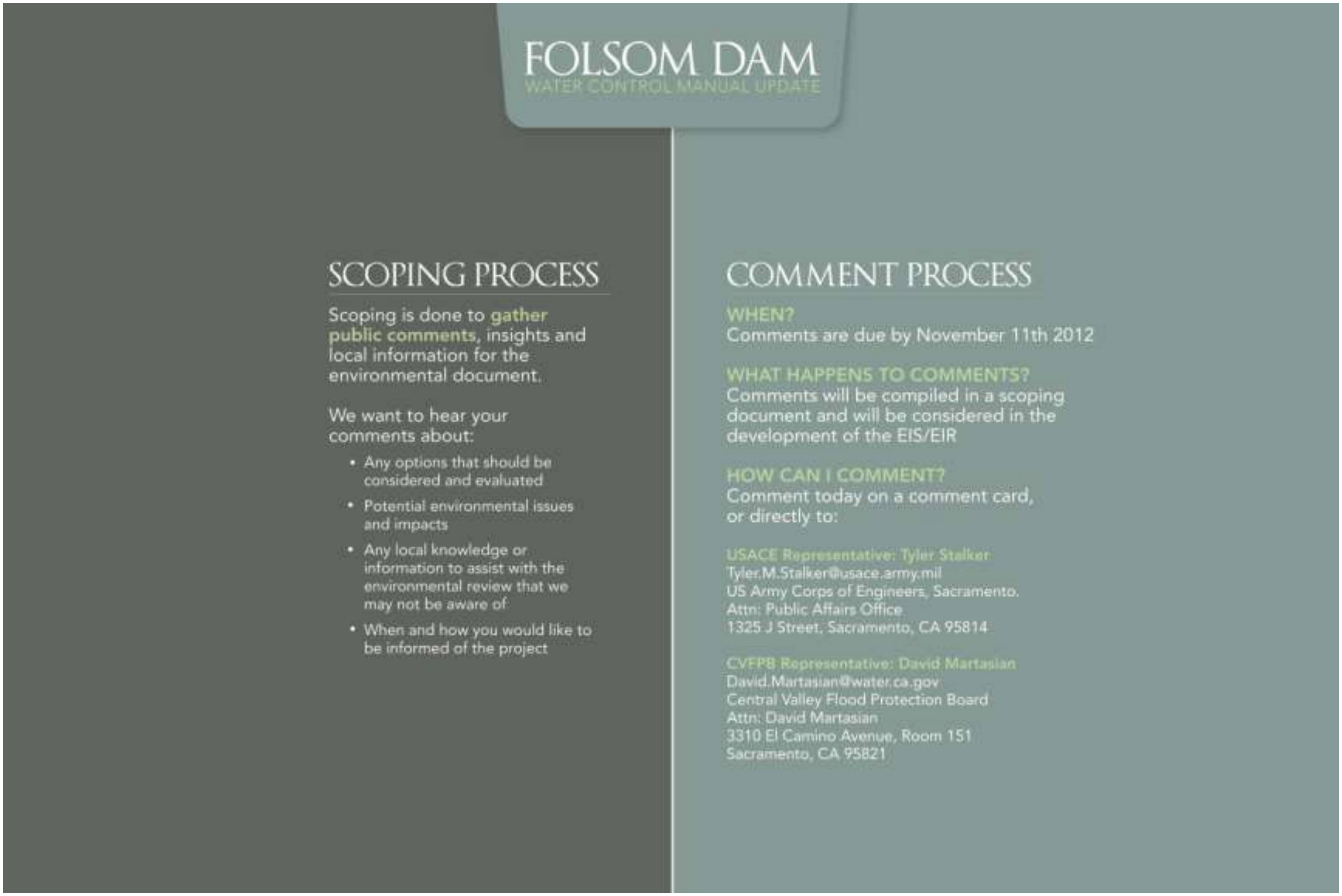
FOLSOM DAM

WATER CONTROL MANUAL UPDATE

STUDY TOOLS

Preliminary reservoir operating scenarios (ROS) will be developed in direct coordination with the partner agencies using existing and future-without project conditions as parameters formulated that have the potential to accomplish the Study purpose. This preliminary array of ROSs will be simulated using the Corps' HEC-ResSim software. Each ROS will then be screened through as many as three tiers of acceptance criteria to arrive at a final array of ROSs, or alternatives

MODEL NAME/SOFTWARE	MODEL APPLICATION	DEVELOPED BY
	ENGINEERING MODELS	
HEC-ResSim	Reservoir System Simulation	Corps
CALSIM II	CVP/SWP	DWR/Reclamation
HEC-RAS	Flow Hydraulics (water surface profiles)	Corps
FLO-2D	Flow Hydraulics (floodplains)	FLO-2D Software Inc.
CHPS-FEWS	Forecasting (6-hour inflows)	NWS
LTGEN	Hydropower	Reclamation/WAPA
	ENVIRONMENTAL MODELS	
DSM 2	Delta Simulation Model	DWR
Water Temperature Models	Water Temperature	Reclamation
Fish Mortality Models	Fish Mortality	Reclamation
	ECONOMIC MODELS	
HEC-FDA	Flood Risk Management	Corps
SWAP	Agricultural Water Supply	UC Davis/DWR
LCPSIM	Municipal and Industrial Water Supply	DWR



FOLSOM DAM

WATER CONTROL MANUAL UPDATE

SCOPING PROCESS

Scoping is done to **gather public comments**, insights and local information for the environmental document.

We want to hear your comments about:

- Any options that should be considered and evaluated
- Potential environmental issues and impacts
- Any local knowledge or information to assist with the environmental review that we may not be aware of
- When and how you would like to be informed of the project

COMMENT PROCESS

WHEN?

Comments are due by November 11th 2012

WHAT HAPPENS TO COMMENTS?

Comments will be compiled in a scoping document and will be considered in the development of the EIS/EIR

HOW CAN I COMMENT?

Comment today on a comment card, or directly to:

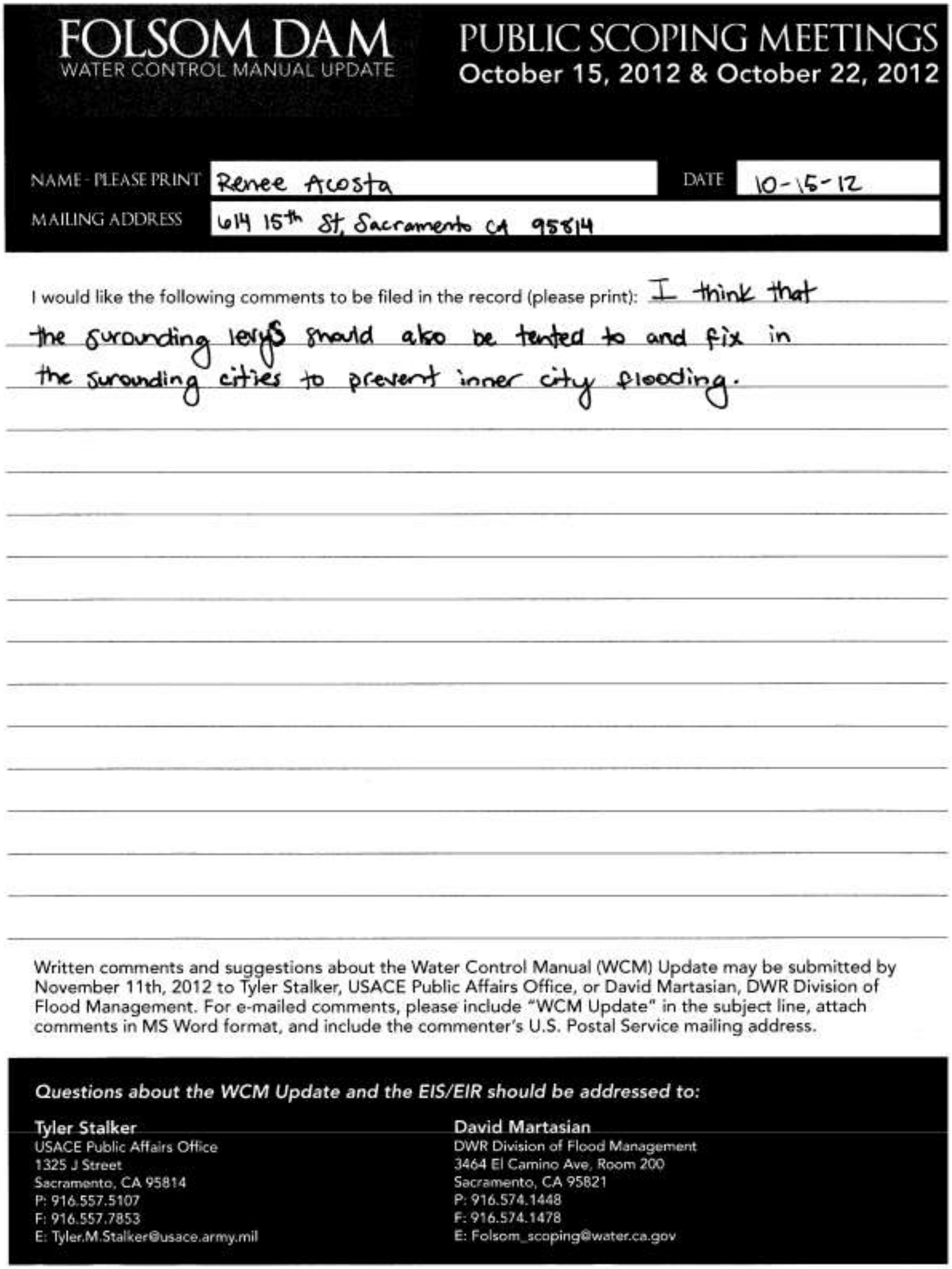
USACE Representative: Tyler Stalker
Tyler.M.Stalker@usace.army.mil
US Army Corps of Engineers, Sacramento.
Attn: Public Affairs Office
1325 J Street, Sacramento, CA 95814

CVFPB Representative: David Martasian
David.Martasian@water.ca.gov
Central Valley Flood Protection Board
Attn: David Martasian
3310 El Camino Avenue, Room 151
Sacramento, CA 95821

❖

Appendix C Public Comments

The following are scanned copies of the comment cards and written correspondence received by the public between October 12, 2012 and November 15, 2012, at or following the public scoping meetings for the Folsom Dam WCM Update. Comments are sorted in chronological order.



FOLSOM DAM
WATER CONTROL MANUAL UPDATE

PUBLIC SCOPING MEETINGS
October 15, 2012 & October 22, 2012

NAME - PLEASE PRINT Renee Acosta

DATE 10-15-12

MAILING ADDRESS 614 15th St, Sacramento CA 95814

I would like the following comments to be filed in the record (please print): I think that the surounding levyS should also be tented to and fix in the surounding cities to prevent inner city flooding.

Written comments and suggestions about the Water Control Manual (WCM) Update may be submitted by November 11th, 2012 to Tyler Stalker, USACE Public Affairs Office, or David Martasian, DWR Division of Flood Management. For e-mailed comments, please include "WCM Update" in the subject line, attach comments in MS Word format, and include the commenter's U.S. Postal Service mailing address.

Questions about the WCM Update and the EIS/EIR should be addressed to:

Tyler Stalker
USACE Public Affairs Office
1325 J Street
Sacramento, CA 95814
P: 916.557.5107
F: 916.557.7853
E: Tyler.M.Stalker@usace.army.mil

David Martasian
DWR Division of Flood Management
3464 El Camino Ave, Room 200
Sacramento, CA 95821
P: 916.574.1448
F: 916.574.1478
E: Folsom_scoping@water.ca.gov

Water Control Manual Update - General Information Query

From: Stalker, Tyler M SPK
Sent: Tuesday, October 16, 2012 3:32 PM
To: Eckert, Lisa E SPK
Subject: Water Control Manual Update - General Information Query

Lisa:

Tom Kelley from Urban Partnership Agreement in San Francisco called looking for some general information about the Joint EIS/EIR being conducted as part of the project.

Tom's phone number is (415) 972-3856.

Thanks.

Respectfully,

Tyler

Tyler M. Stalker
U.S. Army Corps of Engineers, Sacramento District

Public Affairs Office
Office: 916-557-5107

Blackberry: 916-396-2831

Fax: 916-557-7853

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Page 1

CALIFORNIA
Water Boards

Edmund G. Brown Jr.
Governor

Matthew Rodriquez
Secretary for
Environmental Protection

Central Valley Regional Water Quality Control Board

19 October 2012

Vincent Heim
Central Valley Flood Protection Board
3464 El Camino Avenue
Sacramento, CA 95821

CERTIFIED MAIL
7011 2970 0003 8939 6007

COMMENTS TO NOTICE OF PREPARATION FOR THE DRAFT ENVIRONMENTAL IMPACT REPORT, FOLSOM DAM WATER CONTROL MANUAL UPDATE PROJECT, SCH NO. 2012102034, SACRAMENTO COUNTY

Pursuant to the State Clearinghouse's 12 October 2012 request, the Central Valley Regional Water Quality Control Board (Central Valley Water Board) has reviewed the *(Notice of Preparation for Environmental Impact Report* for the Folsom Dam Water Control Manual Update Project, located in Sacramento County.

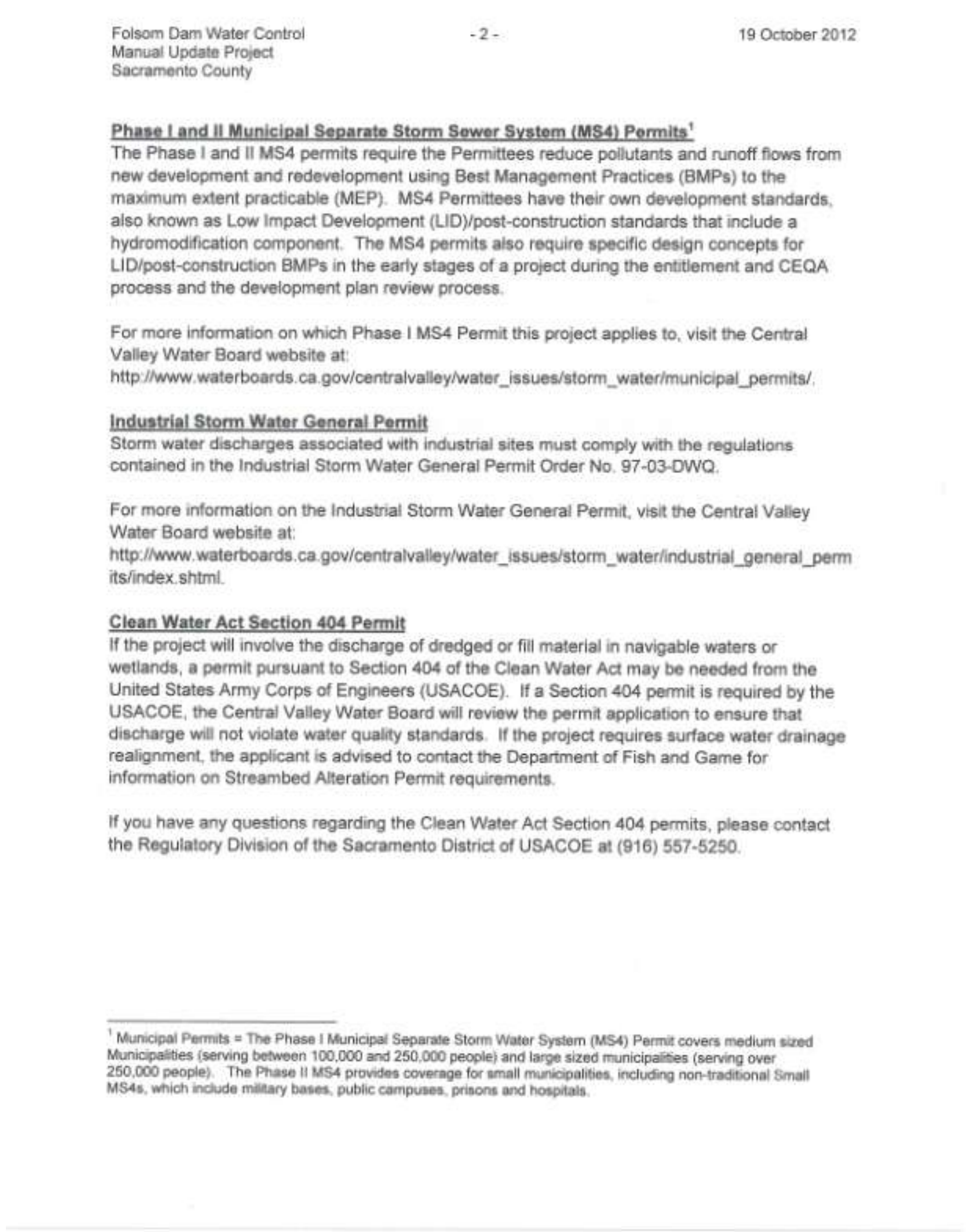
Our agency is delegated with the responsibility of protecting the quality of surface and groundwaters of the state; therefore our comments will address concerns surrounding those issues.

Construction Storm Water General Permit
Dischargers whose project disturb one or more acres of soil or where projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the General Permit for Storm Water Discharges Associated with Construction Activities (Construction General Permit), Construction General Permit Order No. 2009-009-DWQ. Construction activity subject to this permit includes clearing, grading, grubbing, disturbances to the ground, such as stockpiling, or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility. The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP).

For more information on the Construction General Permit, visit the State Water Resources Control Board website at:
http://www.waterboards.ca.gov/water_issues/programs/stormwater/constpermits.shtml.

Karl E. Longley ScD, P.E., chair | Pamela C. Creedon P.E., BCEE, executive officer
11020 Sun Center Drive #200, Rancho Cordova, CA 95670 | www.waterboards.ca.gov/centralvalley

Recycled paper



Phase I and II Municipal Separate Storm Sewer System (MS4) Permits[1]
The Phase I and II MS4 permits require the Permittees reduce pollutants and runoff flows from new development and redevelopment using Best Management Practices (BMPs) to the maximum extent practicable (MEP). MS4 Permittees have their own development standards, also known as Low Impact Development (LID)/post-construction standards that include a hydromodification component. The MS4 permits also require specific design concepts for LID/post-construction BMPs in the early stages of a project during the entitlement and CEQA process and the development plan review process.

For more information on which Phase I MS4 Permit this project applies to, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/water_issues/storm_water/municipal_permits/.

Industrial Storm Water General Permit
Storm water discharges associated with industrial sites must comply with the regulations contained in the Industrial Storm Water General Permit Order No. 97-03-DWQ.

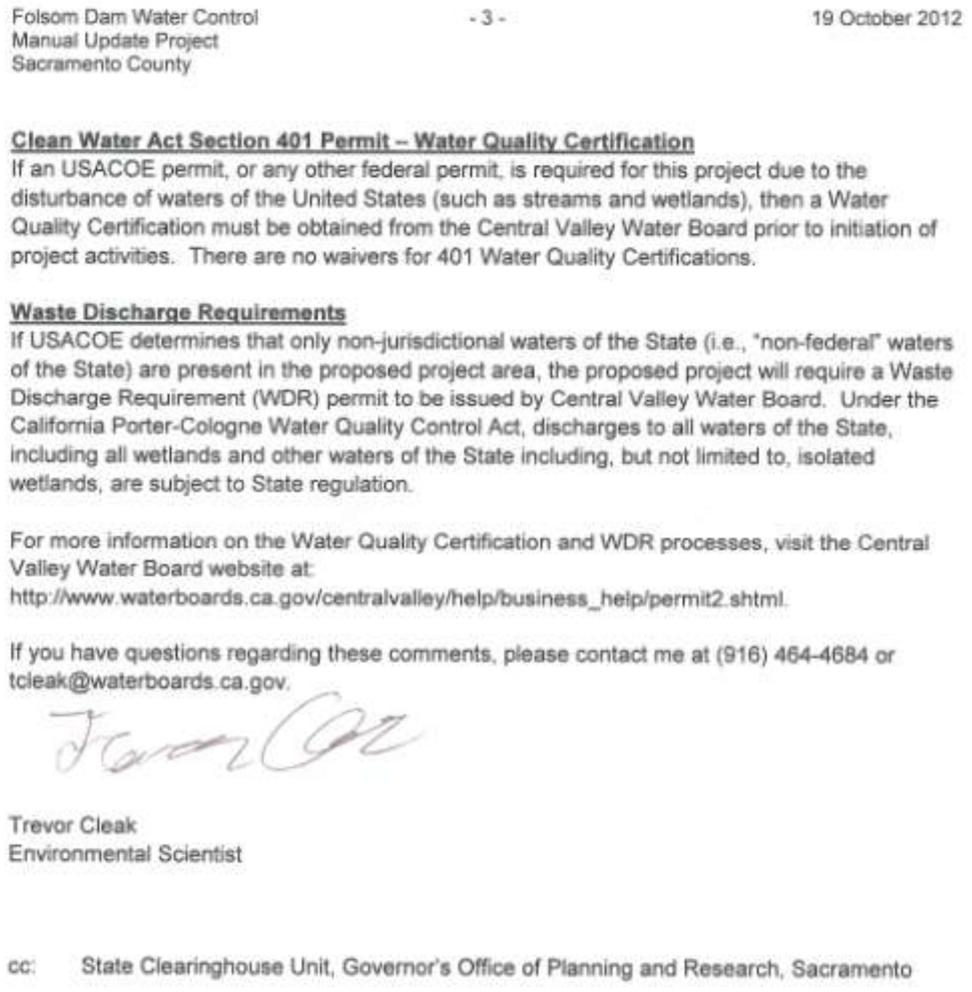
For more information on the Industrial Storm Water General Permit, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/water_issues/storm_water/industrial_general_permits/index.shtml.

Clean Water Act Section 404 Permit
If the project will involve the discharge of dredged or fill material in navigable waters or wetlands, a permit pursuant to Section 404 of the Clean Water Act may be needed from the United States Army Corps of Engineers (USACOE). If a Section 404 permit is required by the USACOE, the Central Valley Water Board will review the permit application to ensure that discharge will not violate water quality standards. If the project requires surface water drainage realignment, the applicant is advised to contact the Department of Fish and Game for information on Streambed Alteration Permit requirements.

If you have any questions regarding the Clean Water Act Section 404 permits, please contact the Regulatory Division of the Sacramento District of USACOE at (916) 557-5250.

---

[1] Municipal Permits = The Phase I Municipal Separate Storm Water System (MS4) Permit covers medium sized Municipalities (serving between 100,000 and 250,000 people) and large sized municipalities (serving over 250,000 people). The Phase II MS4 provides coverage for small municipalities, including non-traditional Small MS4s, which include military bases, public campuses, prisons and hospitals.



Clean Water Act Section 401 Permit – Water Quality Certification
If an USACOE permit, or any other federal permit, is required for this project due to the disturbance of waters of the United States (such as streams and wetlands), then a Water Quality Certification must be obtained from the Central Valley Water Board prior to initiation of project activities. There are no waivers for 401 Water Quality Certifications.

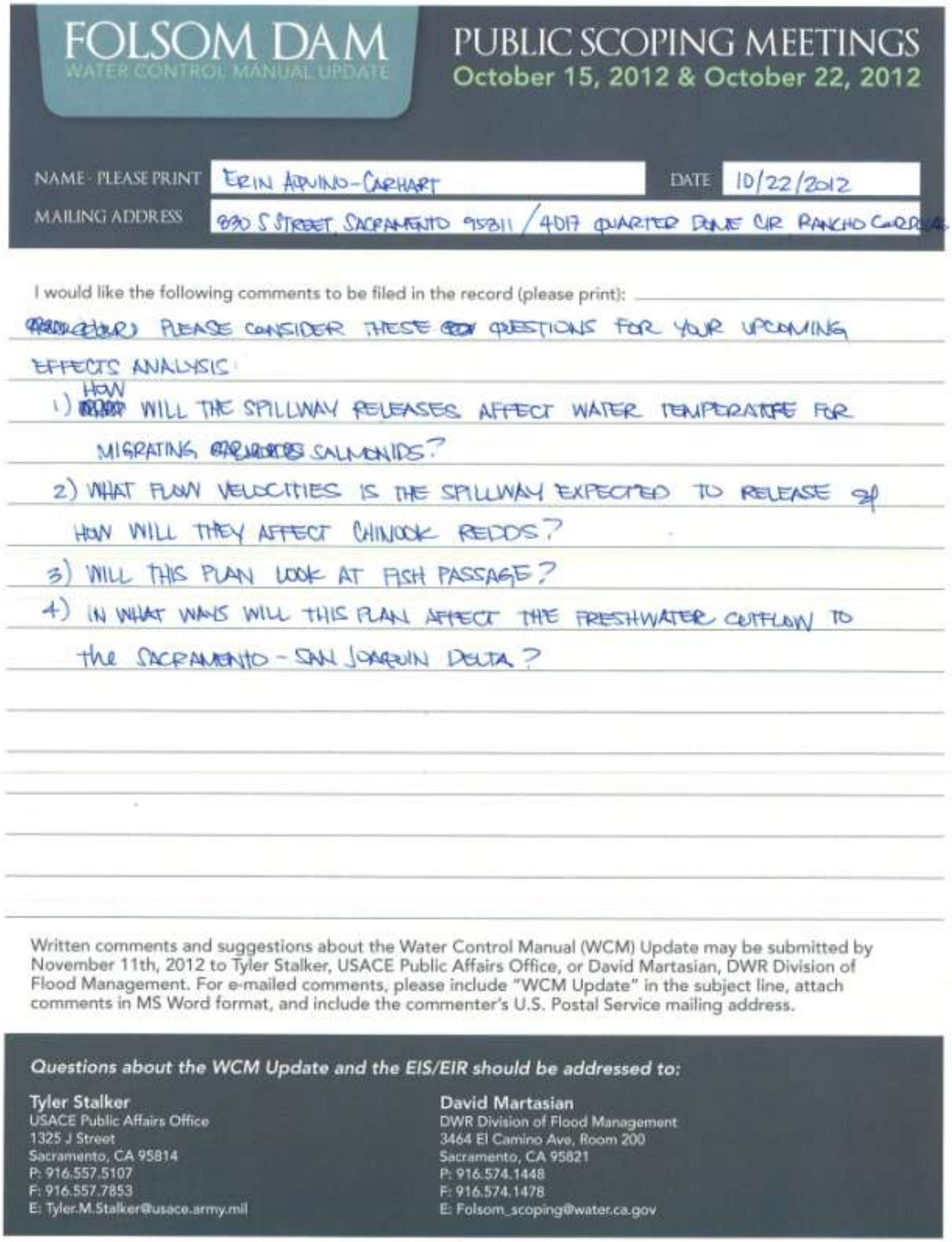
Waste Discharge Requirements
If USACOE determines that only non-jurisdictional waters of the State (i.e., "non-federal" waters of the State) are present in the proposed project area, the proposed project will require a Waste Discharge Requirement (WDR) permit to be issued by Central Valley Water Board. Under the California Porter-Cologne Water Quality Control Act, discharges to all waters of the State, including all wetlands and other waters of the State including, but not limited to, isolated wetlands, are subject to State regulation.

For more information on the Water Quality Certification and WDR processes, visit the Central Valley Water Board website at:
http://www.waterboards.ca.gov/centralvalley/help/business_help/permit2.shtml.

If you have questions regarding these comments, please contact me at (916) 464-4684 or tcleak@waterboards.ca.gov.

Trevor Cleak
Environmental Scientist

cc: State Clearinghouse Unit, Governor's Office of Planning and Research, Sacramento



FOLSOM DAM

WATER CONTROL MANUAL UPDATE

PUBLIC SCOPING MEETINGS

October 15, 2012 & October 22, 2012

NAME · PLEASE PRINT: ERIN AQUINO-CARHART

DATE: 10/22/2012

MAILING ADDRESS: 830 S STREET, SACRAMENTO 95811 / 4017 QUARTER DUNE CIR RANCHO CORD

I would like the following comments to be filed in the record (please print):

PLEASE CONSIDER THESE QUESTIONS FOR YOUR UPCOMING EFFECTS ANALYSIS:

1) HOW WILL THE SPILLWAY RELEASES AFFECT WATER TEMPERATURE FOR MIGRATING SALMONIDS?

2) WHAT FLOW VELOCITIES IS THE SPILLWAY EXPECTED TO RELEASE & HOW WILL THEY AFFECT CHINOOK REDDS?

3) WILL THIS PLAN LOOK AT FISH PASSAGE?

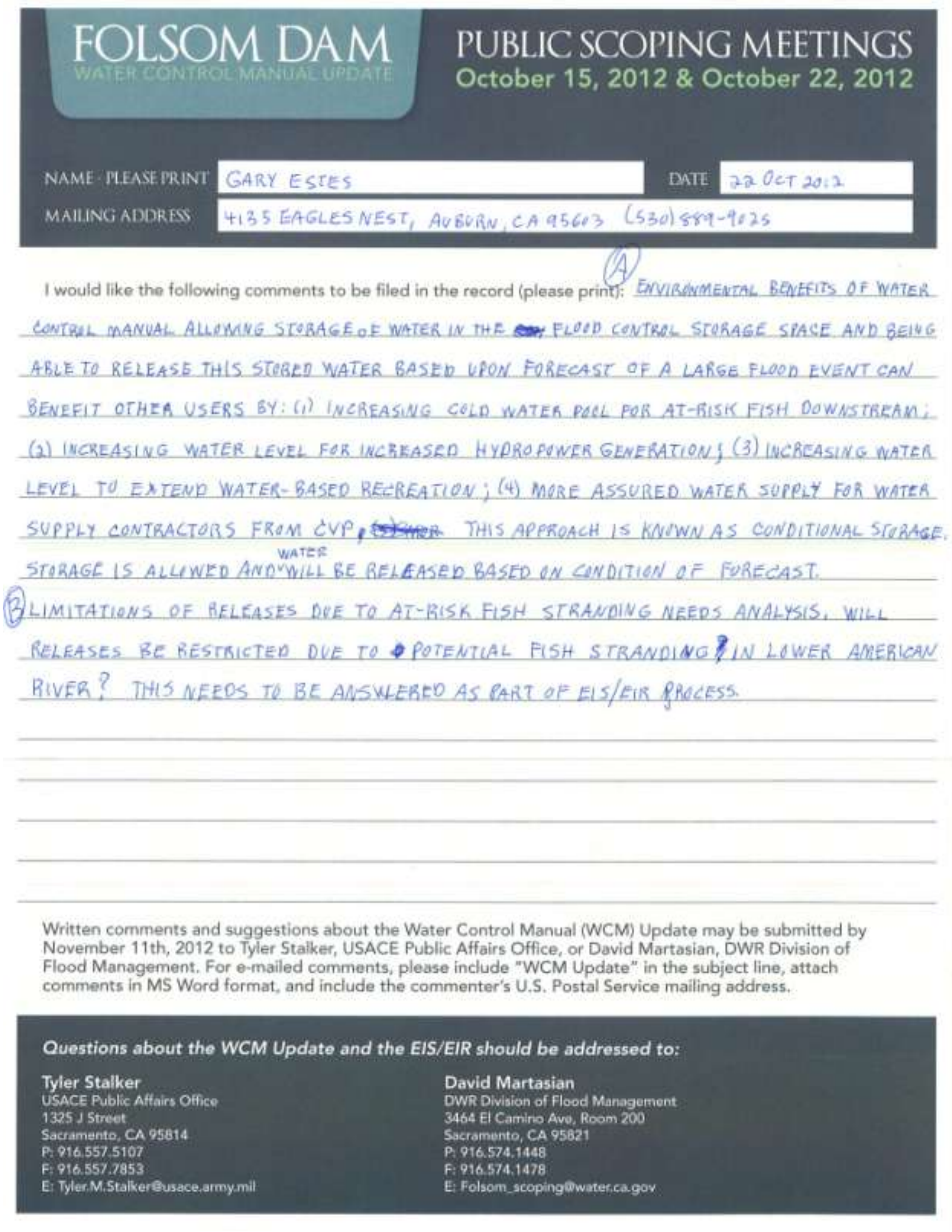
4) IN WHAT WAYS WILL THIS PLAN AFFECT THE FRESHWATER OUTFLOW TO the SACRAMENTO - SAN JOAQUIN DELTA?

Written comments and suggestions about the Water Control Manual (WCM) Update may be submitted by November 11th, 2012 to Tyler Stalker, USACE Public Affairs Office, or David Martasian, DWR Division of Flood Management. For e-mailed comments, please include "WCM Update" in the subject line, attach comments in MS Word format, and include the commenter's U.S. Postal Service mailing address.

Questions about the WCM Update and the EIS/EIR should be addressed to:

Tyler Stalker
USACE Public Affairs Office
1325 J Street
Sacramento, CA 95814
P: 916.557.5107
F: 916.557.7853
E: Tyler.M.Stalker@usace.army.mil

David Martasian
DWR Division of Flood Management
3464 El Camino Ave, Room 200
Sacramento, CA 95821
P: 916.574.1448
F: 916.574.1478
E: Folsom_scoping@water.ca.gov



FOLSOM DAM
WATER CONTROL MANUAL UPDATE

PUBLIC SCOPING MEETINGS
October 15, 2012 & October 22, 2012

NAME · PLEASE PRINT GARY ESTES

DATE 22 OCT 2012

MAILING ADDRESS 4135 EAGLES NEST, AUBURN, CA 95603 (530) 889-9025

I would like the following comments to be filed in the record (please print): Ⓐ ENVIRONMENTAL BENEFITS OF WATER CONTROL MANUAL ALLOWING STORAGE OF WATER IN THE FLOOD CONTROL STORAGE SPACE AND BEING ABLE TO RELEASE THIS STORED WATER BASED UPON FORECAST OF A LARGE FLOOD EVENT CAN BENEFIT OTHER USERS BY: (1) INCREASING COLD WATER POOL FOR AT-RISK FISH DOWNSTREAM; (2) INCREASING WATER LEVEL FOR INCREASED HYDROPOWER GENERATION; (3) INCREASING WATER LEVEL TO EXTEND WATER-BASED RECREATION; (4) MORE ASSURED WATER SUPPLY FOR WATER SUPPLY CONTRACTORS FROM CVP, ~~(5) OTHER~~ THIS APPROACH IS KNOWN AS CONDITIONAL STORAGE. STORAGE IS ALLOWED AND WATER WILL BE RELEASED BASED ON CONDITION OF FORECAST.

Ⓑ LIMITATIONS OF RELEASES DUE TO AT-RISK FISH STRANDING NEEDS ANALYSIS. WILL RELEASES BE RESTRICTED DUE TO POTENTIAL FISH STRANDING IN LOWER AMERICAN RIVER? THIS NEEDS TO BE ANSWERED AS PART OF EIS/EIR PROCESS.

Written comments and suggestions about the Water Control Manual (WCM) Update may be submitted by November 11th, 2012 to Tyler Stalker, USACE Public Affairs Office, or David Martasian, DWR Division of Flood Management. For e-mailed comments, please include "WCM Update" in the subject line, attach comments in MS Word format, and include the commenter's U.S. Postal Service mailing address.

Questions about the WCM Update and the EIS/EIR should be addressed to:

Tyler Stalker
USACE Public Affairs Office
1325 J Street
Sacramento, CA 95814
P: 916.557.5107
F: 916.557.7853
E: Tyler.M.Stalker@usace.army.mil

David Martasian
DWR Division of Flood Management
3464 El Camino Ave, Room 200
Sacramento, CA 95821
P: 916.574.1448
F: 916.574.1478
E: Folsom_scoping@water.ca.gov

Folsom Dam Water Control Manual Mailing List

From: Stalker, Tyler M SPK
Sent: Monday, October 22, 2012 8:36 AM
To: Eckert, Lisa E SPK
Subject: Folsom Dam Water Control Manual Mailing List

Lisa: Can you add the two names below to any mailing lists we have concerning the Folsom Dam Water Control Manual? Thank you.

Erin Aquino-Carhart, erinaquino@gmail.com, 4017 Quarter Dome Cir, Rancho Cordova, CA 95742

Rafael G. Fernando, Jr., rfernando@mwdh2o.com, Metropolitan Water District of Southern CA

Respectfully,

Tyler

Tyler M. Stalker
U.S. Army Corps of Engineers, Sacramento District

Public Affairs Office
Office: 916-557-5107

Blackberry: 916-396-2831

Fax: 916-557-7853

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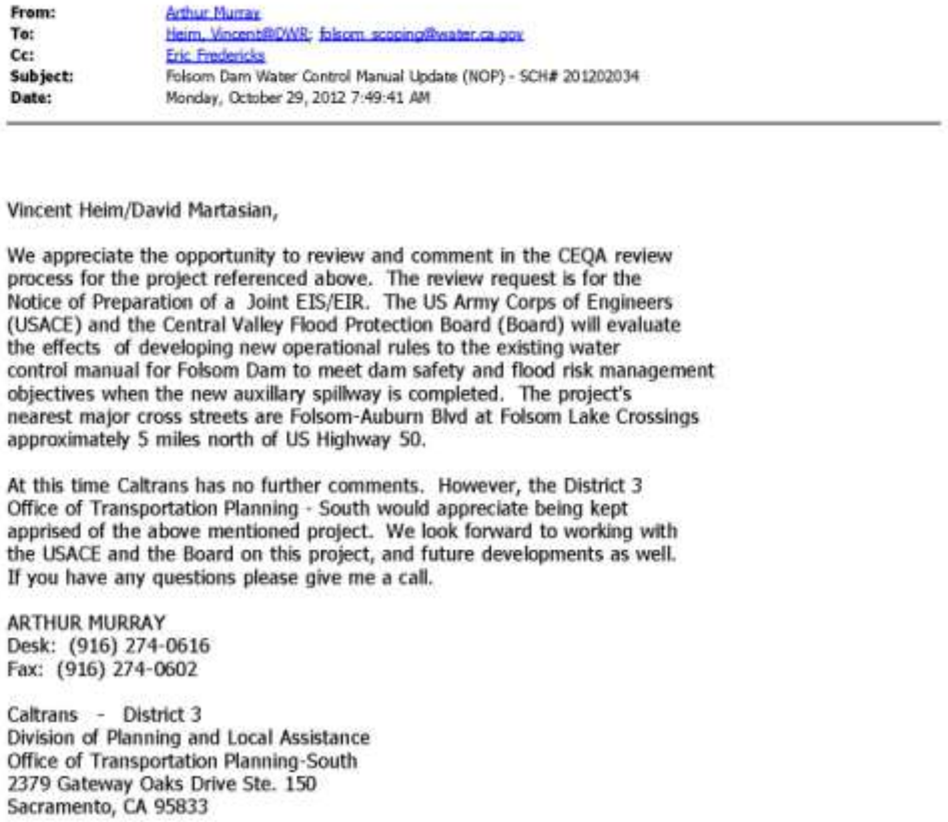


From: Arthur Murray
To: Heim, Vincent@DWR; folsom_scoping@water.ca.gov
Cc: Eric Fredericks
Subject: Folsom Dam Water Control Manual Update (NOP) - SCH# 201202034
Date: Monday, October 29, 2012 7:49:41 AM

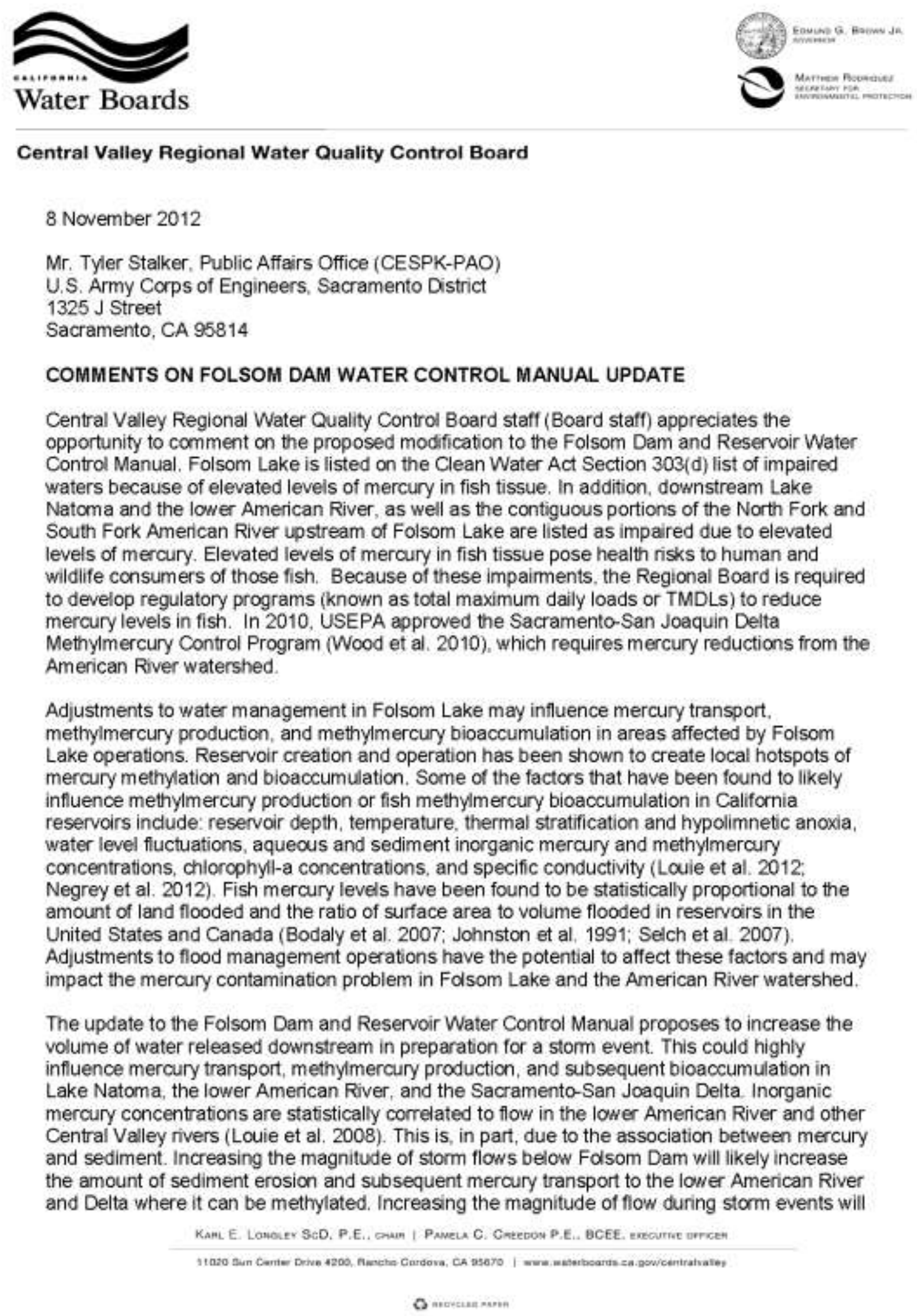
Vincent Heim/David Martasian,

We appreciate the opportunity to review and comment in the CEQA review process for the project referenced above. The review request is for the Notice of Preparation of a Joint EIS/EIR. The US Army Corps of Engineers (USACE) and the Central Valley Flood Protection Board (Board) will evaluate the effects of developing new operational rules to the existing water control manual for Folsom Dam to meet dam safety and flood risk management objectives when the new auxillary spillway is completed. The project's nearest major cross streets are Folsom-Auburn Blvd at Folsom Lake Crossings approximately 5 miles north of US Highway 50.

At this time Caltrans has no further comments. However, the District 3 Office of Transportation Planning - South would appreciate being kept apprised of the above mentioned project. We look forward to working with the USACE and the Board on this project, and future developments as well. If you have any questions please give me a call.

ARTHUR MURRAY
Desk: (916) 274-0616
Fax: (916) 274-0602

Caltrans - District 3
Division of Planning and Local Assistance
Office of Transportation Planning-South
2379 Gateway Oaks Drive Ste. 150
Sacramento, CA 95833



CALIFORNIA
Water Boards

EDMUND G. BROWN JR.
GOVERNOR

MATTHEW RODRIQUEZ
SECRETARY FOR
ENVIRONMENTAL PROTECTION

Central Valley Regional Water Quality Control Board

8 November 2012

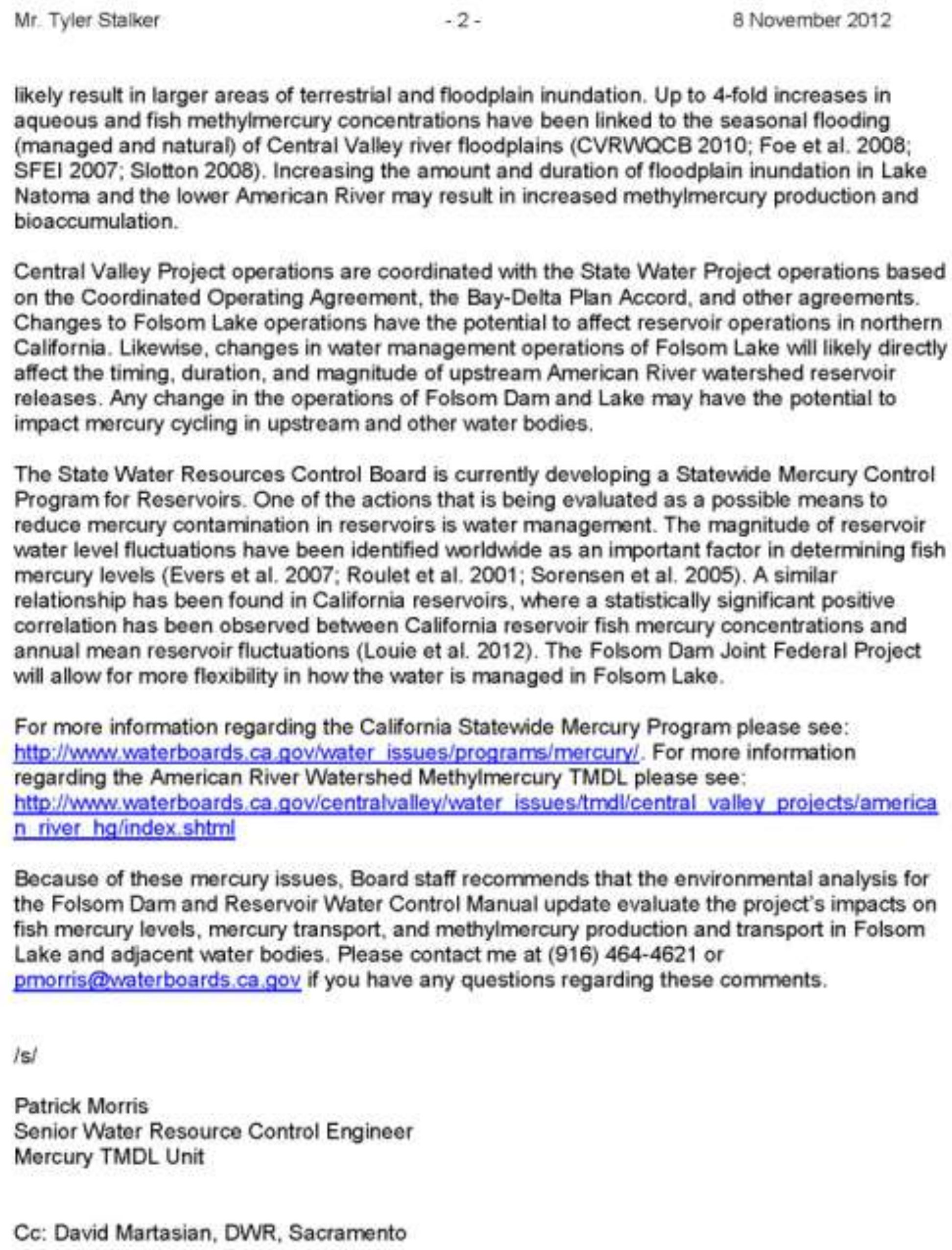
Mr. Tyler Stalker, Public Affairs Office (CESPK-PAO)
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, CA 95814

COMMENTS ON FOLSOM DAM WATER CONTROL MANUAL UPDATE

Central Valley Regional Water Quality Control Board staff (Board staff) appreciates the opportunity to comment on the proposed modification to the Folsom Dam and Reservoir Water Control Manual. Folsom Lake is listed on the Clean Water Act Section 303(d) list of impaired waters because of elevated levels of mercury in fish tissue. In addition, downstream Lake Natoma and the lower American River, as well as the contiguous portions of the North Fork and South Fork American River upstream of Folsom Lake are listed as impaired due to elevated levels of mercury. Elevated levels of mercury in fish tissue pose health risks to human and wildlife consumers of those fish. Because of these impairments, the Regional Board is required to develop regulatory programs (known as total maximum daily loads or TMDLs) to reduce mercury levels in fish. In 2010, USEPA approved the Sacramento-San Joaquin Delta Methylmercury Control Program (Wood et al. 2010), which requires mercury reductions from the American River watershed.

Adjustments to water management in Folsom Lake may influence mercury transport, methylmercury production, and methylmercury bioaccumulation in areas affected by Folsom Lake operations. Reservoir creation and operation has been shown to create local hotspots of mercury methylation and bioaccumulation. Some of the factors that have been found to likely influence methylmercury production or fish methylmercury bioaccumulation in California reservoirs include: reservoir depth, temperature, thermal stratification and hypolimnetic anoxia, water level fluctuations, aqueous and sediment inorganic mercury and methylmercury concentrations, chlorophyll-a concentrations, and specific conductivity (Louie et al. 2012; Negrey et al. 2012). Fish mercury levels have been found to be statistically proportional to the amount of land flooded and the ratio of surface area to volume flooded in reservoirs in the United States and Canada (Bodaly et al. 2007; Johnston et al. 1991; Selch et al. 2007). Adjustments to flood management operations have the potential to affect these factors and may impact the mercury contamination problem in Folsom Lake and the American River watershed.

The update to the Folsom Dam and Reservoir Water Control Manual proposes to increase the volume of water released downstream in preparation for a storm event. This could highly influence mercury transport, methylmercury production, and subsequent bioaccumulation in Lake Natoma, the lower American River, and the Sacramento-San Joaquin Delta. Inorganic mercury concentrations are statistically correlated to flow in the lower American River and other Central Valley rivers (Louie et al. 2008). This is, in part, due to the association between mercury and sediment. Increasing the magnitude of storm flows below Folsom Dam will likely increase the amount of sediment erosion and subsequent mercury transport to the lower American River and Delta where it can be methylated. Increasing the magnitude of flow during storm events will



likely result in larger areas of terrestrial and floodplain inundation. Up to 4-fold increases in aqueous and fish methylmercury concentrations have been linked to the seasonal flooding (managed and natural) of Central Valley river floodplains (CVRWQCB 2010; Foe et al. 2008; SFEI 2007; Slotton 2008). Increasing the amount and duration of floodplain inundation in Lake Natoma and the lower American River may result in increased methylmercury production and bioaccumulation.

Central Valley Project operations are coordinated with the State Water Project operations based on the Coordinated Operating Agreement, the Bay-Delta Plan Accord, and other agreements. Changes to Folsom Lake operations have the potential to affect reservoir operations in northern California. Likewise, changes in water management operations of Folsom Lake will likely directly affect the timing, duration, and magnitude of upstream American River watershed reservoir releases. Any change in the operations of Folsom Dam and Lake may have the potential to impact mercury cycling in upstream and other water bodies.

The State Water Resources Control Board is currently developing a Statewide Mercury Control Program for Reservoirs. One of the actions that is being evaluated as a possible means to reduce mercury contamination in reservoirs is water management. The magnitude of reservoir water level fluctuations have been identified worldwide as an important factor in determining fish mercury levels (Evers et al. 2007; Roulet et al. 2001; Sorensen et al. 2005). A similar relationship has been found in California reservoirs, where a statistically significant positive correlation has been observed between California reservoir fish mercury concentrations and annual mean reservoir fluctuations (Louie et al. 2012). The Folsom Dam Joint Federal Project will allow for more flexibility in how the water is managed in Folsom Lake.

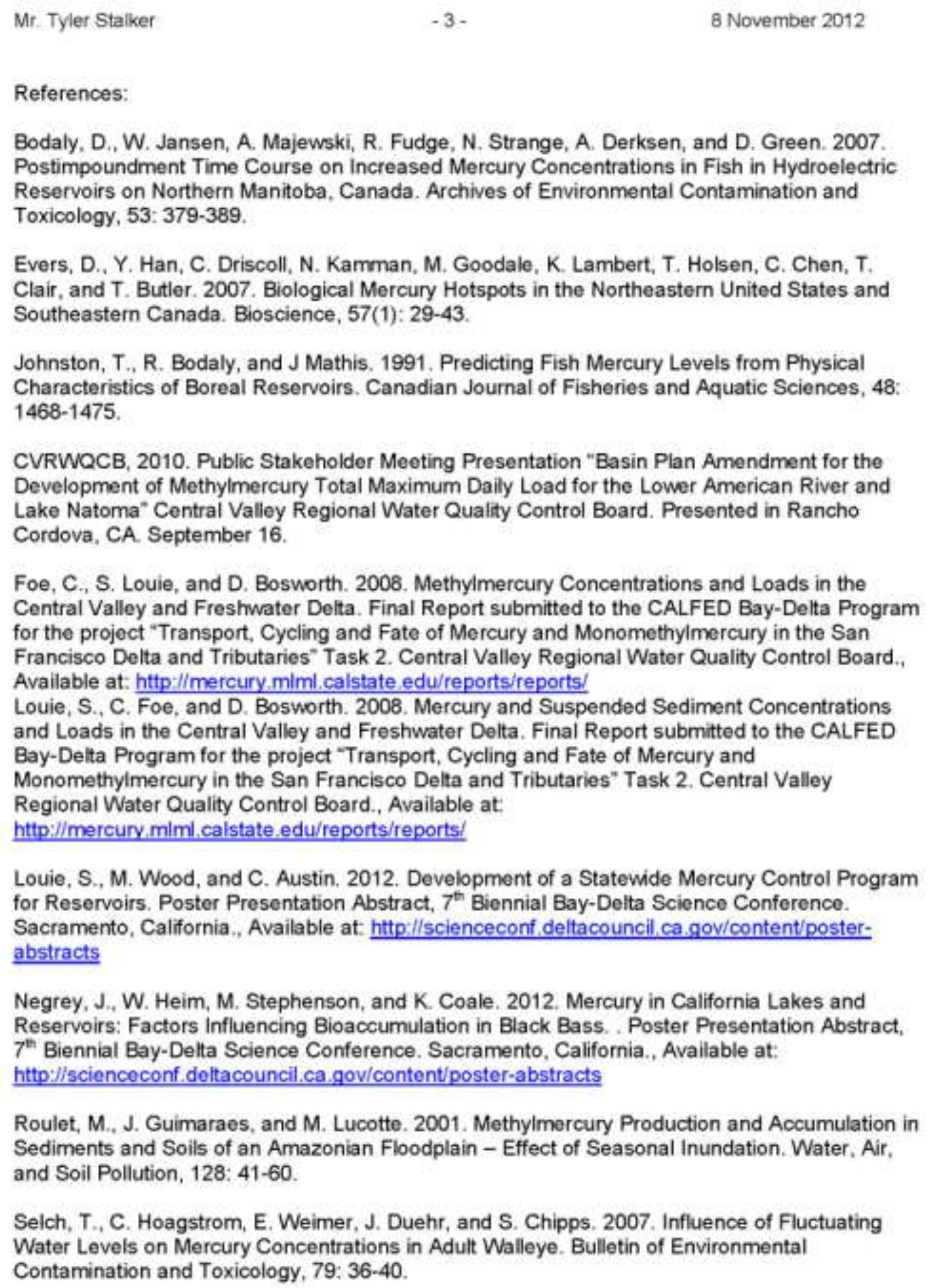
For more information regarding the California Statewide Mercury Program please see: http://www.waterboards.ca.gov/water_issues/programs/mercury/. For more information regarding the American River Watershed Methylmercury TMDL please see: http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/american_river_hg/index.shtml

Because of these mercury issues, Board staff recommends that the environmental analysis for the Folsom Dam and Reservoir Water Control Manual update evaluate the project's impacts on fish mercury levels, mercury transport, and methylmercury production and transport in Folsom Lake and adjacent water bodies. Please contact me at (916) 464-4621 or pmorris@waterboards.ca.gov if you have any questions regarding these comments.

/s/

Patrick Morris
Senior Water Resource Control Engineer
Mercury TMDL Unit

Cc: David Martasian, DWR, Sacramento



References:

Bodaly, D., W. Jansen, A. Majewski, R. Fudge, N. Strange, A. Derksen, and D. Green. 2007. Postimpoundment Time Course on Increased Mercury Concentrations in Fish in Hydroelectric Reservoirs on Northern Manitoba, Canada. Archives of Environmental Contamination and Toxicology, 53: 379-389.

Evers, D., Y. Han, C. Driscoll, N. Kamman, M. Goodale, K. Lambert, T. Holsen, C. Chen, T. Clair, and T. Butler. 2007. Biological Mercury Hotspots in the Northeastern United States and Southeastern Canada. Bioscience, 57(1): 29-43.

Johnston, T., R. Bodaly, and J Mathis. 1991. Predicting Fish Mercury Levels from Physical Characteristics of Boreal Reservoirs. Canadian Journal of Fisheries and Aquatic Sciences, 48: 1468-1475.

CVRWQCB, 2010. Public Stakeholder Meeting Presentation "Basin Plan Amendment for the Development of Methylmercury Total Maximum Daily Load for the Lower American River and Lake Natoma" Central Valley Regional Water Quality Control Board. Presented in Rancho Cordova, CA. September 16.

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Louie, S., C. Foe, and D. Bosworth. 2008. Mercury and Suspended Sediment Concentrations and Loads in the Central Valley and Freshwater Delta. Final Report submitted to the CALFED Bay-Delta Program for the project "Transport, Cycling and Fate of Mercury and Monomethylmercury in the San Francisco Delta and Tributaries" Task 2. Central Valley Regional Water Quality Control Board., Available at: http://mercury.mlml.calstate.edu/reports/reports/

Louie, S., M. Wood, and C. Austin. 2012. Development of a Statewide Mercury Control Program for Reservoirs. Poster Presentation Abstract, 7th Biennial Bay-Delta Science Conference. Sacramento, California., Available at: http://scienceconf.deltacouncil.ca.gov/content/poster-abstracts

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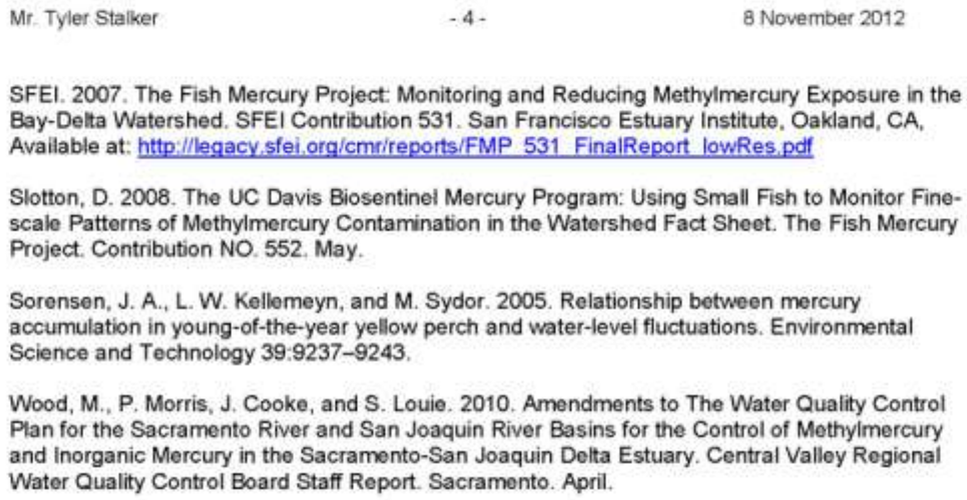
Selch, T., C. Hoagstrom, E. Weimer, J. Duehr, and S. Chipps. 2007. Influence of Fluctuating Water Levels on Mercury Concentrations in Adult Walleye. Bulletin of Environmental Contamination and Toxicology, 79: 36-40.



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Sorensen, J. A., L. W. Kellemeyn, and M. Sydor. 2005. Relationship between mercury accumulation in young-of-the-year yellow perch and water-level fluctuations. Environmental Science and Technology 39:9237–9243.

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Bill George – *President*
Division 3

John P. Fraser – *Director*
Division 2

Alan Day – *Director*
Division 5

El Dorado Irrigation District

George W. Osborne – *Vice President*
Division 1

George A. Wheeldon – *Director*
Division 4

Jim Abercrombie
General Manager

Thomas D. Cumpston
General Counsel

In Reply Refer To: ECL1112-1302

November 9, 2012

VIA CERTIFIED MAIL

Central Valley Flood Protection Board
Attn: Mr. David Martasian
3464 El Camino Avenue, Room 200
Sacramento, CA 95821

U.S. Army Corps of Engineers
Attn: Mr. Tyler Stalker
1325 J Street
Sacramento, CA 95814

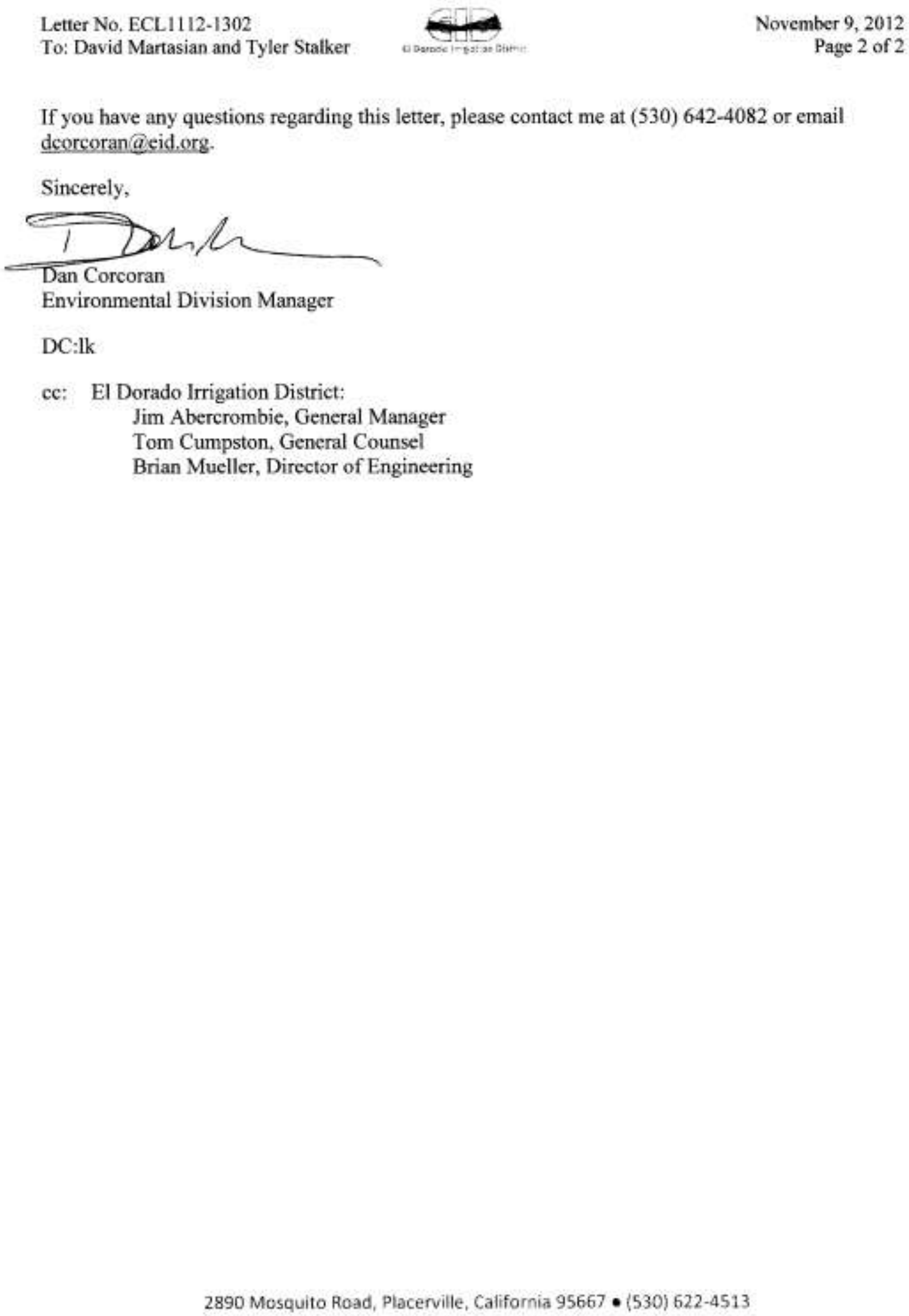
SUBJECT: Response to Notice of Preparation – Folsom Dam Water Control Manual Update

Dear Mr. Martasian and Mr. Stalker:

Thank you for this opportunity to respond to the Notice of Preparation (NOP) for the proposed Joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Folsom Dam Water Control Manual Update (Project). The El Dorado Irrigation District (EID) currently maintains both a 7,550 acre-foot (AF) Long-Term Central Valley Project (CVP) Water Service Contract and a 4,560 AF Long-Term Warren Act Contract (LTWA) for water supplies in Folsom Reservoir. Additionally, EID is nearing completion of an additional 17,000 AF LTWA Contract, which will be critical to future growth of the western portion of EID's service area. As such, EID maintains a significant interest in any potential negative and/or positive effects/impacts of the proposed Project related to current and future regional water supplies. In addition to this overall interest, EID offers the following specific comment for the Central Valley Flood Protection Board (CVFPB) and U.S. Army Corps of Engineers (USACE) to consider during preparation of the joint EIS/EIR.

The NOP indicates that the area of analysis will include the CVP and State Water Project (SWP) service areas. However, as indicated above, EID maintains one LTWA contract and is currently pursuing a second such contract to divert its local supplies at Folsom Reservoir. Such contracts are not bound by the service areas limitations specified in contracts for CVP (and potentially SWP) supplies. EID anticipates many other purveyors with supplies in Folsom Reservoir also have service areas that extend beyond the CVP and SWP service areas. Therefore, any potential impacts to these contracts could affect a contractor's entire service area potentially requiring adjustment to other local supplies and management considerations available to the purveyor. In the case of EID, most of the service area is located outside (east) of the CVP Consolidated Place of Use (CPOU) and any changes to Folsom supplies would require changes to other local available supplies in the eastern portion of EID's service area to accommodate revised demands in the portion of EID's service area within the CVP CPOU. As such, the area of analysis should address the full service areas of each purveyor and not limit to analyses to CVP and SWP service areas.

2890 Mosquito Road, Placerville, California 95667 • (530) 622-4513



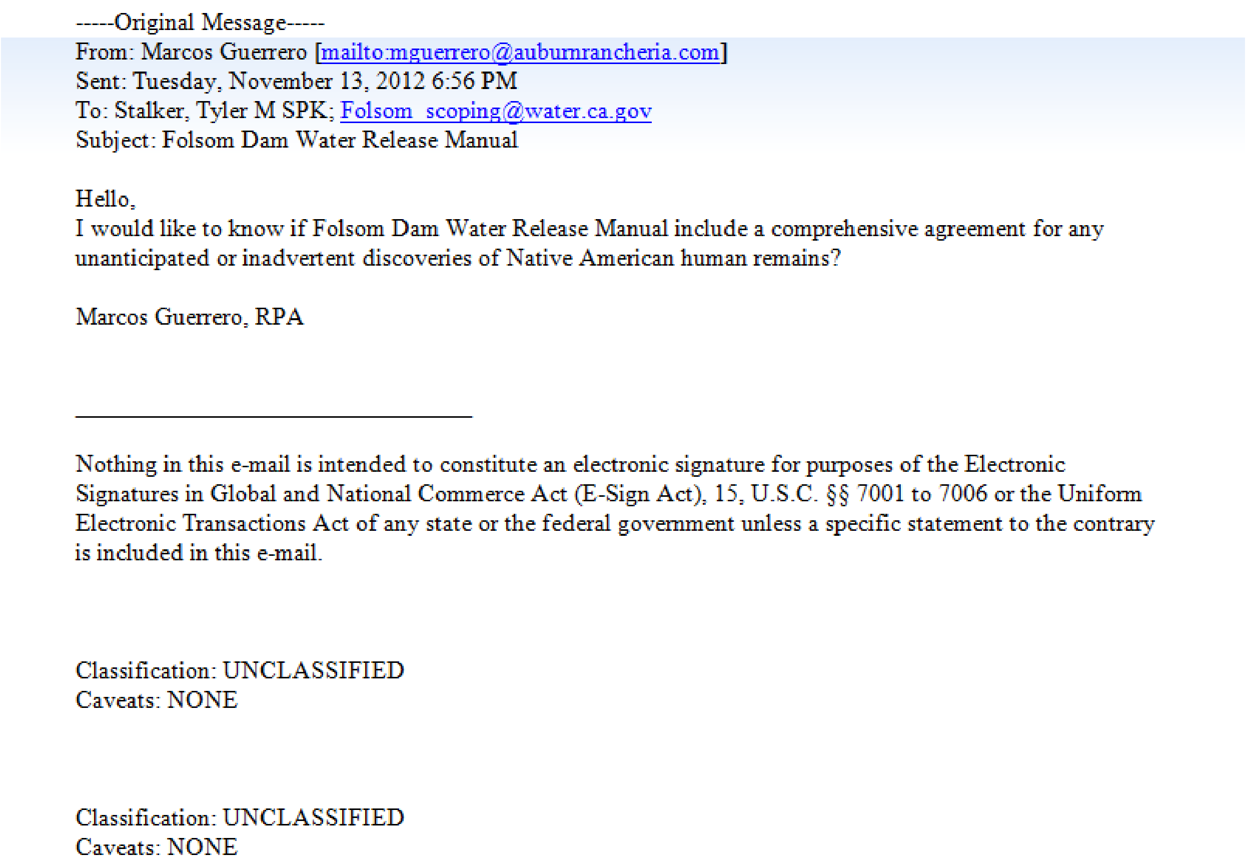
If you have any questions regarding this letter, please contact me at (530) 642-4082 or email dcorcoran@eid.org.

Sincerely,

Dan Corcoran
Environmental Division Manager

DC:lk

cc: El Dorado Irrigation District:
Jim Abercrombie, General Manager
Tom Cumpston, General Counsel
Brian Mueller, Director of Engineering



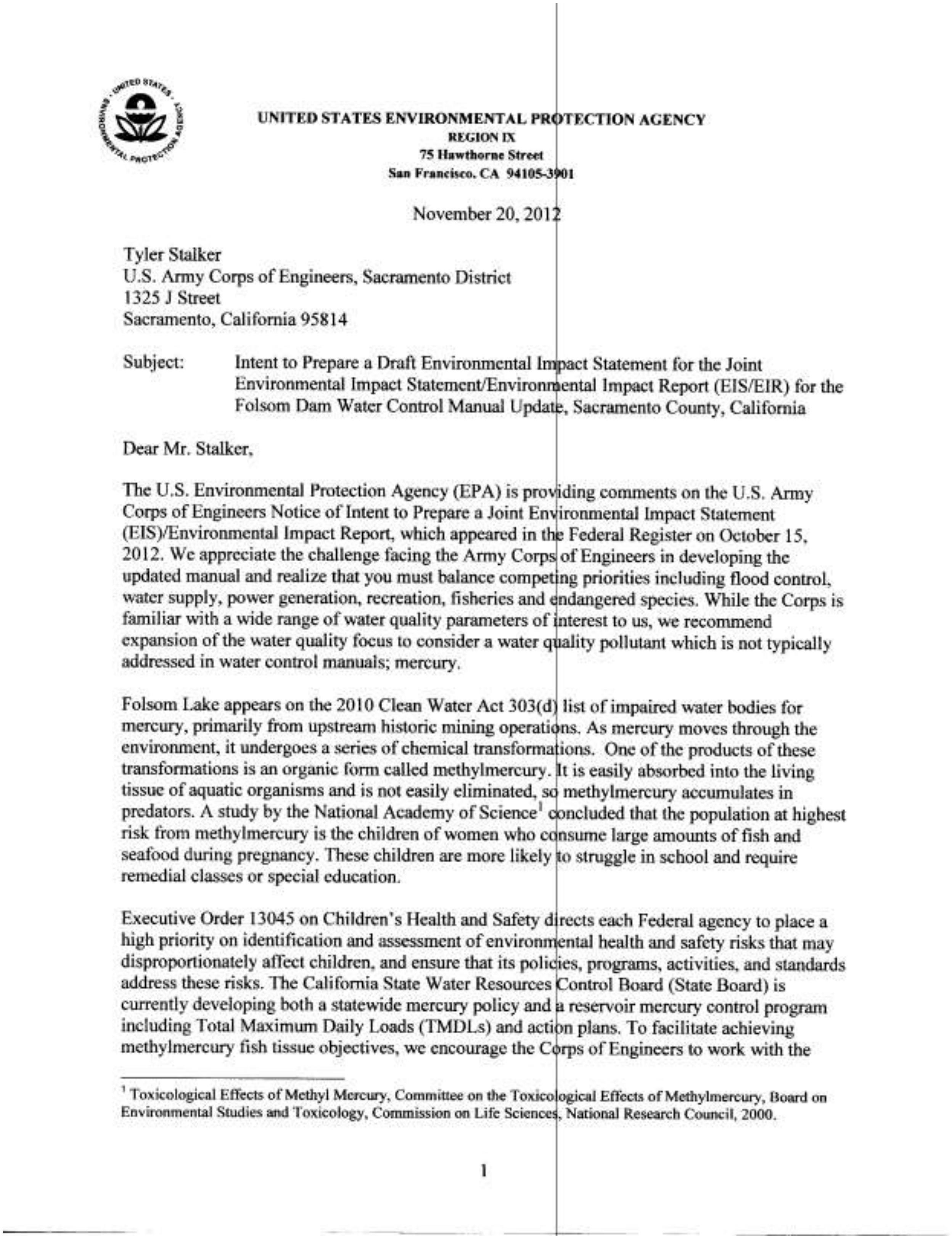
-----Original Message-----
From: Marcos Guerrero [mailto:mguerrero@auburnrancheria.com]
Sent: Tuesday, November 13, 2012 6:56 PM
To: Stalker, Tyler M SPK; Folsom_scoping@water.ca.gov
Subject: Folsom Dam Water Release Manual

Hello,
I would like to know if Folsom Dam Water Release Manual include a comprehensive agreement for any unanticipated or inadvertent discoveries of Native American human remains?

Marcos Guerrero, RPA

Classification: UNCLASSIFIED
Caveats: NONE

Classification: UNCLASSIFIED
Caveats: NONE



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

November 20, 2012

Tyler Stalker
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814

Subject: Intent to Prepare a Draft Environmental Impact Statement for the Joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Folsom Dam Water Control Manual Update, Sacramento County, California

Dear Mr. Stalker,

The U.S. Environmental Protection Agency (EPA) is providing comments on the U.S. Army Corps of Engineers Notice of Intent to Prepare a Joint Environmental Impact Statement (EIS)/Environmental Impact Report, which appeared in the Federal Register on October 15, 2012. We appreciate the challenge facing the Army Corps of Engineers in developing the updated manual and realize that you must balance competing priorities including flood control, water supply, power generation, recreation, fisheries and endangered species. While the Corps is familiar with a wide range of water quality parameters of interest to us, we recommend expansion of the water quality focus to consider a water quality pollutant which is not typically addressed in water control manuals; mercury.

Folsom Lake appears on the 2010 Clean Water Act 303(d) list of impaired water bodies for mercury, primarily from upstream historic mining operations. As mercury moves through the environment, it undergoes a series of chemical transformations. One of the products of these transformations is an organic form called methylmercury. It is easily absorbed into the living tissue of aquatic organisms and is not easily eliminated, so methylmercury accumulates in predators. A study by the National Academy of Science[1] concluded that the population at highest risk from methylmercury is the children of women who consume large amounts of fish and seafood during pregnancy. These children are more likely to struggle in school and require remedial classes or special education.

Executive Order 13045 on Children's Health and Safety directs each Federal agency to place a high priority on identification and assessment of environmental health and safety risks that may disproportionately affect children, and ensure that its policies, programs, activities, and standards address these risks. The California State Water Resources Control Board (State Board) is currently developing both a statewide mercury policy and a reservoir mercury control program including Total Maximum Daily Loads (TMDLs) and action plans. To facilitate achieving methylmercury fish tissue objectives, we encourage the Corps of Engineers to work with the

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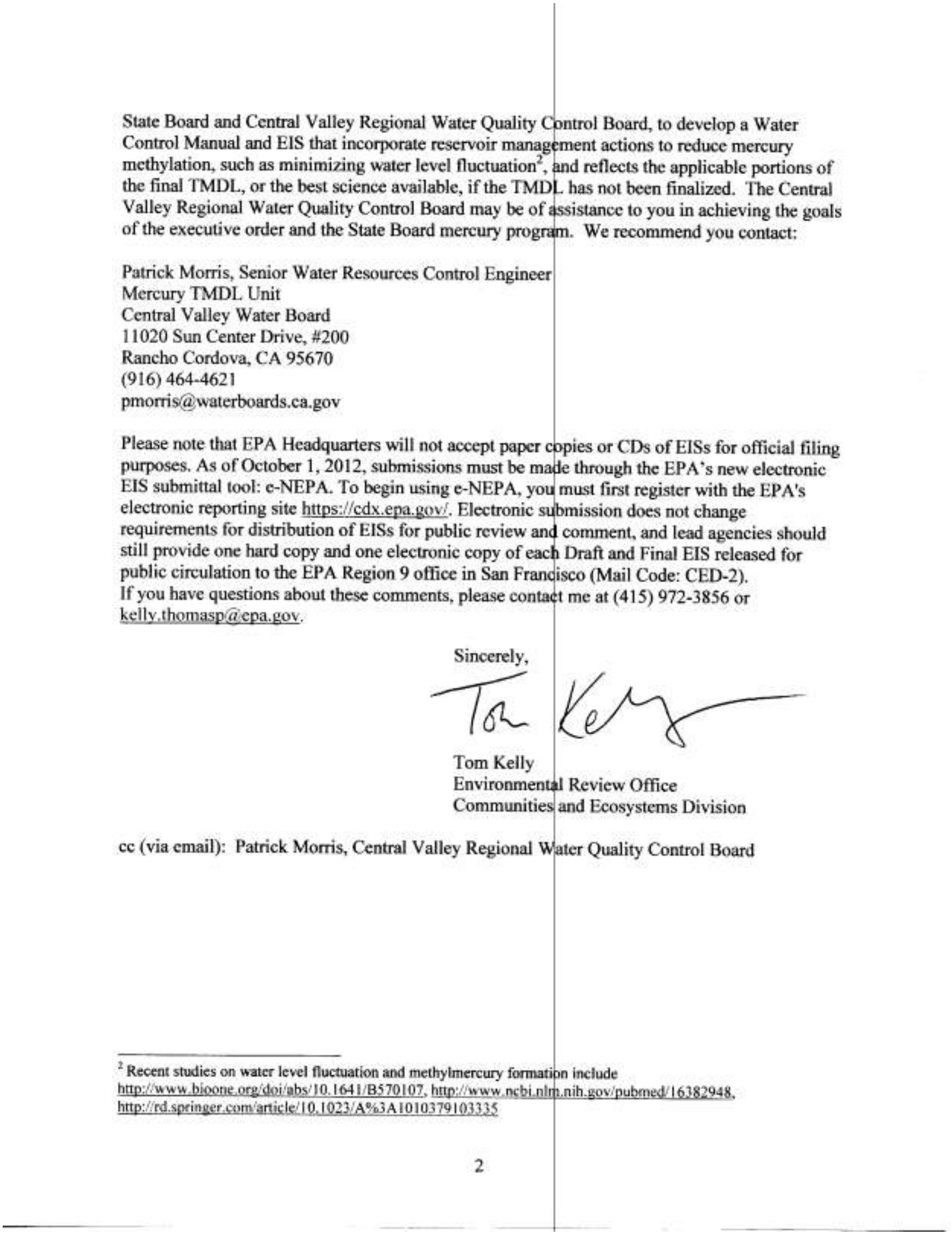
[1] Toxicological Effects of Methyl Mercury, Committee on the Toxicological Effects of Methylmercury, Board on Environmental Studies and Toxicology, Commission on Life Sciences, National Research Council, 2000.



State Board and Central Valley Regional Water Quality Control Board, to develop a Water Control Manual and EIS that incorporate reservoir management actions to reduce mercury methylation, such as minimizing water level fluctuation[2], and reflects the applicable portions of the final TMDL, or the best science available, if the TMDL has not been finalized. The Central Valley Regional Water Quality Control Board may be of assistance to you in achieving the goals of the executive order and the State Board mercury program. We recommend you contact:

Patrick Morris, Senior Water Resources Control Engineer
Mercury TMDL Unit
Central Valley Water Board
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670
(916) 464-4621
pmorris@waterboards.ca.gov

Please note that EPA Headquarters will not accept paper copies or CDs of EISs for official filing purposes. As of October 1, 2012, submissions must be made through the EPA's new electronic EIS submittal tool: e-NEPA. To begin using e-NEPA, you must first register with the EPA's electronic reporting site https://cdx.epa.gov/. Electronic submission does not change requirements for distribution of EISs for public review and comment, and lead agencies should still provide one hard copy and one electronic copy of each Draft and Final EIS released for public circulation to the EPA Region 9 office in San Francisco (Mail Code: CED-2).
If you have questions about these comments, please contact me at (415) 972-3856 or kelly.thomasp@epa.gov.

Sincerely,

Tom Kelly

Tom Kelly
Environmental Review Office
Communities and Ecosystems Division

cc (via email): Patrick Morris, Central Valley Regional Water Quality Control Board

---

[2] Recent studies on water level fluctuation and methylmercury formation include http://www.bioone.org/doi/abs/10.1641/B570107, http://www.ncbi.nlm.nih.gov/pubmed/16382948, http://rd.springer.com/article/10.1023/A%3A1010379103335

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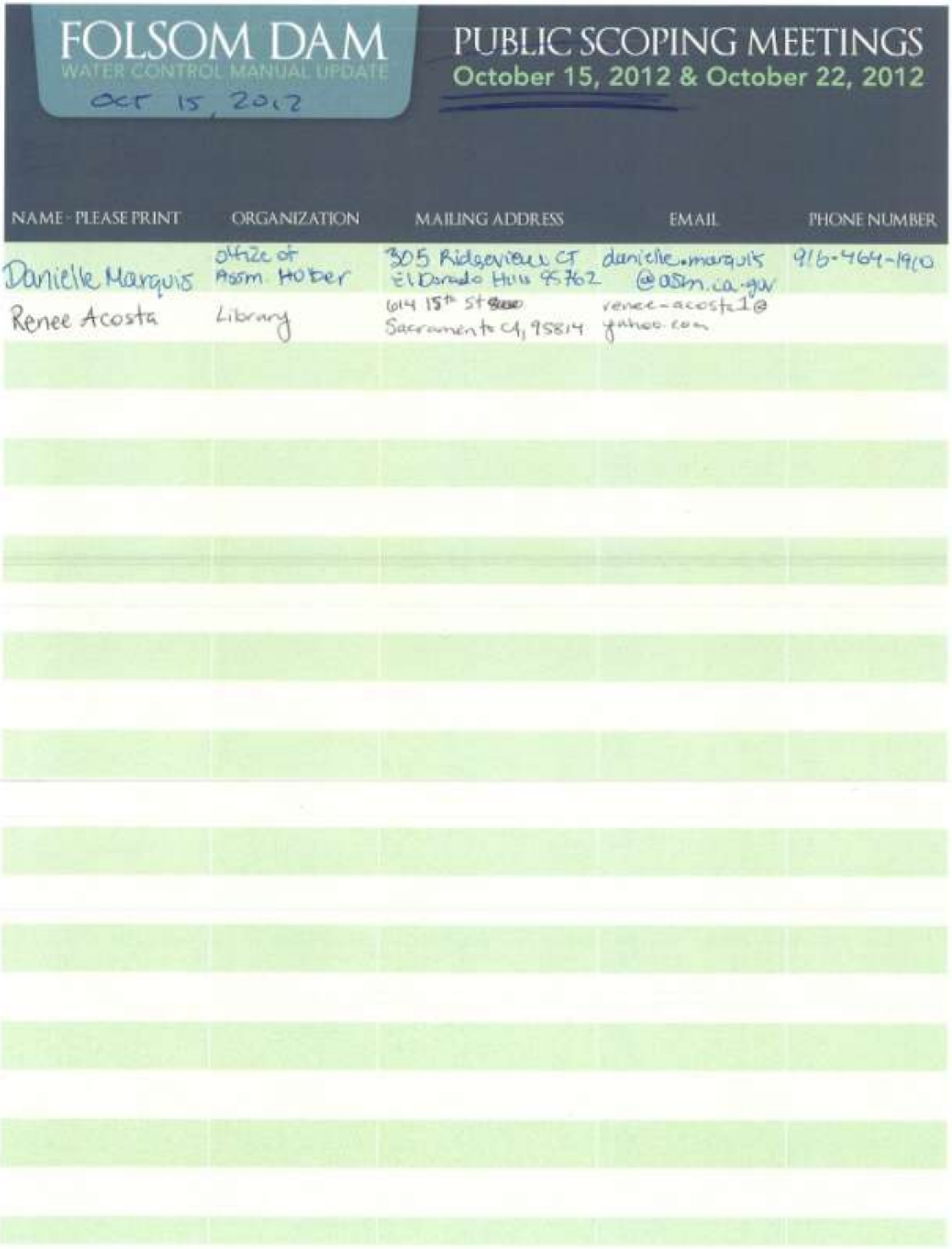
Appendix D Scoping Meetings Sign-In Sheets

Following are scanned copies of the sign-in sheets from the public scoping meetings for the Folsom Dam WCM Update held on October 15 and October 22, 2012.

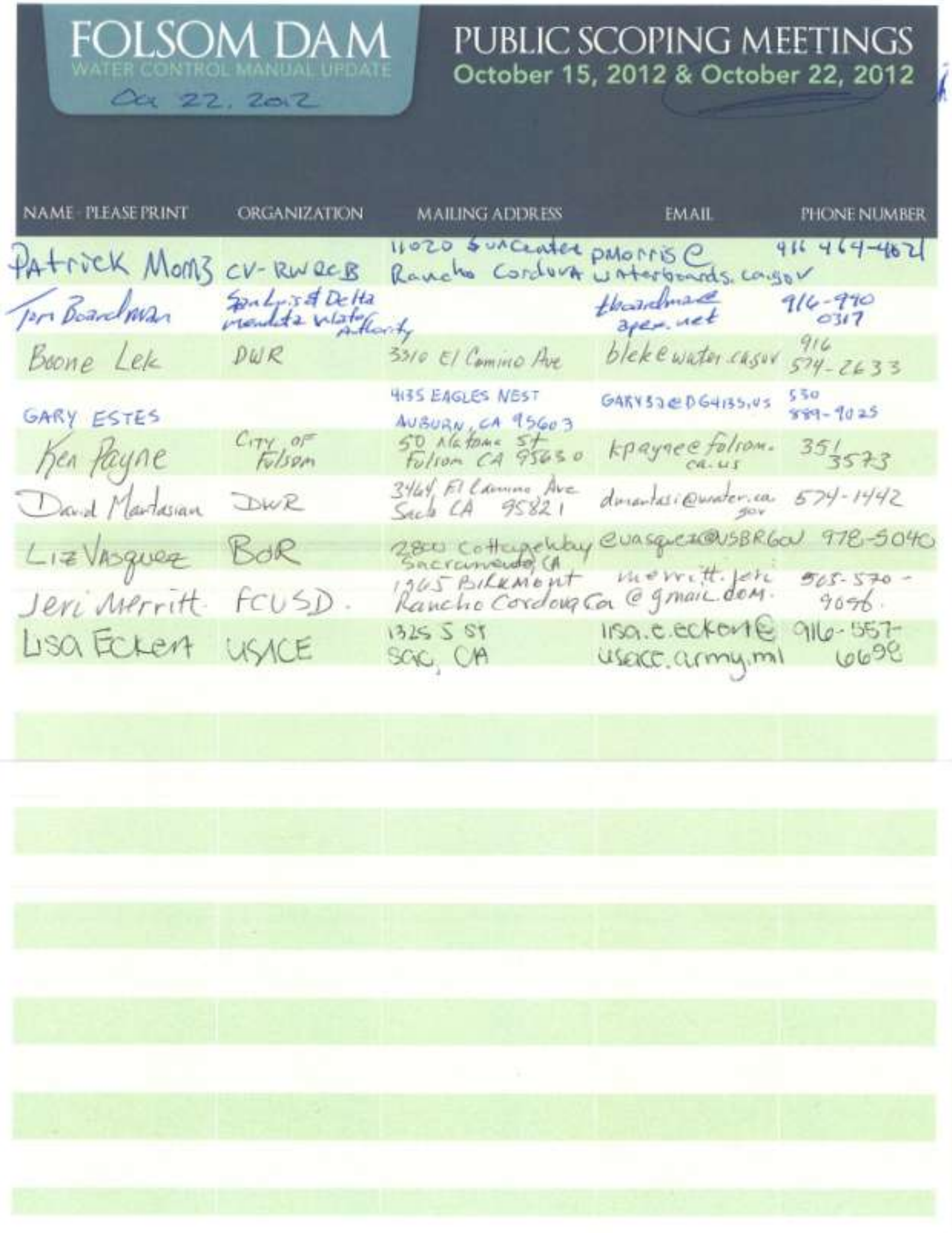


FOLSOM DAM
WATER CONTROL MANUAL UPDATE

Oct 15, 2012

PUBLIC SCOPING MEETINGS
October 15, 2012 & October 22, 2012

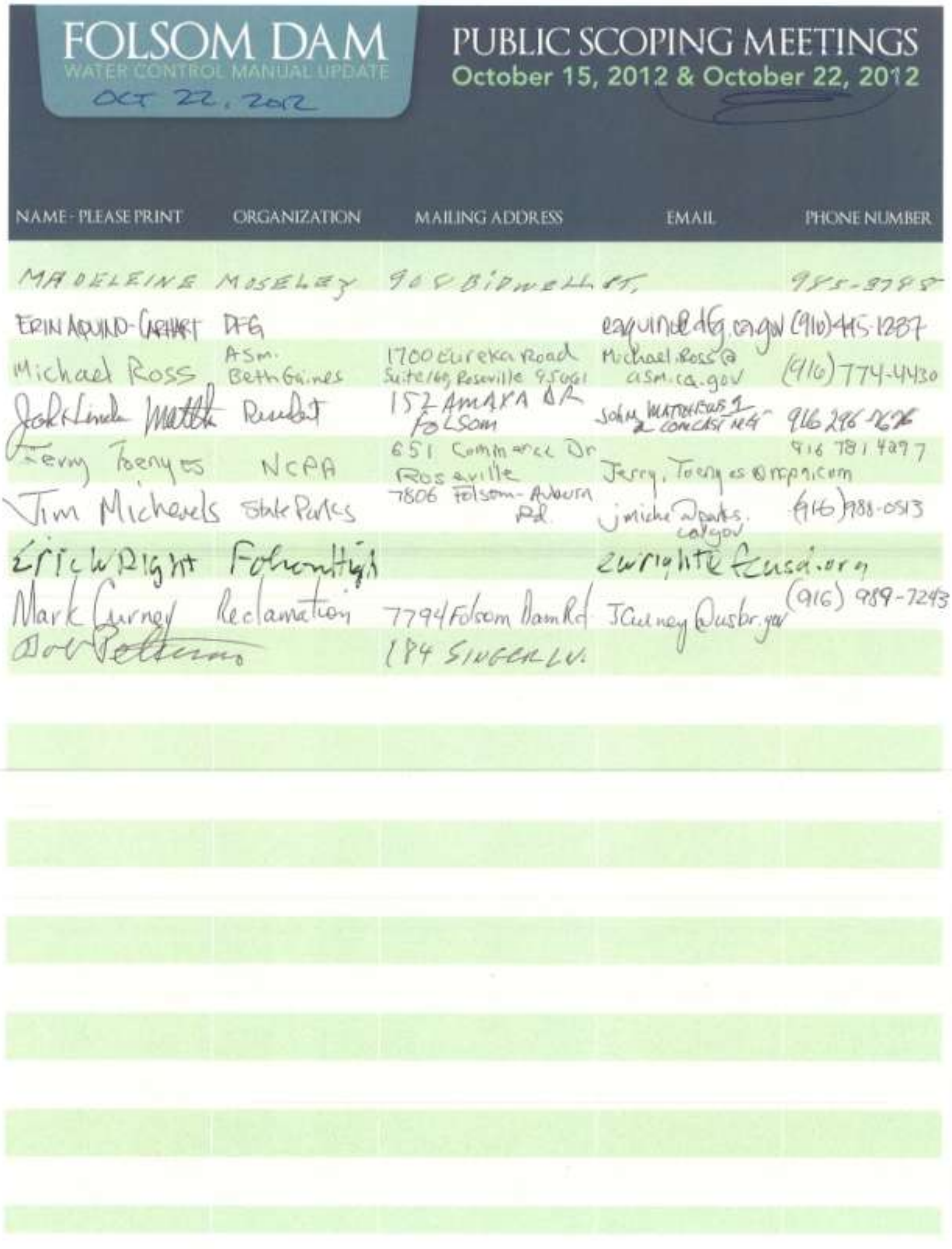
NAME - PLEASE PRINT	ORGANIZATION	MAILING ADDRESS	EMAIL	PHONE NUMBER
Danielle Marquis	Office of Assm. Huber	305 Ridgeview Ct El Dorado Hills 95762	danielle.marquis@asm.ca.gov	916-464-1910
Renee Acosta	Library	614 15th St Sacramento CA, 95814	renee-acosta1@yahoo.com	



FOLSOM DAM
WATER CONTROL MANUAL UPDATE
Oct 22, 2012

PUBLIC SCOPING MEETINGS
October 15, 2012 & October 22, 2012

NAME - PLEASE PRINT	ORGANIZATION	MAILING ADDRESS	EMAIL	PHONE NUMBER
Patrick Morris	CV-RWQCB	11020 Suncenter Rancho Cordova	pmorris@ waterboards.ca.gov	916 464-4621
Tom Boardman	San Luis & Delta Mendota Water Authority		tboardman@ aper.net	916-990 0317
Boone Lek	DWR	3310 El Camino Ave	blek@water.ca.gov	916 574-2633
GARY ESTES		4135 EAGLES NEST AUBURN, CA 95603	GARY32@DG4135.US	530 889-9025
Ken Payne	City of Folsom	50 Natoma St Folsom CA 95630	kpayne@folsom. ca.us	351 3573
David Martasian	DWR	3464 El Camino Ave Sacto CA 95821	dmartasi@water.ca. gov	574-1442
Liz Vasquez	BoR	2800 Cottage Way Sacramento, CA	evasquez@USBR.GOV	978-5040
Jeri Merritt	FCUSD.	1365 Birkmont Rancho Cordova Ca	merritt.jeri @gmail.com.	505-570-9096.
Lisa Eckert	USACE	1325 J St Sac, CA	lisa.c.eckert@ usace.army.mil	916-557-6698



FOLSOM DAM
WATER CONTROL MANUAL UPDATE
OCT 22, 2012

PUBLIC SCOPING MEETINGS
October 15, 2012 & October 22, 2012

NAME - PLEASE PRINT	ORGANIZATION	MAILING ADDRESS	EMAIL	PHONE NUMBER
MADELEINE MOSELEY		908 BIDWELL ST.		985-3788
ERIN AQUINO-CARHART	DFG		eaquino@dfg.ca.gov	(916)445-1287
Michael Ross	ASM. Beth Gaines	1700 Eureka Road Suite 169, Roseville 95661	Michael.Ross@asm.ca.gov	(916) 774-4430
John & Linda Matthews	Resident	152 AMAXA DR FOLSOM	John MATTHEWS 1 @ COMCAST NET	916 296 7676
Terry Toenyes	NCPA	651 Commerce Dr Roseville	Jerry.Toenyes@ncpa.com	916 781 4297
Jim Micheaels	State Parks	7806 Folsom-Auburn Rd	jmiche@parks.ca.gov	(916)988-0513
Eric Wright	Folsom High		ewright@fcusd.org	
Mark Gurney	Reclamation	7794 Folsom Dam Rd	JGurney@usbr.gov	(916) 989-7243
Bob Patterson		184 SINGER LN.		

Appendix H: Future Level of Demand for Water

1.0 FUTURE LEVEL OF DEMAND FOR WATER

This future condition captures the changes in flood operations and the structural modifications to Folsom Dam would not create any additional storage space for water supply. However, any increases in future level of demand from water users in the region may have an effect on the volume of water that would be stored throughout the CVP/SWP reservoirs, including Folsom Lake. This change in storage would have an effect on how the other project purposes of each CVP/SWP reservoir are met, including the other project purposes at Folsom Dam (e.g. flood control, water storage and supply, recreation, etc.).

Alternative 2 model results were compared to the No Action/No Project condition, with an estimated future level of water demand within the regional affects assessment area through year 2033 applied to both CalSim model constructs. 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.

1.1 Comparison of Alternative 2 - Forecast-informed Operations Future Condition to No Action/No Project Future Condition – Year 2033 Level of Water Demand

1.1.1 Hydrology and Hydraulics

This section discusses period of record hydrology comparisons between Alternative 2 – Forecast-informed Operations and No Action/No Project while using a future level of water demand condition forecasted to 2033 in the CalSim II model. A detailed explanation of how future levels of demand are represented in the CalSim II model is provided in Appendix A. In addition, significance criteria for hydrology effects would be the same as discussed in section 4.2.2.

When comparing the Alternative 2 future condition modeled daily discharge frequencies to the No Action/No Project future condition, there was a substantial decrease in the discharge frequency of the 30,000 cfs to 40,000 cfs range but a substantial increase in the 40,000 cfs to 50,000 cfs range and the 70,000 cfs to 80,000 cfs range, as shown in Table 5-24. The modeling indicates almost no difference in discharge frequency in the 80,000 cfs to 115,000 cfs range. Overall, Alternative 2 – Forecast-informed operation discharges and effects on channel stability would be considered similar to those under No Action/No Project when considering future levels of water demand.

Table 1-1. Modeled Average Daily Discharge Frequencies for No Action/No Project and Alternative 2 - Forecast-informed Operations assuming future levels of water demand.

Discharge (cfs)	No Action/No Project Future Condition Discharge Frequencies (# of days)	Alternative 2 – Forecast-informed Operation Future Condition Discharge Frequencies (# of days)
< 10,000	28339	28363

10,000 to < 20,000	891	931
20,000 to < 30,000	146	148
30,000 to < 40,000	158	36
40,000 to < 50,000	18	34
50,000 to < 60,000	8	15
60,000 to < 70,000	9	3
70,000 to < 80,000	3	12
80,000 to < 90,000	2	3
90,000 to < 100,000	1	1
100,000 to 115,000	4	4

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 5-15), and the greatest benefits are gained for the rarest of events.

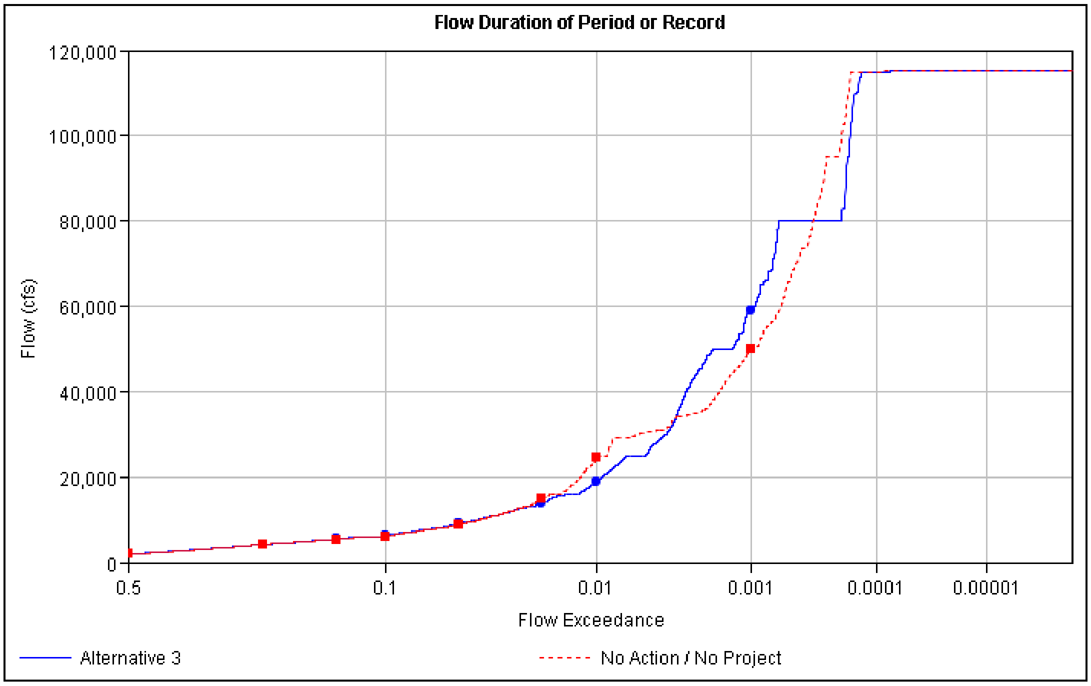


Figure 1-1: Probability of Flow Exceedance for Alternative 2 Future Condition and No Action/No Project Future Condition

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 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). These data are illustrated in Figure 5-16 below.

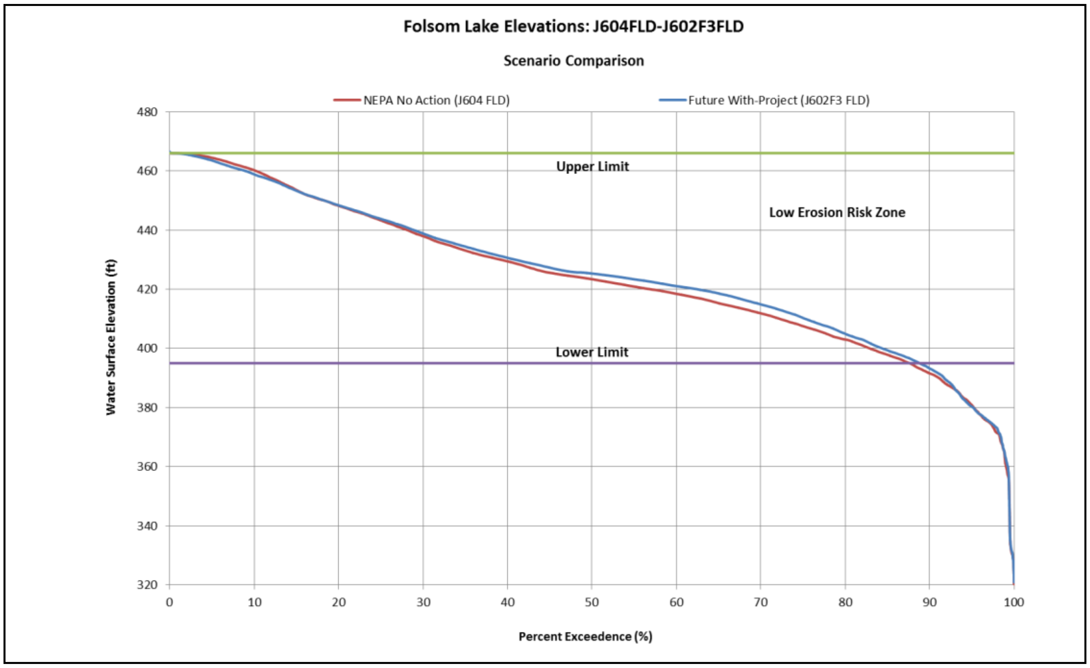


Figure 1-2. Folsom Lake Pool Level Comparison of No Action/No Project Future Condition to Alternative 2 Forecast-informed Operations Future Condition

1.1.2 Water Quality

This section discusses water quality comparisons between Alternative 2 – Forecast-informed Operations and No Action/No Project while using a future level of water demand condition in the CalSim II models. Significance criteria for water quality effects would be the same as discussed in section 4.4.2.

Water quality modeling indicates that, in general, there is little difference between Alternative 2 operations and the No Action/No Project under future conditions.

As shown in Table 5-25, the magnitude of differences in Delta outflow is within a range of ±1.0 percent for the full simulation period average monthly outflow. Although Alternative 2 - Forecast-informed Operations future condition results show a maximum of a 1.6-percent decrease in average monthly values for March of dry water years, long-term average March through May outflow show an increase of 0.7 percent over the full simulation period with a maximum of 0.6-percent reduction observed in dry water years.

Table 1-2. Delta Outflow, E/I Ratio for Alternative 2 - Forecast-informed Operations future condition vs. No Action/No Project future condition.

Delta Outflow	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Long-term and water year type average Delta Outflow – Generally similar long-term average Delta outflows and generally similar average Delta outflow most of the time during all water year types (±1.6 percent).	Monthly Maximum Reduction	√	–1.2 percent	–1.2 percent	–1.3 percent	–1.6 percent	–1.2 percent
	Delta Outflow March–May	√	√	√	√	√	√
	Delta Outflow Objectives	NA	√	√	√	√	√
E/I Ratio	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Long-term and water year type average E/I Ratio – Generally similar long-term average and generally similar most of the time during all water year types. The maximum change is seen is (±3.1 percent) in Critical year types.	E/I Ratio	–1.2 percent to +0.6 percent	–1.9 percent to +1.8 percent	–1.5 percent to +0.8 percent	–1.2 percent to +1.6 percent	–0.2 percent to +0.6 percent	–1.2 percent to +3.1 percent

Long-term average monthly E/I ratios show a maximum absolute difference in the range of –0.2 to +0.1 percent. The relative difference ranges from –1.2 percent in average monthly values for April to 0.6 percent in average monthly values for February.

The X2 location in general also shows minimal difference for the two scenarios (Table 5-26). Long-term average changes –0.1 km for May through July, and 0.1 km 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 and a few positive shifts of 0.1 km. The maximum year-to-year change for each month in the 82-year POR ranged from 0.3 km in August to 1.2 km in December. Minimum monthly change observed was –2.8 km in June to –0.1 km in September. The average X2 moves east of the control point relative to the No

Action/No Project future condition two times: at the 64 km control point in one year in April of dry water years, and in one year at the 74 km control point in April of critical water years (Table 5-26).

Table 1-3. X2 Location for Alternative 2 - Forecast-informed Operations future condition vs. No Action/No Project future condition.

X2 Location	Evaluation Parameters	Long-term	Wet	Above Normal	Below Normal	Dry	Critical
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.	X2 Location (km)	±0.1	±0.2	±0.3	±0.3	±0.1	±0.1
	X2 Location Count 81 km	NC	√	√	√	√	√
	X2 Location Count 74 km	NA	√	√	√	√	1
	X2 Location Count 64 km	NA	√	√	√	1	√

Both scenarios have average X2 locations greater than those required by September standards while meeting October X2 standards. Both scenarios meet the Delta outflow objectives for July through January. Results indicate that the scenarios are “consistent” with respect to the fall X2 standards (Table 5-27). The X2 for Alternative 2 - Forecast-informed Operations Future Condition scenario has three instances with a greater than or equal to 1 km shift: once in March and twice in 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 would be 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. In addition, typical CVP/SWP operations would be managed to prevent those minor shifts in X2 location.

Table 1-4. Long-term and water year type average X2 Location Analysis for Alternative 2 - Forecast-informed Operations Future Condition vs. No Action/No Project Future Condition.

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) and June (-2.8 km).	Change in X2 Location Monthly Maximum Value km	1.1 east
	Change in X2 Location Monthly Minimum Value km	0.4 east
	X2 Location Relative Change km (Maximum)	1.2
	X2 Location Relative Change km (Minimum)	–2.8
	X2 Exceeding Fall Standards (Count)	√
	X2 Location Shift	**Count**
	> or = 1 km	3
	0.5–1.0 km	16
	0.25–0.5 km	22

The CCWD Rock Slough intake occurrences of salinity levels at greater than 150 mg/L levels show an increase in average salinity in one year in September of critical water years and a decrease in average salinity in one year in October of below-normal water years (Table 5-28). The maximum difference in salinity was an increase of 16.69 mg/L (from 211.69 mg/L to 228.37 mg/L) occurring in water year 1991, a critical water year. 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 salinity, the effect would be considered less than significant because of the similar results for all other water year types. In addition, it is expected that CVP/SWP operations would be managed to avoid those increases in salinity.

Table 1-5. Water year type Salinity at Rock Slough Intake for Alternative 2 - Forecast-informed Operations future condition vs. No Action/No Project future condition.

Salinity Rock Slough	Evaluation Parameters	Long-term	Wet	Above Normal	Below Normal	Dry	Critical
Water year type Salinity at Rock Slough Intake – Generally similar long-term average and generally similar most of the time during all water year types.	Salinity Rock Slough (Change in Count >150 mg/L)	NA	√	√	o	√	1
	Salinity Rock Slough Max Change (>150 mg/L: 16.69 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.

1.1.3 Vegetation and Wildlife

This section discusses comparisons between vegetation and wildlife conditions, including special status plants and animals, for Alternative 2 – Forecast-informed Operations and No Action/No Project while using a future level of water demand condition in the CalSim II models. Significance criteria for vegetation and wildlife effects, including special status plants and animals, would be the same as discussed in section 4.5.2. A detailed analysis of potential differences in cottonwood growth and backwater recharge along the lower American River is provided in Appendix C.

Lower American River

The lower American River terrestrial assessment focuses on cottonwood growth and backwater recharge. This section includes a summary of the results.

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, relative to No Action/No Project future condition. Relative to No Action/No Project future condition, this change could provide additional flows for cottonwood radial growth and provide a potential benefit during the cottonwood growing season. However, when looking at change under the 3,000-cfs threshold comparison, cottonwood maintenance and optimal growth would stay relatively consistent during the cottonwood growing season between Alternative 2 - Forecast-informed Operations future condition and No Action/No Project future condition. Therefore, effects on vegetation growth in the riparian corridor of the lower American River with Alternative 2 - Forecast-informed Operations future condition would be less than significant. 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. Given the minimal difference between No Action/No Project future condition and Alternative 2 - Forecast-informed Operations future condition, average daily flows are projected to remain essentially the same. As a result, there would be essentially no change to the magnitude and frequency of flows to 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). Folsom Reservoir has water levels that routinely fluctuate. 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.

Special Status Plant and Animal Species

Because effects on backwater habitats with Alternative 2 - Forecast-informed Operations future condition would be less than significant, effects on elderberry shrubs and special-status species that depend on these habitats would also be 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.

1.1.4 Fisheries

This section discusses comparisons between conditions for fisheries under Alternative 2 – Forecast-informed Operations and No Action/No Project while using a future level of water demand condition in the CalSim II models. Significance criteria for fisheries effects would be the same as discussed in section 4.6.2.

Lower American River

For salmonid and other fish species, daily flow and water temperature model results on a monthly basis 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.

A discussion of general changes in simulated water temperatures in the lower American River under Alternative 2 - Forecast-informed Operations future condition relative to No Action/No Project future condition is provided in the Water Quality section, and is summarized below. Monthly water temperature exceedance distributions below Nimbus Dam demonstrate that water temperatures are generally similar during October through March, and are cooler during May through September, including substantially more often during May, June, and August. Changes in water temperature at Watt Avenue and at the mouth of the lower American River exhibit similar trends under the Alternative 2 future condition relative to No Action future condition as described for below Nimbus Dam, including similar water temperatures during October through February, and cooler temperatures more often during March through September.

A summary of general changes in flows in the lower American River below Nimbus Dam under Alternative 2 - Forecast-informed Operations future condition relative to No Action/No Project future condition 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 November, December, March through July, and September, lower more often during October and February, and generally similar or higher and lower with similar frequencies during January and August, as described in more detail for below Nimbus Dam.

Long-term average monthly flows below Nimbus Dam under the Alternative 2 future condition relative to the No Action future condition are generally lower during October through February and during August, and higher during March through July and September (Table 5-29). As shown in Figures 5-17 to 5-28, average monthly flows exhibit similar trends by water year type during wet and above-normal water years. Average monthly flows during below-normal water years are lower during February and August through October, and are higher during December, March, April, June, and July. Average monthly flows during dry water year types are lower during October, November, February, and March, and are higher during January, April through June, and August. During critical water years, average monthly flows are higher during most months, including November through February, April, May, August, and September, and are similar during the remaining months. 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.

Table 1-6. Average Monthly Flows below Nimbus Dam under Alternative 2 - Forecast-informed Operations Future Condition and No Action/No Project Future Condition.

Analysis Period	Flow (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep

Long-term												
Full Simulation Period[2]												
No Action/No Project future condition	2,029	3,017	3,423	4,735	5,200	3,901	3,036	3,379	3,273	3,133	2,215	2,336
Alternative 2 - Forecast-informed Operations future condition	1,928	2,883	3,339	4,482	4,818	4,147	3,422	3,526	3,555	3,296	2,170	2,435
Difference	-101	-134	-84	-253	-382	246	386	147	282	163	-45	99
Percent Difference[3]	-5.0	-4.4	-2.5	-5.3	-7.3	6.3	12.7	4.4	8.6	5.2	-2.0	4.2
Water Year Types[1]												
Wet												
No Action/No Project future condition	2,265	3,821	5,892	8,855	9,094	6,124	4,894	5,826	5,620	3,267	2,918	3,565
Alternative 2 - Forecast-informed Operations future condition	2,108	3,566	5,641	8,310	8,221	7,069	5,578	5,964	6,019	3,352	2,926	3,800
Difference	-157	-255	-251	-545	-873	945	684	138	399	85	8	235
Percent Difference[3]	-6.9	-6.7	-4.3	-6.2	-9.6	15.4	14.0	2.4	7.1	2.6	0.3	6.6
Above Normal												
No Action/No Project future condition	1,927	3,847	3,347	6,150	6,836	5,680	3,154	2,982	2,520	3,702	2,355	3,136
Alternative 2 - Forecast-informed Operations future condition	1,865	3,578	3,190	5,428	6,849	5,914	3,463	3,214	2,970	3,989	2,175	3,280
Difference	-62	-269	-157	-722	13	234	309	232	450	287	-180	144
Percent Difference[3]	-3.2	-7.0	-4.7	-11.7	0.2	4.1	9.8	7.8	17.9	7.8	-7.6	4.6
Below Normal												
No Action/No Project future condition	2,031	2,401	2,290	2,337	3,873	2,574	2,807	3,009	2,447	3,890	2,144	1,609
Alternative 2 - Forecast-informed Operations future condition	1,878	2,392	2,358	2,331	3,589	2,625	3,018	2,996	2,550	4,447	1,914	1,572
Difference	-153	-9	68	-6	-284	51	211	-13	103	557	-230	-37
Percent Difference[3]	-7.5	-0.4	3.0	-0.3	-7.3	2.0	7.5	-0.4	4.2	14.3	-10.7	-2.3
Dry												
No Action/No Project future condition	1,948	2,464	1,807	1,680	1,832	2,280	1,530	1,430	1,853	3,020	1,773	1,440
Alternative 2 - Forecast-informed Operations future condition	1,892	2,397	1,823	1,748	1,663	1,752	1,776	1,722	2,178	3,009	1,811	1,436
Difference	-56	-67	16	68	-169	-528	246	292	325	-11	38	-4
Percent Difference[3]	-2.9	-2.7	0.9	4.0	-9.2	-23.2	16.1	20.4	17.5	-0.4	2.1	-0.3
Critical												
No Action/No Project future condition	1,661	1,941	1,374	1,168	1,109	1,060	996	1,216	1,426	1,484	1,133	921
Alternative 2 - Forecast-informed Operations future condition	1,661	1,969	1,418	1,229	1,127	1,064	1,156	1,285	1,432	1,493	1,184	986
Difference	0	28	44	61	18	4	160	69	6	9	51	65
Percent Difference[3]	0	1.4	3.2	5.2	1.6	0.4	16.1	5.7	0.4	0.6	4.5	7.1

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

[2] Based on the entire simulation period

[3] Relative difference of the monthly average

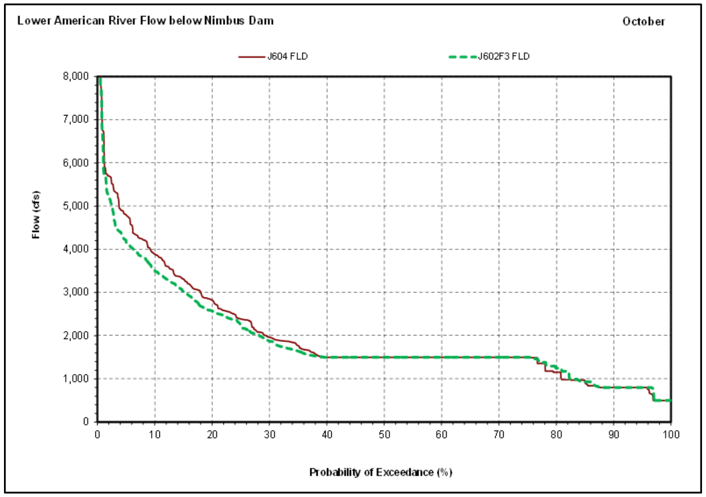


Figure 1-3. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for October.

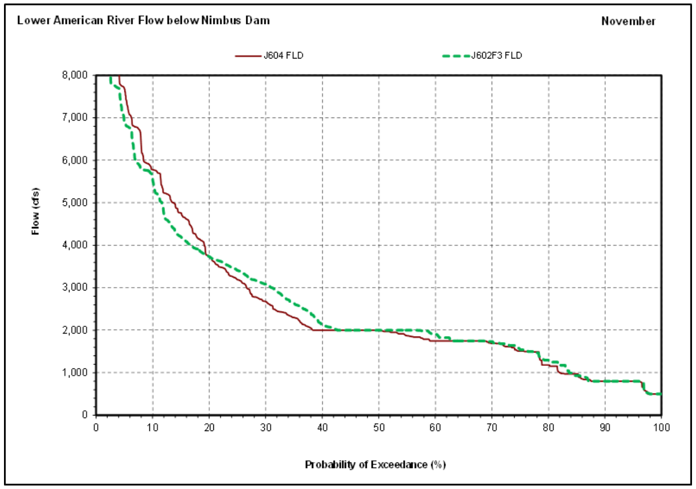


Figure 1-4. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for November under Alternative 2 - Forecast-informed Operations Future Condition and No Action/ No Project Future Condition.

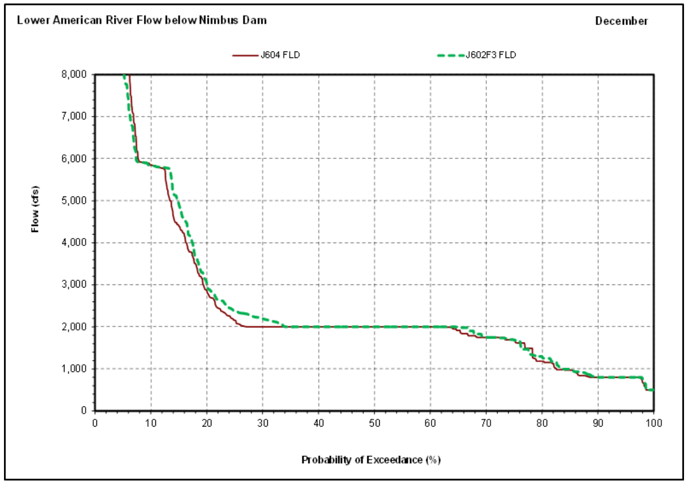


Figure 1-5. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for December under Alternative 2 - Forecast-informed Operations future condition and No Action/ No Project future condition.

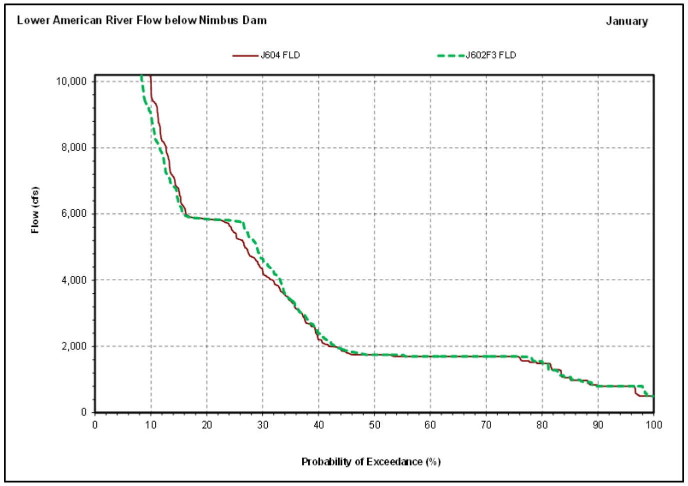


Figure 1-6. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for January under Alternative 2 - Forecast informed Operations Future Condition and No Action/ No Project Future Condition.

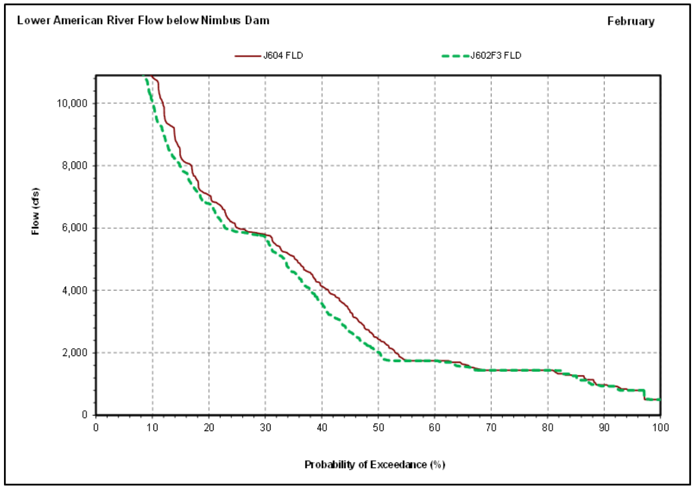


Figure 1-7. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for February under Alternative 2 - Forecast-informed Operations Future Condition and No Action/ No Project Future Condition.

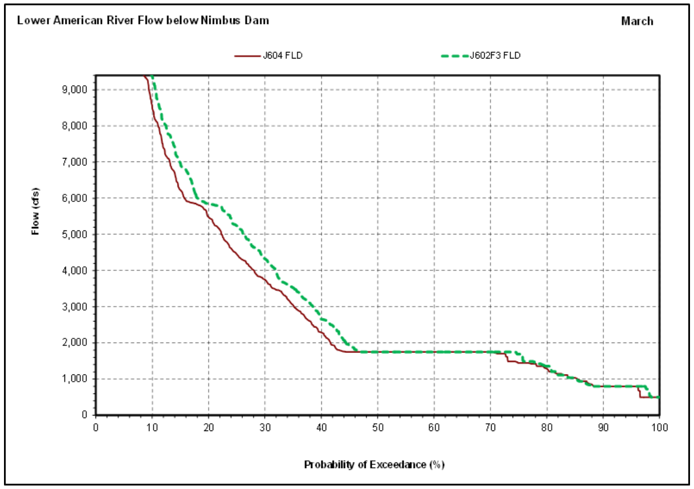


Figure 1-8. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for March under Alternative 2 - Forecast informed Operations Future Condition and No Action/No Project Future Condition.

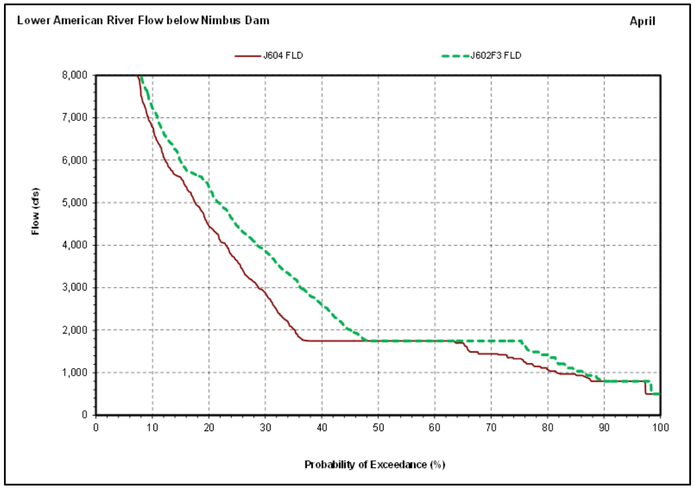


Figure 1-9. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for June under Alternative 2 - Forecast-informed Operations Future Condition and No Action/No Project Future Condition.

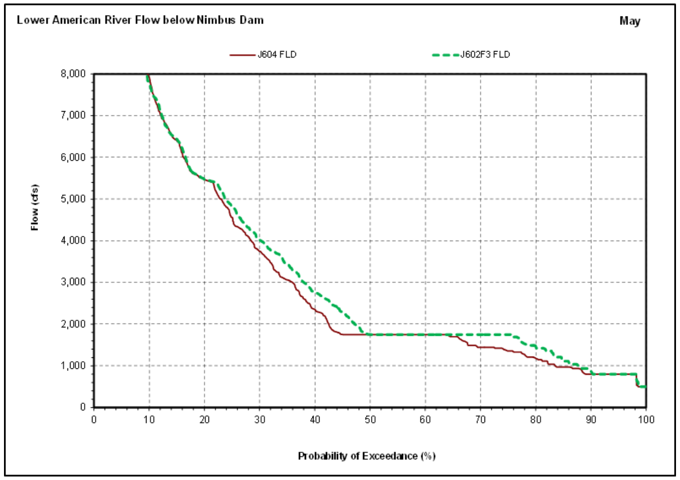


Figure 1-10. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for May under Alternative 2 - Forecast-informed Operations Future Condition and No Action/No Project Future Condition.

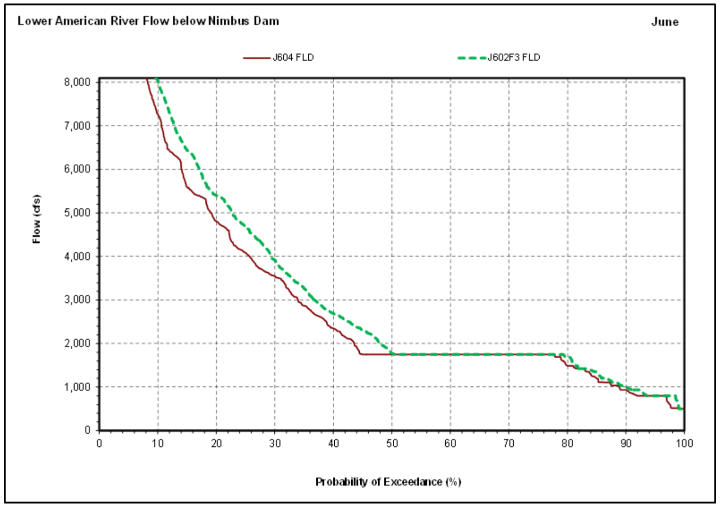


Figure 1-11. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for June under Alternative 2 - Forecast-informed Operations Future Condition and No Action/No Project Future Condition.

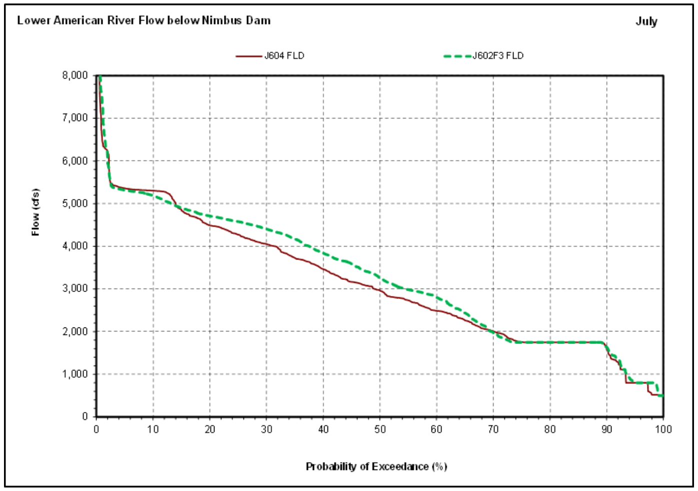


Figure 1-12. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for July under Alternative 2 - Forecast-informed Operations Future Condition and No Action/No Project Future Condition.

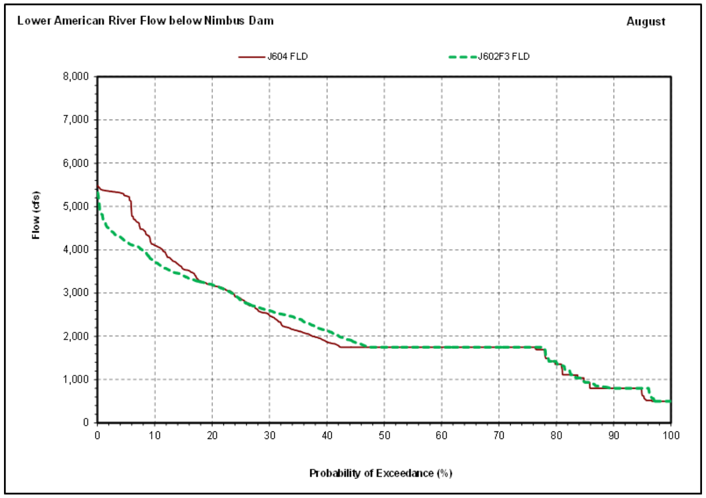


Figure 1-13. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for August under Alternative 2 - Forecast-informed Operations Future Condition and No Action/No Project Future Condition.

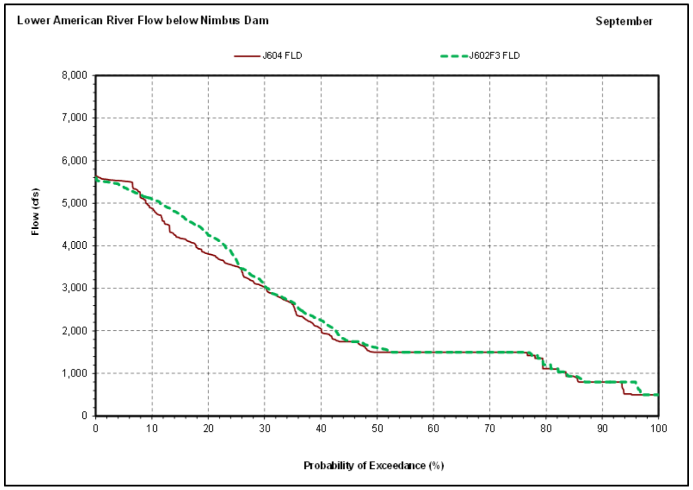


Figure 1-14. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for September under Alternative 2 - Forecast-informed Operations Future Condition and No Action/No Project Future Condition.

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 generally similar (i.e., less than 5 percent) during January (Table 5-30). Flows decrease by 10 percent or more with higher frequency during November, and with substantially higher frequency (i.e., 10 percent or more) during October, February and March under Alternative 2 - Forecast-informed Operations future condition relative to No Action/No Project future condition. By contrast, flows increase by 10 percent or more with higher frequency during August and September, and with substantially higher frequency during December, April, May, June and July.

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, August and September (Table 5-31). Net reductions in flow of 10 percent or more occur with higher frequency during December, and with generally substantially higher frequency during October, November, January, February and March under Alternative 2 - Forecast-informed Operations future condition relative to No Action/No Project future condition. Net increases in flow of 10 percent or more occur with substantially higher frequency during April and July under Alternative 2 - Forecast-informed Operations future condition relative to No Action/No Project future condition.

Table 1-7. 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 With-Project (Alternative 2 - Forecast-informed Operations) relative to the No Action/No Project future 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	6	7	-3	-25	33	54	37	42	29	6	17
	American River at Watt Ave	10	All Years	-2	8	6	-3	-26	33	53	37	41	33	6	17
	Mouth of the American River (RM 1)	10	All Years	0	7	1	-5	-24	28	53	38	41	33	7	18

Table 1-8. 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 With-Project (Alternative 2 - Forecast-informed Operations) relative to the No Action/No Project Future 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	Lower 40 percent	10	7	4	4	-4	13	56	54	18	11	9	10
	American River at Watt Ave	10	Lower 40 percent	10	7	4	5	-4	13	56	54	20	15	9	10
	Mouth of the American River (RM 1)	10	Lower 40 percent	13	7	1	6	0	12	53	56	19	17	8	10

Based on the general changes in flows (described above) and water temperatures (see Water Temperature section), 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 future condition relative to No Action/No Project future condition are described in the following sections.

Riverine Temperatures

Simulated monthly water temperatures at representative nodes in the rivers in the Project Area indicate that water temperatures under Alternative 2 - Forecast-informed Operations future condition relative to No Action/No Project future condition would generally be: (1) equivalent or similar most of the time in the Sacramento River, but would be measurably cooler more often during August, and measurably warmer more often during September below Keswick Dam and at Bend Bridge; (2) equivalent or similar most of the time in the Feather River below the Thermalito Afterbay Outlet and at the mouth; and (3) cooler more often during the spring and summer and warmer during April in the American River.

Changes in simulated water temperatures within each evaluated water body under Alternative 2 - Forecast-informed Operations future condition relative to No Action/No Project future condition are summarized in Tables 5-32 to 5-34, below.

Table 1-9. Riverine Water Temperatures Long-term Average and Average by Water Year Type for Alternative 2 - Forecast-informed Operations Future Condition vs. No Action/No Project Future Condition.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Results**					
River and Location	Generally similar long-term average water temperatures and average water temperatures by water year type during most months at all locations.	**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		✓	✓	✓	✓	✓	✓
American River below Nimbus Dam		Cooler in May	✓	Cooler in May, Jun, & Aug	✓	Cooler in May & Jun	✓
American River at Watt Avenue		Cooler in May, Jun, & Aug	Cooler in May & Aug	Cooler in May–Aug	Cooler in May–Jul	Cooler in May, Jun, & Aug	Cooler in Mar–Aug
American River at the mouth		Cooler in Apr–Sep	Cooler in Mar & May–Aug	Cooler in May–Aug	Cooler in Apr–Jul	Cooler in Apr–Aug	Cooler in Mar–Sep

Table 1-10. Water Temperature – Net Measurable Differences over Entire Monthly Exceedance Distributions for Alternative 2 - Forecast-informed Operations Future Condition vs. No Action/No Project Future Condition.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Results
River and Location	Generally similar water temperatures over most of the monthly exceedance distributions at all locations.	**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		✓
American River below Nimbus Dam		Net measurable decreases in May, Jun, & Aug; net increase in Apr
American River at Watt Avenue		Net measurable decreases in May–Sep
American River at the mouth		Net measurable decrease in Mar–Sep

Table 1-11. Water Temperature – Net Measurable Differences over Warmest 25 percent of Monthly Exceedance Distributions

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Results
River and Location	Generally similar water temperatures over most of the monthly exceedance distributions at all locations.	**Warmest 25 percent of the Monthly Exceedance Distributions**
Sacramento River below Keswick Dam		Net measurable reduction in Aug, net increase in Sep
Sacramento River at Bend Bridge		Net measurable reduction in Aug, net increase in Sep
Sacramento River at Feather River confluence		✓
Sacramento River at Freeport		✓
Feather River below Thermalito Afterbay Outlet		✓
Feather River at the mouth		✓
American River below Nimbus Dam		Net measurable decreases in May–Sep
American River at Watt Avenue		Net measurable decreases in Mar–Sep
American River at the mouth		Net measurable decreases in Mar–Sep

Note: “✓” refers to similar values of the evaluation metric for both scenarios

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, except for May when there is a measurably decrease in water temperature. Mean monthly water temperatures by water year type would be generally similar most of the time, except for measurably cooler water temperatures during May, June, and August of above-normal water years and during May and June of dry water years. Monthly water temperature exceedance probability distributions would be generally similar with slight differences most of the time during all months, but are slightly cooler during May, June, and August, and are warmer during April.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more of the time during May, June, and August, and a net measurable increase would occur over 10 percent or more of the time during April. 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 May through September.

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, but would be measurably cooler during May, June, and August. Monthly water temperatures by water year type would be generally similar most of the time, but would be measurably cooler during May and August of wet water years; May through August of above-normal water years; May through July of below-normal water years; May, June, and August of dry water years; and during March through August of critical years. Monthly water temperature exceedance probability distributions would be generally similar most of the time during all months with some slight differences, but would be cooler during March through September.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more of the time during May through September. Over the warmest 25 percent of the monthly distributions, net measurable decreases in water temperature would occur in over 10 percent or more in the distributions during March through September.

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 most months of the year, and would be measurably cooler during April through September. Monthly water temperatures by water year type would be generally similar most of the time, but would be measurably cooler during March of above-normal and critical water years, April of below-normal and dry water years, May through August of most water year types, and September of critical years. Monthly water temperature exceedance probability distributions would be generally similar during most months of the year, but would be cooler during March through September.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more of the time during March through September. 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 March through September.

Steelhead

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). Additional flow and water temperature nodes were used to simulate potential redd dewatering (i.e., daily water temperatures by river mile).

Table 5-35 summarizes the net difference in water temperature index value exceedance probabilities for steelhead observed from model outputs for the lower American River. Table 5-36 presents the long-term average and average by water wear type steelhead spawning WUA comparison results for Alternative 2 and No Action/No Project under future water demand conditions, while Figure 5-29 compares the exceedance distribution for steelhead spawning WUA. Table 5-37 and Figure 5-30 summarize the results of the steelhead redd dewatering analysis for the two scenarios being compared.

Relative to the No Action/No Project future condition, the Alternative 2 - Forecast-informed Operations future condition would be expected to provide:

a) Similar adult immigration (November through March [peaking during January]) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often during most months of the evaluation period, except for February when lower flows occur more often; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency at both locations during February, are similar or lower more often during January, are higher by 10 percent or more with higher or substantially higher frequency during November and March, and are similar or higher more often during December; (3) during low-flow conditions, flows are similar or lower by 10 percent or more with higher frequency during February, are higher by 10 percent or more with higher or substantially higher frequency during November, January, and March, and are similar or higher by 10 percent or more with higher frequency during December; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during most months of the evaluation period, but with lower temperatures more often during March; and (5) equivalent monthly probabilities of exceeding both UO and UT WTI values at both locations evaluated.

b) Similar adult holding (November through March [peaking during January]) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often during most months of the evaluation period, except for February when lower flows occur more often; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency at both locations during February, and are higher by 10 percent or more with higher or substantially higher frequency during November, December, and March, with minor net changes in flow of 10 percent or more during January; (3) during low-flow conditions, flows are lower by 10 percent or more with higher frequency during February, and are higher by 10 percent or more with higher or substantially higher frequency during November, December, January, and March; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during most months of the evaluation period, but with lower temperatures more often during March at Watt Avenue; and (5) equivalent monthly probabilities of exceeding both UO and UT WTI values at both locations evaluated.

Table 1-12. 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 With-Project (Alternative 2 - Forecast-informed Operations) relative to the No Action/No Project Future Condition											
			Description	Value		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	November through March	Mean Daily Water Temperature (°F)	American River at Watt Ave	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 Temperature (°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 Ave	61	All Years		-1	0	0	0	0						
				65	All Years		0	0	0	0	0						
Adult Spawning	January through mid-April	Mean Daily Water Temperature (°F)	American River below Nimbus Dam	54	All Years				0	0	0	6					
				57	All Years				0	0	0	0					
			American River at Watt Ave	54	All Years				0	0	-1	6					
				57	All Years				0	0	-2	0					
Embryo Incubation	January through May	Mean Daily Water Temperature (°F)	American River below Nimbus Dam	54	All Years				0	0	0	2	-1				
				57	All Years				0	0	0	-2	-4				
			American River at Watt Ave	54	All Years				0	0	-1	-1	0				
				57	All Years				0	0	-2	-2	-4				
Juvenile Rearing and Downstream Movement	Year-round	Mean Daily Water Temperature (°F)	American River below Nimbus Dam	65	All Years	-1	0	0	0	0	0	0	-2	-5	-5	-4	-3
				68	All Years	0	0	0	0	0	0	0	0	-1	-2	-1	-2
			American River at Watt Ave	65	All Years	0	0	0	0	0	0	-1	-6	-4	-1	-5	-3
				68	All Years	0	0	0	0	0	0	-1	-3	-5	-7	-7	-5
			Mouth of the American River (RM 1)	65	All Years	0	0	0	0	0	0	-2	-7	-5	-1	-1	1
				68	All Years	-1	0	0	0	0	0	-1	-7	-5	-5	-5	-5
Smolt Emigration	December through April	Mean Daily Water Temperature (°F)	American River at Watt Ave	52	All Years			0	0	0	-3	2					
				55	All Years			0	0	0	-1	-2					
			Mouth of the American River (RM 1)	52	All Years			1	0	0	-1	1					
				55	All Years			-1	0	0	-2	-2					

Table 1-13. Long-term Average and Average by Water Year Type Steelhead Spawning WUA.

Lower American River Steelhead Annual Spawning WUA Averages (percent of Maximum WUA)			
Water Year Type Category	Alternative 2 - Forecast-informed Operations future condition	No Action/No Project future condition	Difference
All Water Years	72.9 percent	71.9 percent	1.0 percent
Wet	54.2 percent	53.9 percent	0.3 percent
Above Normal	66.7 percent	65.9 percent	0.9 percent
Below Normal	83.7 percent	82.8 percent	0.8 percent
Dry	89.0 percent	88.4 percent	0.5 percent
Critical	82.6 percent	79.0 percent	3.6 percent

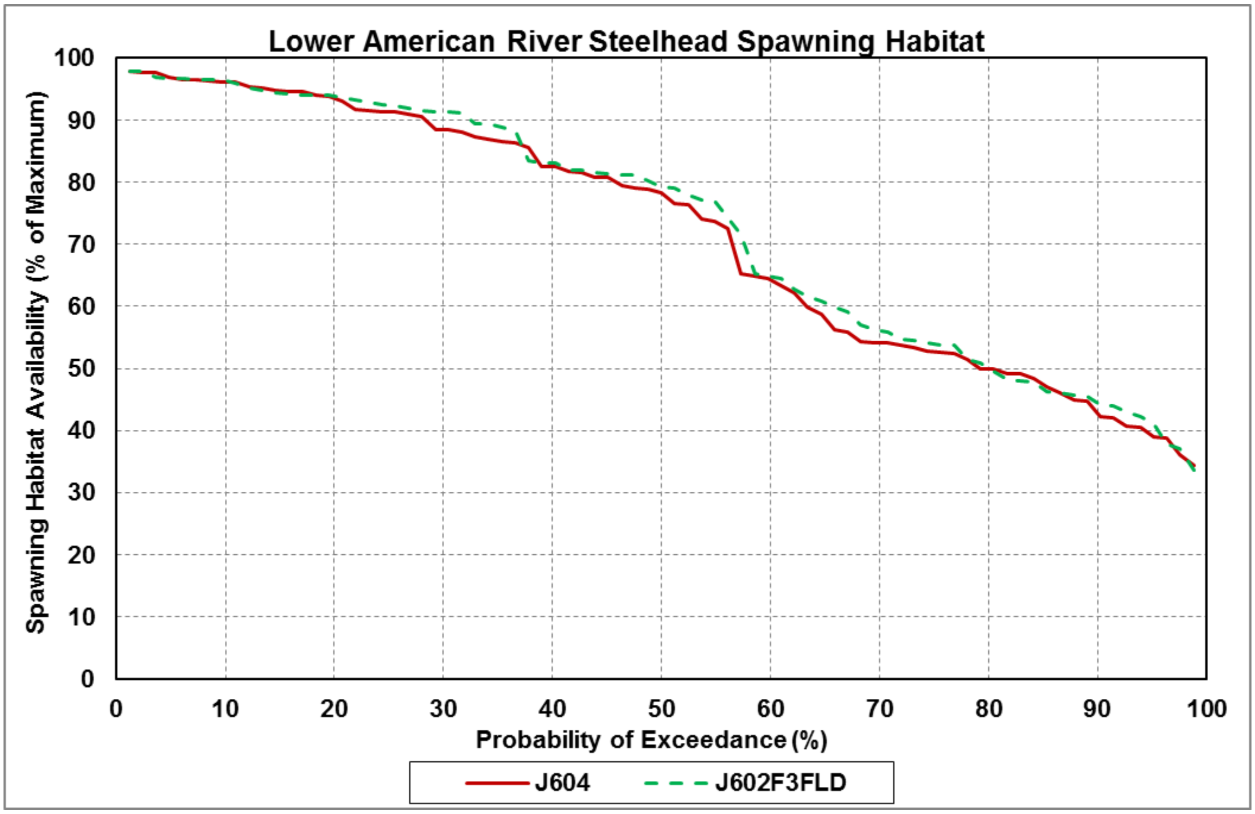


Figure 1-15. Steelhead Spawning WUA Exceedance Distribution.

Table 1-14. Long-term Average and Average by Water Year Type Steelhead Redd Dewatering Index.

Lower American River Steelhead Annual Redd Dewatering Index Averages (percent)			
Water Year Type Category	Alternative 2 – Forecast-informed Future Condition	No Action/No Project Future Condition	Difference
All Water Years	25.7 percent	26.8 percent	–1.1 percent
Wet	44.7 percent	46.4 percent	–1.7 percent
Above Normal	42.7 percent	43.4 percent	–0.7 percent
Below Normal	14.6 percent	16.0 percent	–1.5 percent
Dry	7.3 percent	6.7 percent	0.6 percent
Critical	1.4 percent	1.5 percent	–0.1 percent

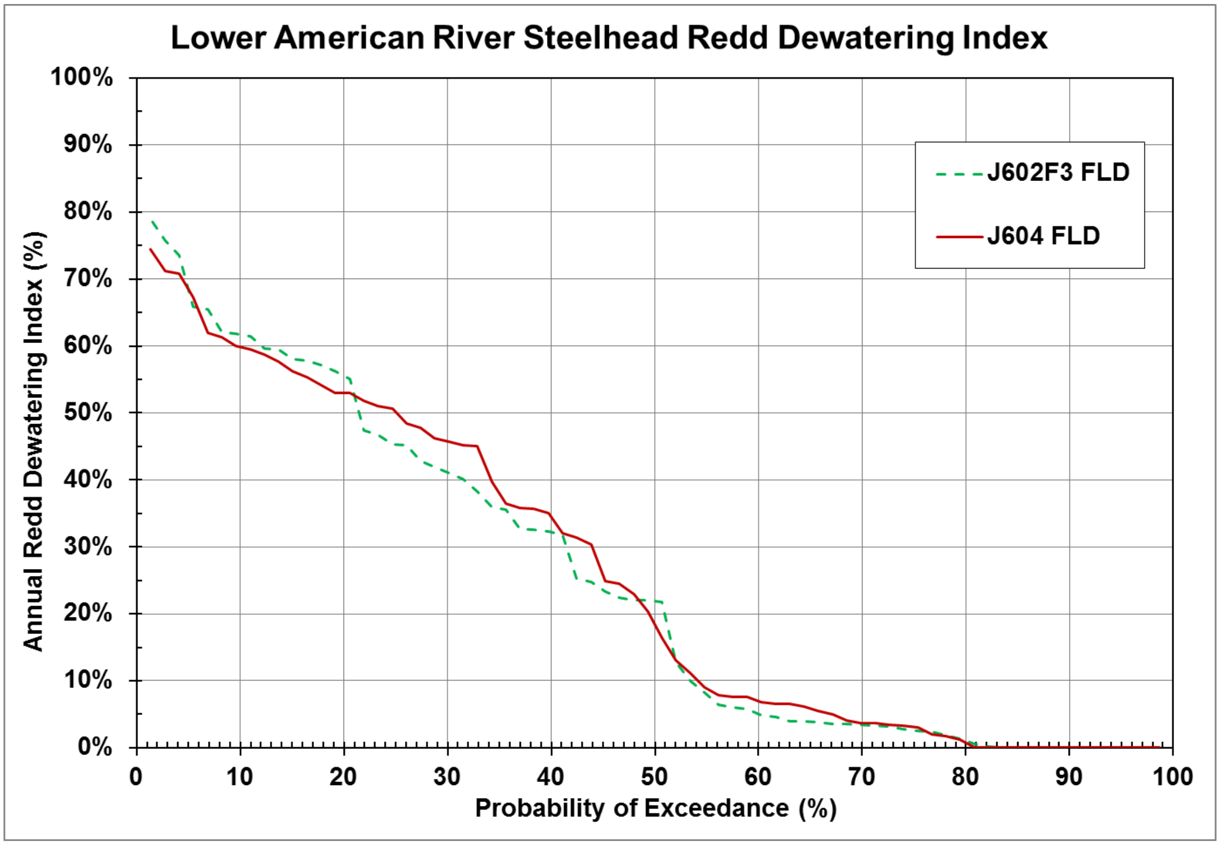


Figure 1-16. Steelhead Redd Dewatering Index Exceedance Distribution.

c) Similar spawning (January through mid-April [peaking during February]) conditions due to: (1) generally equivalent long-term average spawning WUA and average spawning WUA during all water year types, except for slightly higher spawning WUA during critical water years; (2) over the annual spawning WUA exceedance distribution, slightly higher probability of spawning WUA equal to or greater than 80 percent of maximum spawning WUA, and generally similar or slightly higher spawning WUA over the distribution when spawning WUA is less than 80 percent of maximum under both scenarios; (3) over the monthly water temperature exceedance distributions, similar water temperatures most of the time, but with lower water temperatures during March at Watt Avenue, and higher temperatures during April below Nimbus Dam (primarily when water temperatures under both scenarios are below 52°F); and (4) similar probabilities of exceeding WTI values at both locations during all months, except for a slight decrease in the probability of exceedance of the UT WTI value during March at Watt Avenue, and an increase in the probability of exceedance of the UO WTI value during the first half of April. Although there is an increase in the probability of exceedance during the first half of April, less than 1 percent of steelhead spawning is expected to occur during April. Therefore, water temperature conditions are expected to be generally similar overall for steelhead spawning.

d) More suitable embryo incubation (January through May [peaking during March]) conditions due to: (1) slightly lower long-term average annual redd dewatering index and similar or slightly lower average redd dewatering index during all water year types; (2) slightly lower or similar annual redd dewatering index over most of the exceedance distribution; (3) over the monthly water temperature exceedance distributions, similar or lower water temperatures most of the time during most months of the evaluation period, but with slightly higher temperatures during April (below Nimbus Dam); and (4) similar most of the time during all months, with primarily some slight decreases in probabilities of exceeding UT WTI values at both locations.

e) More suitable juvenile rearing and downstream movement (year-round) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during most months of the year; (2) over the entire flow exceedance distributions, flows at all locations are higher by 10 percent or more with higher or substantially higher frequency during most months of the year, except during February when they are lower by 10 percent or more with substantially higher frequency, and during January when flows are similar or lower by 10 percent or more with higher frequency; (3) during low-flow conditions, flows at all locations are higher by 10 percent or more with higher or substantially higher frequency during most months of the year, except during February when they are lower by 10 percent or more with generally higher or substantially higher frequency, and during December when minor net changes in flow of 10 percent or more occur; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures most of the time during most months of the year, but with higher temperatures during April below Nimbus Dam (primarily when water temperatures are below 52°F); and (5) generally similar probabilities of exceeding UO and UT WTI values at all locations during October through April, and reduced probabilities of exceedance during May through September at all locations.

f) Slightly less suitable smolt emigration (December through April [peaking during January]) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often during most months of the evaluation period, except during February when flows are lower; (2) over the entire flow exceedance distributions, flows are similar or higher by 10 percent or more with higher or substantially higher frequency at both locations most of the time, but are lower by 10 percent or more with higher frequency during January at the mouth and during February at both locations; (3) during low-flow conditions, flows are similar or higher by 10 percent or more with higher or substantially higher frequency at both locations most of the time, but are lower by 10 percent or more with higher frequency during February; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during most months of the evaluation period, but with higher water temperatures during April below Nimbus Dam, and lower water temperatures during March at Watt Avenue and the mouth, and during April at the mouth; and (5) similar or generally slightly lower probabilities of exceeding WTI values over the evaluation period.

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 J602F3 FLD relative to J604. Although flows decrease more often during February, flows increase more often during other months of the year, the probability of redd dewatering is slightly reduced, spawning habitat availability increases slightly, and water temperatures are reduced more often during the warmest months of the juvenile rearing period. 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 the Alternative 2 future condition relative to the No Action/No Project future condition.

Fall-run Chinook Salmon

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) (Table 5-38). Additional flow and water temperature nodes were used to simulate potential redd dewatering (i.e., daily water temperatures by river mile).

Table 5-39 summarizes the net difference in water temperature index value exceedance probabilities for Fall-run Chinook salmon observed from model outputs for the lower American River. Table 5-40 presents the long-term average and average by water wear type Fall-run Chinook salmon spawning WUA comparison results for Alternative 2 and No Action/No Project under future water demand conditions, while Figure 5-31 compares the exceedance distribution for Fall-run Chinook salmon spawning WUA. Table 5-41 and Figure 5-32 summarize the results of the Fall-run Chinook salmon redd dewatering analysis for the two scenarios being compared.

Table 1-15. Net Difference in Water Temperature Index Value Exceedance Probabilities for Fall-run Chinook Salmon.

Fall-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 Alternative 2 - Forecast-informed Operations Future Condition relative to the No Action/No Project Future Condition											
			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 Temp (°F)	American River below Nimbus Dam	64	All Years	-1	0	0								-6	-1
				68	All Years	0	0	0								-1	-2
			American River at Watt Avenue	64	All Years	0	0	0								-4	-2
				68	All Years	0	0	0								-7	-5
			Mouth of the American River (RM 1)	64	All Years	2	0	0								2	1
				68	All Years	-1	0	0								-5	-5
Adult Spawning	Mid-October through December	Mean Daily Water Temp (°F)	American River below Nimbus Dam	56	All Years	2	0	0									
				58	All Years	1	0	0									
			American River at Watt Avenue	56	All Years	2	-1	0									
				58	All Years	1	-1	0									
Embryo Incubation	Mid-October through March	Mean Daily Water Temp (°F)	American River below Nimbus Dam	56	All Years	2	0	0	0	0	0						
				58	All Years	1	0	0	0	0	0						
			American River at Watt Avenue	56	All Years	2	-1	0	0	0	-1						
				58	All Years	1	-1	0	0	0	-1						
Juvenile Rearing and Emigration	January through May	Mean Daily Water Temp (°F)	American River below Nimbus Dam	61	All Years				0	0	0	0	-4				
				65	All Years				0	0	0	0	-2				
			American River at Watt Avenue	61	All Years				0	0	0	-2	-7				
				65	All Years				0	0	0	-1	-6				
			Mouth of the American River (RM 1)	61	All Years				0	0	-1	-4	-4				
				65	All Years				0	0	0	-2	-7				

Table 1-16. Long-term Average and Average by Water Year Type Fall-run Chinook Salmon Spawning WUA.

Lower American River Fall-run Chinook Salmon Annual Weighted WUA Averages (percent)			
Water Year Type Category	**Alternative 2 Forecast-informed Operations Future Condition**	**No Action/No Project Future Condition**	**Difference**
All Water Years	84.2 percent	84.1 percent	0.1 percent
Wet	80.7 percent	82.3 percent	–1.6 percent
Above Normal	80.8 percent	81.5 percent	–0.7 percent
Below Normal	88.5 percent	86.8 percent	1.7 percent
Dry	85.1 percent	85.0 percent	0.1 percent
Critical	88.4 percent	85.7 percent	2.7 percent

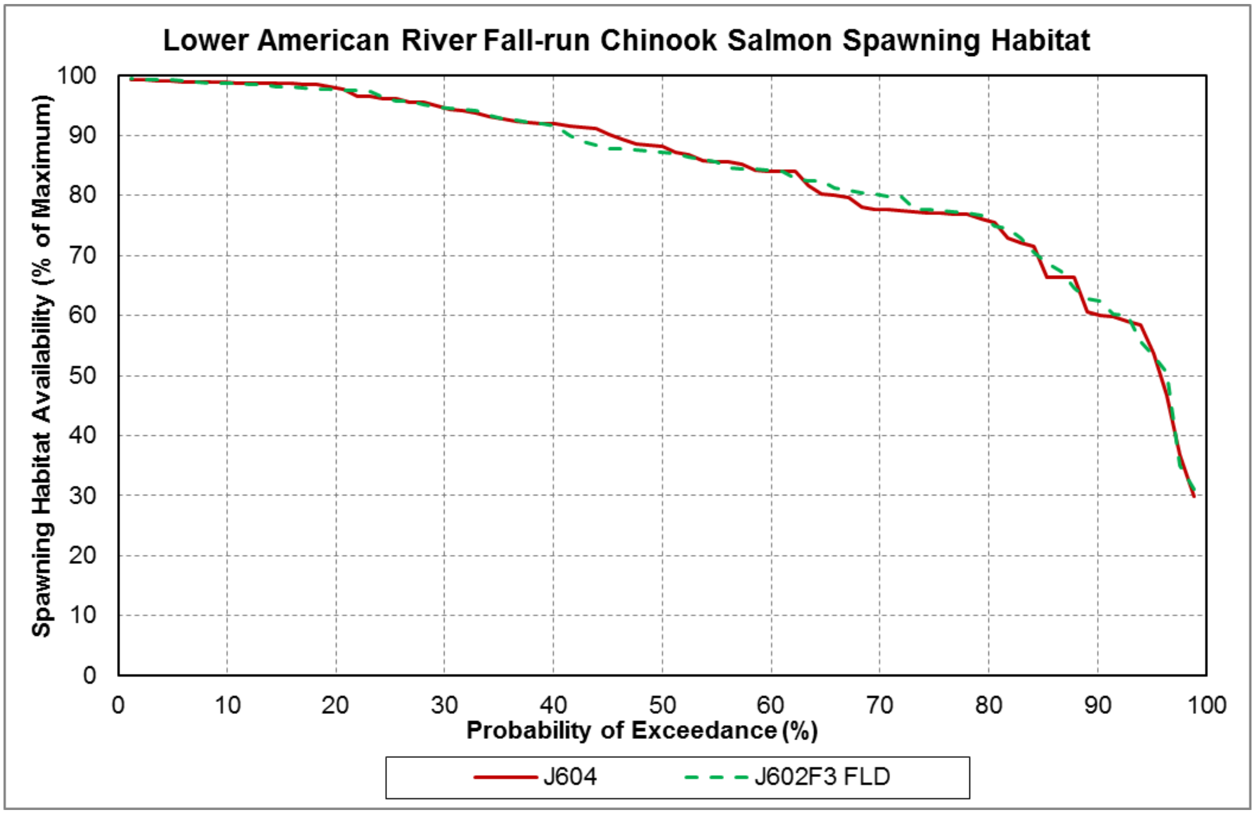


Figure 1-17. Fall-run Chinook Salmon Spawning WUA Exceedance Distribution.

Table 1-17. 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 Operation Future Condition**	**No Action/No Project Future Condition**	**Difference**
All Water Years	8.41 percent	8.19 percent	0.23 percent
Wet	11.21 percent	11.32 percent	–0.11 percent
Above Normal	5.23 percent	6.10 percent	–0.87 percent
Below Normal	4.72 percent	4.77 percent	–0.05 percent
Dry	5.68 percent	7.40 percent	–1.73 percent
Critical	13.20 percent	7.86 percent	5.34 percent

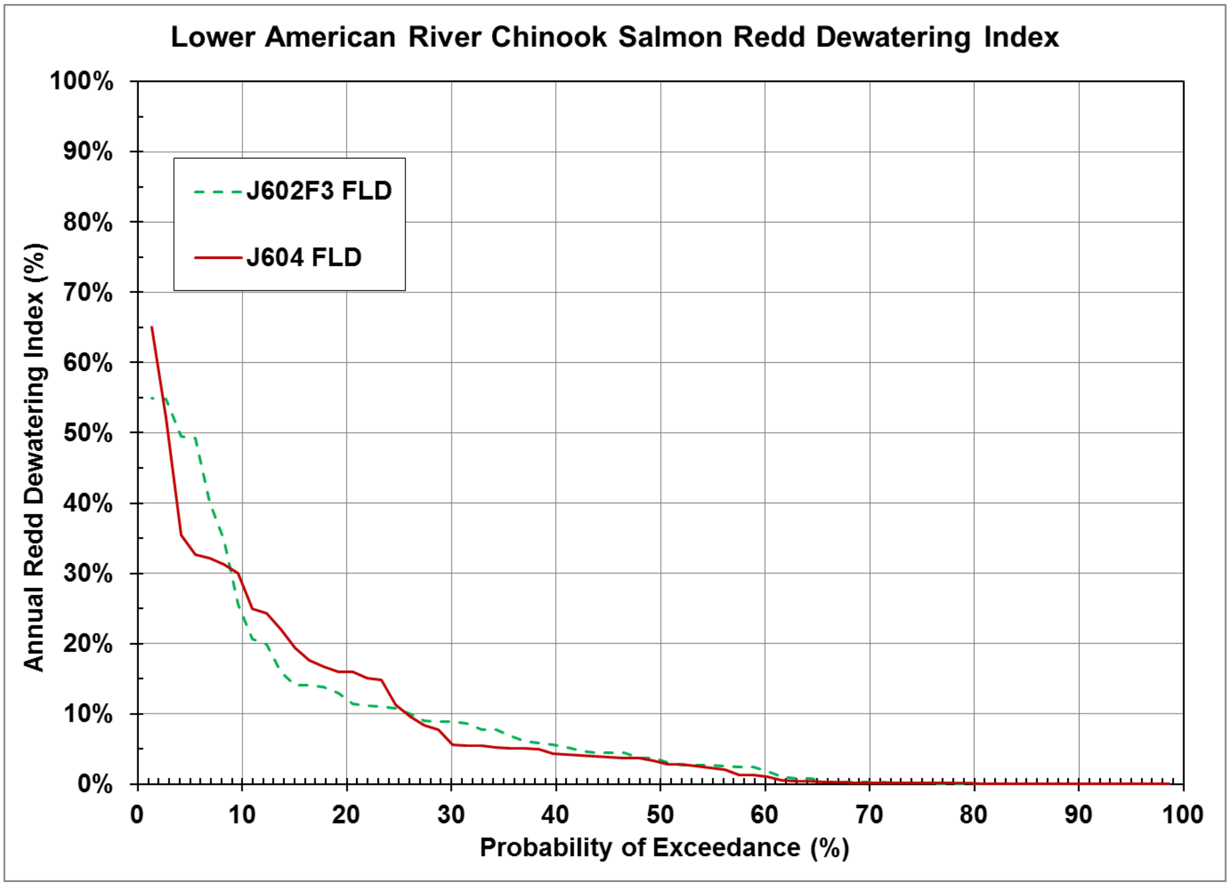


Figure 1-18. Fall-run Chinook Salmon Redd Dewatering Index Exceedance Distribution.

Table 1-18. Long-term Average and Average by Water Year Type Fall-run Chinook Salmon Early Lifestage Mortality.

Lower American River Fall-run Chinook Salmon Annual Early Lifestage Mortality Averages (percent)

Water Year Type Category	Alternative 2 Forecast-informed Operations Future Condition	No Action/No Project Future Condition	Difference
All Water Years	7.7 percent	8.2 percent	–0.4 percent
Wet	4.7 percent	5.2 percent	–0.5 percent
Above Normal	4.1 percent	4.2 percent	0.0 percent
Below Normal	5.4 percent	5.6 percent	–0.3 percent
Dry	10.9 percent	11.7 percent	–0.7 percent
Critical	15.5 percent	15.9 percent	–0.3 percent

Relative to the No Action/No Project future condition, the Alternative 2 - Forecast-informed Operation future condition would be expected to provide:

a) Similar adult immigration and staging (August through December [peaking during November]) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during most months of the evaluation period, but with lower flows more often during October; (2) over the entire flow exceedance distributions, flows at all locations are similar or higher by 10 percent or more with higher or substantially higher frequency during all months of the evaluation period; (3) during low-flow conditions, flows at all locations are similar or higher by 10 percent or more with higher or substantially higher frequency during all months of the evaluation period; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures most of the time during all months of the evaluation period; and (5) generally similar probabilities of exceeding UO and UT WTI values with some slight differences in exceedance, primarily including reductions in exceedance during August and September.

b) Similar spawning (mid-October through December [peaking during November]) conditions due to: (1) similar long-term average spawning WUA and average spawning WUA during most water year types, except for slightly lower spawning WUA during wet water years, and slightly higher spawning WUA during below-normal and critical water years; (2) over the annual spawning WUA exceedance distribution, slightly higher probability of spawning WUA equal to or greater than 80 percent of maximum spawning WUA, and generally similar spawning WUA when spawning WUA is less than 80 percent of maximum; (3) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during all months of the evaluation period; and (4) similar probabilities of exceeding WTI values during all months evaluated at both locations, except for slightly increased probabilities of exceedance of the UO WTI value during October.

c) Similar embryo incubation conditions (mid-October through March) due to: (1) similar long-term average annual redd dewatering index and similar average redd dewatering index during most water year types, but with slightly reduced dewatering during dry water years and increased dewatering during critical water years; (2) similar or higher and lower annual redd dewatering index with similar frequencies over the exceedance distribution; (3) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during all months of the evaluation period; and (4) similar probabilities of exceeding WTI values during all months evaluated at both locations, but with slightly increased probabilities of exceedance of the UO WTI value during October.

d) Similar early lifestage mortality due to: (1) lower annual long-term average early lifestage mortality and average annual early lifestage mortality by water year type; and (2) similar or slightly lower early lifestage annual mortality over the entire exceedance distribution (Figure 5-33).

e) Slightly more suitable juvenile rearing and downstream movement (January through May [peaking during February]) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often during most months of the evaluation period, except for February when flows are lower; (2) over the entire flow exceedance distributions, flows at all locations are higher by 10 percent or more with higher or substantially higher frequency during most months, except during February when they are lower by 10 percent or more with substantially higher frequency, and during January when flows are similar or lower by 10 percent or more with higher frequency; (3) during low-flow conditions, flows at all locations are higher by 10 percent or more with higher or substantially higher frequency during most months, except during February when they are lower by 10 percent or more with substantially higher frequency, and during January when flows are similar or lower by 10 percent or more with higher frequency; (3) during low-flow conditions, flows at all locations are higher by 10 percent or more with higher or substantially higher frequency during most months, except during February when they are lower by 10 percent or more with generally higher or substantially higher frequency; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures most of the time during most months, but with higher temperatures during April below Nimbus Dam (primarily when water temperatures are below 52°F); and (5) generally similar probabilities of exceeding WTI values at all locations, but with generally slightly reduced probabilities of exceedance during April and May at most locations.

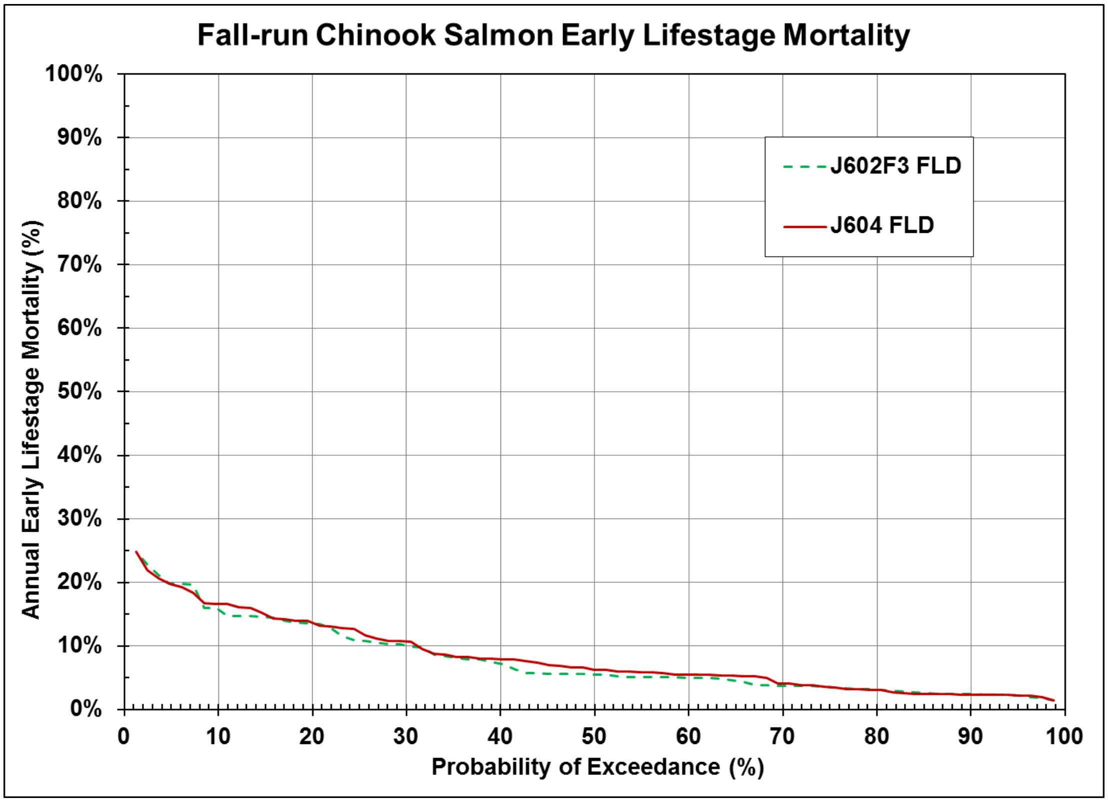


Figure 1-19. Fall-run Chinook Salmon Annual Early Lifestage Mortality Exceedance Distribution.

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 salmonids in the lower American River, habitat conditions are expected to be generally similar for fall-run Chinook salmon under Alternative 2 future condition relative to the No Action/No Project future condition. Although flows decrease during February, flows increase during most months of the year, and water temperatures are cooler during the warmest periods of the year, including during April and May of the juvenile rearing and emigration lifestage, and during August and September of the adult immigration and staging lifestage.

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

Flow and water temperature model results were examined for the lower American River near the mouth of the lower American River (i.e., RM 1) for non-natal juvenile rearing. The net difference in water temperature index value exceedance probabilities for spring-run Chinook salmon is summarized in Table 5-42.

Table 1-19. 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 Future Condition											
			Description	Value (°F)		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Non-Natal Juvenile Rearing	November through April	Mean Daily Water Temper-ature (°F)	Mouth of the American River (RM 1)	61	All Years	▨	0	0	0	0	-1	-4	▨	▨	▨	▨	▨
				65	All Years	▨	0	0	0	0	0	-2	▨	▨	▨	▨	▨

Relative to the No Action/No Project future condition scenario, the Alternative 2 future condition scenario would be expected to provide:

g) Similar non-natal juvenile rearing (November through April) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often during most months of the evaluation period, except during February when flows are lower; (2) over the entire flow exceedance distributions, flows are similar or higher by 10 percent or more with higher or substantially higher frequency at both locations most of the time, but are lower by 10 percent or more with higher frequency during January at the mouth and during February at both locations; (3) during low-flow conditions, flows are similar or higher by 10 percent or more with higher or substantially higher frequency at both locations most of the time, but are lower by 10 percent or more with higher frequency during February; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during most months of the evaluation period, but with lower water temperatures during March and April; and (5) similar or slightly lower probabilities of exceeding WTI values over the evaluation period.

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 the Alternative 2 future condition scenario relative to No Action/ No Project future condition scenario. Although flows decrease more often, water temperature index values are exceeded with similar frequency. 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.

<u>River Lamprey</u>

Flow and water temperature model results were examined for the lower American at Watt Avenue and near the mouth of the lower American River (i.e., RM 1) (Table 5-43).

Table 1-20. Net Difference in Water Temperature Index Value Exceedance Probabilities for River Lamprey.

River Lamprey 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 Future Condition											
			Description	Value		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	September through June	Mean Daily Water Temperature (°F)	American River at Watt Ave	42-60[1]	All Years	0	0	0	0	0	1	2	5	1	▨	▨	0
			Mouth of the American River (RM 1)	42-60	All Years	0	1	0	0	0	2	3	3	1	▨	▨	0
Spawning and Embryo Incubation	February through July	Mean Daily Water Temperature (°F)	American River at Watt Ave	50-64	All Years	▨	▨	▨	▨	0	-2	1	6	5	1	▨	▨
Ammocoete Rearing and Downstream Movement	Year-round	Mean Daily Water Temperature (°F)	American River at Watt Ave	72	All Years	0	0	0	0	0	0	0	-1	-3	-1	-2	-1
			Mouth of the American River (RM 1)	72	All Years	0	0	0	0	0	0	-1	-2	-6	-5	-7	-2
[1]Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.																	

Relative to the No Action/No Project future condition scenario, the Alternative 2 Forecast-Informed Operations future condition scenario would be expected to provide:

h) Similar adult immigration (September through June) conditions due to: (1) over the monthly flow exceedance distributions, similar or higher flows more often during most months of the evaluation period; (2) over the entire flow exceedance distributions, flows at both locations are higher by 10 percent or more with higher or substantially higher frequency during most months, except during February when they are lower by 10 percent or more with substantially higher frequency, and during January when flows are similar or lower by 10 percent or more with higher frequency; (3) during low-flow conditions, flows at all locations are higher by 10 percent or more with higher or substantially higher frequency during most months, except during February when they are lower by 10 percent or more with substantially higher frequency, and during January when flows are similar or lower by 10 percent or more with higher frequency; (3) during low-flow conditions, flows at all locations are higher by 10 percent or more with higher or substantially higher frequency during most months, except during February when they are lower by 10 percent or more with generally higher or substantially higher frequency, and during December when minor net changes in flow of 10 percent or more occur; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures most of the time during most months; and (5) generally similar probabilities of exceeding UO and UT WTI values at both locations, but with reduced probabilities of exceedance during March through May.

i) Slightly more suitable spawning and embryo incubation (February through July) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during all months of the evaluation period, except for February when flows are lower; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency during February, and are higher by 10 percent or more with substantially higher frequency during March through July; (3) during low-flow conditions, flows are lower by 10 percent or more with higher frequency during February, and are higher by 10 percent or more with substantially higher frequency during March through July; (4) over the monthly water temperature exceedance distributions, cooler water temperatures most of the time during most months of the evaluation period, with similar temperatures during February and April; and (5) similar monthly probabilities of water temperatures occurring within the specified range during most months evaluated, but with increased probabilities of occurring within the range during May and June.

j) Slightly more suitable ammocoete rearing and downstream movement (year-round) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during most months of the year; (2) over the entire flow exceedance distributions, flows at both locations are higher by 10 percent or more with higher or substantially higher frequency during most months of the year, except during February when they are lower by 10 percent or more with substantially higher frequency, and during January when flows are similar or lower by 10 percent or more with higher frequency; (3) during low-flow conditions, flows at both locations are higher by 10 percent or more with higher or substantially higher frequency during most months of the year, except during February when they are lower by 10 percent or more with similar or higher frequency, and during December at the mouth when minor net changes in flow of 10 percent or more occur; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures most of the time during most months of the year, but with higher temperatures during April below Nimbus Dam (primarily when water temperatures are below 52°F); and (5) generally similar probabilities of exceeding UO and UT WTI values at all locations during October through April, and reduced probabilities of exceedance during May through September at both locations.

Overall, in consideration of all flow and water temperature-related indicators of potential impact, as well as peak lifestage-specific temporal considerations, habitat conditions are expected to be more suitable for river lamprey under the Alternative 2 future condition scenario relative to the No Action/No Project future condition scenario, particularly in consideration of more suitable water temperatures during the warmest months of the rearing and downstream movement lifestage.

Pacific Lamprey

Flow and water temperature model results were examined for the lower American at Watt Avenue and near the mouth of the lower American River (i.e., RM 1) (Table 5-44).

Table 1-21. Net Difference in Water Temperature Index Value Exceedance Probabilities for Pacific Lamprey.

Pacific Lamprey in the Lower American River						
Lifestage	Evaluation Period	Indicator of	Location	Metric	Range	Net Change in Probability of Exceedance under With-Project (Alternative 2 - Forecast-informed Operations) relative to the No Action/No Project Future Condition

		Potential Impact	Description	Value		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult Immigration	January through June	Mean Daily Water Temperature (°F)	American River at Watt Ave	42-60[1]	All Years	▨	▨	▨	0	0	1	2	5	1	▨	▨	▨
			Mouth of the American River (RM 1)	42-60	All Years	▨	▨	▨	0	0	2	3	3	1	▨	▨	▨
Spawning and Embryo Incubation	January through August	Mean Daily Water Temperature (°F)	American River at Watt Ave	50-64	All Years	▨	▨	▨	0	0	-2	1	6	5	1	4	▨
Ammocoete Rearing and Downstream Movement	Year-round	Mean Daily Water Temperature (°F)	American River at Watt Ave	72	All Years	0	0	0	0	0	0	0	-1	-3	-1	-2	-1
			Mouth of the American River (RM 1)	72	All Years	0	0	0	0	0	0	-1	-2	-6	-5	-7	-2

[1] Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.

Relative to the No Action/No Project future condition scenario, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

k) Similar adult immigration (January through June) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during most months, but with generally similar flows during January and lower flows during February; (2) over the entire flow exceedance distributions, flows at both locations are higher by 10 percent or more with substantially higher frequency during most months of the evaluation period, except during February when they are lower by 10 percent or more with substantially higher frequency, and during January when flows are similar or lower by 10 percent or more with higher frequency; (3) during low-flow conditions, flows at both locations are higher by 10 percent or more with higher or substantially higher frequency during most months of the evaluation period, except during February when they are similar or lower by 10 percent or more with higher frequency; (4) over the monthly water temperature exceedance distributions, lower water temperatures most of the time during most months of the evaluation period, except for February when temperatures are similar; and (5) generally similar probabilities of exceeding UO and UT WTI values at both locations during most months, and reduced probabilities of exceedance during April and May at both locations.

l) Slightly more suitable spawning and embryo incubation (March through August) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during most months of the evaluation period; (2) over the entire flow exceedance distributions, flows are higher by 10 percent or more with generally substantially higher frequency during the evaluation period; (3) during low-flow conditions, flows are higher by 10 percent or more with substantially higher frequency during all months of the evaluation period; (4) over the monthly water temperature exceedance distributions, lower water temperatures most of the time during most months of the evaluation period; and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months evaluated, but with increased probabilities of occurring within the range during May, June, and August.

m) Slightly more suitable ammocoete rearing and downstream movement (year-round) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during most months of the year; (2) over the entire flow exceedance distributions, flows at both locations are higher by 10 percent or more with higher or substantially higher frequency during most months of the year, except during February when they are lower by 10 percent or more with substantially higher frequency, and during January when flows are similar or lower by 10 percent or more with higher frequency; (3) during low-flow conditions, flows at both locations are higher by 10 percent or more with higher or substantially higher frequency during most months of the year, except during February when they are lower by 10 percent or more with similar or higher frequency, and during December at the mouth when minor net changes in flow of 10 percent or more occur; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures most of the time during most months of the year; and (5) generally similar probabilities of exceeding UO and UT WTI values at all locations during October through April, and reduced probabilities of exceedance during May through September at both locations.

Overall, in consideration of all flow and water temperature–related impact indicators, habitat conditions are expected to be more suitable for Pacific lamprey under the Alternative 2 future condition relative to the No Action/No Project future condition, particularly in consideration of more suitable water temperatures during the warmest months of the rearing and downstream movement lifestage.

Hardhead

Flow and water temperature model results were examined for the lower American at Watt Avenue (Table 5-45).

Table 1-22. Net Difference in Water Temperature Index Value Exceedance Probabilities for Hardhead.

Hardhead in the Lower American River																	
Life-stage	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 Future Condition											
			Description	Value		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Adult and Other Life-stages	Year-round	Mean Daily Water Temperature (°F)	American River at Watt Ave	61-77[1]	All Years	2	-1	0	0	0	0	-2	-7	-2	1	2	1

Spawning	April through June	Mean Daily Water Temperature (°F)	American River at Watt Ave	59-64	All Years							-1	3	4			
[1]Water temperature ranges are evaluated by calculating the net change in the probability of water temperatures occurring within the specified range.																	

Relative to the No Action/No Project future scenario, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

n) Similar adult and other lifestage (year-round) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during most months of the year; (2) over the entire flow exceedance distributions, flows are higher by 10 percent or more with higher or substantially higher frequency during most months of the year, except during February when they are lower by 10 percent or more with substantially higher frequency, and during January when minor net changes in flows of 10 percent or more occur; (3) during low-flow conditions, flows are higher by 10 percent or more with higher or substantially higher frequency during most months of the year, except during February when they are lower by 10 percent or more with higher frequency, and during December when minor net changes in flow of 10 percent or more occur; (4) over the monthly water temperature exceedance distributions, similar or lower water temperatures most of the time during most months of the year; and (5) similar probabilities of water temperatures occurring within the specified range during most months of the year, but with slightly increased probabilities during October and August, and decreased probabilities during April through June (due to reductions in water temperatures).

o) More suitable spawning (April through June) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during April through June; (2) over the entire flow exceedance distributions, flows are higher by 10 percent or more with substantially higher frequency during April through June; (3) during low-flow conditions, flows are higher by 10 percent or more with substantially higher frequency during April through June; (4) over the monthly water temperature exceedance distributions, similar or lower temperatures during April through June; and (5) similar or slightly increased monthly probabilities of water temperatures occurring within the specified range during April through June.

Overall, in consideration of all flow and water temperature-related indicators of potential impact, habitat conditions are expected to be similar or more suitable for hardhead under the Alternative 2 future condition scenario relative to the No Action/No Project scenario, primarily due to increased flows and decreased water temperatures.

Recreational Fisheries (American Shad and Striped Bass)

Flow and water temperature model results were examined for the lower American at Watt Avenue. In addition, flows near the mouth of the lower American River (i.e., RM 1) were evaluated for adult attraction into the lower American River.

Relative to the No Action/No Project Future Condition, the Alternative 2 Forecast-informed future condition scenario would be expected to provide the following:

> American shad - similar adult attraction, more suitable adult immigration and spawning, and similar juvenile rearing and downstream movement conditions;
>
> Striped bass – more suitable adult attraction, more suitable immigration and spawning, and similar juvenile rearing conditions.

Overall, in consideration of all flow and water temperature-related indicators of potential impact, habitat conditions are expected to be similar for American shad and striped bass under the Alternative 2 future condition scenario relative to the No Action/No Project future condition scenario.

Sacramento River

The species and lifestage-specific interpretive comparisons below are based on numerous output provided in the appendices, 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.

For salmonid species, flow and water temperature model results were generated for the Sacramento River 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, spawning habitat availability (weighted usable area, or WUA) for salmonid species was also analyzed. Modeling results for other fish species are described separately.

Winter-run Chinook Salmon

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

a) Similar adult immigration (November through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Verona and Freeport; and (4) generally equivalent monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated, but with a slightly lower exceedance probability during May at Freeport (1.3 percent).

b) Similar adult holding (November through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at both locations evaluated; and (4) generally equivalent monthly probabilities of exceeding both UT and UO WTI values at both locations.

c) Similar spawning (April through August) and embryo incubation (April through September) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent or similar net changes in flow of 10 percent or more during all months at both locations; (4) generally equivalent long-term average spawning WUA and by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over most of the distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, with slightly increased exceedance probabilities (up to 2.4 percent) and some slightly reduced exceedance probabilities (up to 2.4 percent).

d) Similar spawning (April through August) and embryo incubation (Aril through September) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent or similar net changes in flow of 10 percent or more during all months at both locations; (4) generally equivalent long-term average spawning WUA and by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over most of the distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, with slightly increased exceedance probabilities (up to 2.4 percent) and some slightly reduced exceedance probabilities (up to 2.4 percent).

In consideration of the general similarity of impact indicators to all lifestages of winter-run Chinook salmon in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Spring-run Chinook Salmon

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

a) Similar adult immigration (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

b) Similar adult holding (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at both locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UT and UO WTI values at both locations evaluated, but with a slightly lower probability of exceedance during August below Keswick Dam (1.3 percent).

c) Similar adult holding (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at both locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UT and UO WTI values at both locations evaluated, but with a slightly lower probability of exceedance during August below Keswick Dam (1.3 percent).

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions during the evaluation period; (3) equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Verona; and (4) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, but with slightly reduced exceedance probabilities during August and September below Keswick Dam and at Verona, respectively (1.3 percent).

e) Generally equivalent smolt emigration (October through May) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent flows most of the time over the monthly flow exceedance distributions during the evaluation period; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Verona and Freeport; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values at all locations evaluated during all months of the evaluation period, but with slightly reduced exceedance probabilities during May and October at Freeport (1.6 percent and 1.3 percent, respectively).

In consideration of the general similarity of impact indicators to all lifestages of spring-run Chinook salmon in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Fall-run Chinook Salmon

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

a) Similar adult immigration and staging (July through December) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated, except for a slight decrease (1.3 percent) in exceedance probability during August at Red Bluff.

b) Similar spawning (October through December) and embryo incubation (October through March) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.5 percent) and some slight decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent flows over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during all months at both locations; (4) generally equivalent long-term average spawning WUA and spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, but with slightly reduced exceedance probabilities at Ball's Ferry and Bend Bridge during October (1.6 percent and 1.3 percent, respectively).

c) Similar juvenile rearing and downstream movement (December through July) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Verona and Freeport; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations, but with slightly reduced exceedance probabilities at Freeport during April (3.7 percent).

In consideration of the general similarity of impact indicators to all lifestages of fall-run Chinook salmon in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Late-fall Run Chinook Salmon

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

a) Similar adult immigration and staging (October through April) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Verona and Freeport; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

b) Similar spawning (January through April) and embryo incubation (January through June) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with a slight increase of 1.5 percent and decrease 1.6 percent in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during all months at both locations; (4) generally equivalent long-term average spawning WUA and spawning WUA by water year type; (5) over the annual spawning

WUA exceedance distribution, generally equivalent spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values at all locations.

c) Similar juvenile rearing and downstream movement (April through December) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 2.0 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations evaluated; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations, but with slightly reduced exceedance probabilities below Keswick Dam during August (1.3 percent) and at Freeport during April (3.7 percent).

In consideration of the general similarity of impact indicators to all lifestages of late fall-run Chinook salmon in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Steelhead

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

a) Similar adult immigration (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Verona and Freeport; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated, except for a slight (1.3 percent) decrease in exceedance probability during August at Red Bluff.

b) Similar adult holding (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent or similar net changes in flow of 10 percent or more during all months at both locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UT and UO WTI values at both locations evaluated, but with slightly reduced exceedance probabilities below Keswick Dam during August (1.3 percent).

c) Similar spawning (December through April) and embryo incubation (December through May) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases of (up to1.5 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during both months at both locations; (4) generally equivalent long-term average spawning WUA and spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations.

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Verona; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations, but with slightly reduced exceedance probabilities below Keswick Dam and at Bend Bridge during August (1.3 percent) and at Verona (1.3 percent) during September.

e) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Verona; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations, but with slightly reduced exceedance probabilities below Keswick Dam and at Bend Bridge during August (1.3 percent) and at Verona (1.3 percent) during September.

In consideration of the general similarity of impact indicators to all lifestages of steelhead in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Green Sturgeon

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

a) Similar adult immigration and holding (February through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated, but with a slightly decreased probability (3.7 percent) of exceedance during April at Freeport.

b) Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

c) Similar adult post-spawning holding and emigration (July through November) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except for a slight (3.0 percent) increase in exceedance probability at Freeport during August; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated, but with slightly reduced exceedance probabilities at Red Bluff during August and September (1.4 percent and 2.8 percent, respectively).

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except for a slight (3 percent) decrease in exceedance probability in January at Freeport; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of green sturgeon in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

River Lamprey

Flow model results were examined for the Sacramento River below Keswick Dam, at Red Bluff, at Wilkins Slough, and at Freeport and water temperature model results were examined for the Sacramento River below Keswick Dam, at Red Bluff, and at Freeport.

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

a) Similar adult immigration (September through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Freeport; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, but with some slightly increased probability of temperatures occurring within the specified range at Freeport during October and April (2.4 percent and 1.9 percent, respectively), as well as a slight decrease in probability of temperatures occurring within the specified range below Keswick Dam during October (1.3 percent).

b) Similar spawning and embryo incubation (February through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.8 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified ranges at all locations evaluated.

c) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during August when flows are higher by 10 percent or more with slightly higher frequency (3 percent) at Freeport; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of river lamprey in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Pacific Lamprey

Flow model results were examined for the Sacramento River below Keswick Dam, at Red Bluff, at Wilkins Slough, and at Freeport and water temperature model results were examined for the Sacramento River below Keswick Dam, at Red Bluff, at Wilkins Slough and at Freeport.

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

a) Similar adult immigration (January through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.8 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Freeport; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, except a slight increase (1.9 percent) in probability of temperatures occurring within the specified range during April at Freeport.

b) Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.5 percent) and decreases (up to 1.8 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, but with slightly increased exceedance probabilities below Keswick Dam during August (2.1 percent).

c) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.8 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during January when flows are lower by 10 percent or more with slightly higher frequency (3 percent) at Freeport; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of Pacific lamprey in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Hardhead

Flow model results were examined for the Sacramento River below Keswick Dam, at Wilkins Slough, and at Freeport and water temperature model results were examined for the Sacramento River below Keswick Dam, at Wilkins Slough, below the Feather River Confluence and at Freeport.

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide:

a) Similar adult and other lifestage (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.1 percent) and decreases (up to 1.6 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during January when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) at Verona and Freeport; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, except for a slightly (3.7 percent) decreased probability of temperatures occurring within the specified range during April at Freeport.
b) Similar spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 2.0 percent) and decreases (up to 1.8 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at all locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of hardhead in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Recreational Fisheries (Striped Bass, American Shad and White Sturgeon)

Flow model results were examined for the Sacramento River below Keswick Dam, at Bend Bridge, at Red Bluff, at Verona, and at Freeport and water temperature model results were examined for the Sacramento River below Keswick Dam, at Ball's Ferry, at Jelly's Ferry, at Bend Bridge, below the Feather River confluence, and at Freeport.

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

> Striped bass and American shad – similar adult immigration and spawning, and similar juvenile rearing and downstream movement conditions; and
>
> White sturgeon – similar adult immigration and holding, similar spawning and embryo incubation, and similar juvenile rearing and down stream movement conditions.

In consideration of the general similarity of impact indicators to all lifestages of striped bass, American shad and white sturgeon in the Sacramento River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Feather River

Flow and water temperature model results for the Feather River below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River were analyzed. In addition to flow and water temperature modeling, model results for spawning habitat availability (WUA) for salmonid species were also examined.

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. 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 Existing Condition and No Action future condition scenarios. Although these results are not repeated for the discussions below, model results for the Low Flow Channel below the Fish Barrier Dam along with the information presented below were also considered and incorporated into the impact determinations for spring-run Chinook salmon, fall-run Chinook salmon, steelhead, river lamprey, Pacific lamprey, and hardhead.

Spring-run Chinook Salmon

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition would be expected to provide:

a) Similar adult immigration (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows by water year type most of the time during all water year types, but with some slight increases (up to 3.7 percent) and some slight decreases (up to 2.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito

Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, except during July when flows are higher by 10 percent or more with slightly higher frequency at the mouth (3 percent) and during September when flows are lower by 10 percent or more with substantially higher frequency below the Thermalito Afterbay Outlet and at the mouth (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values.

b) Similar adult holding (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows by water year type most of the time during all water year types, but with a slight increase of 1.9 percent and a slight decrease of 2.4 percent in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, except during September when flows are lower by 10 percent or more with a substantially higher frequency (12.1 percent) below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values.

c) Similar spawning (September through October) and embryo incubation (September through February) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with a slight increase of 1.4 percent and some slight decreases (up to 2.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) lower flows by 10 percent or more with slightly higher frequency (about 3.7 percent) during September below the Thermalito Afterbay Outlet, and higher flows by 10 percent or more with slightly higher frequency (about 1.2 percent) during October below the Thermalito Afterbay Outlet; (4) generally equivalent long-term average spawning WUA, and equivalent or similar average spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally similar spawning WUA over the entire distribution, with spawning WUA always above 80 percent of maximum; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values.

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 3.7 percent) and decreases (up to 2.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time, except during July when flows are higher by 10 percent or more with slightly higher frequency at the mouth (3 percent) and during September when flows are lower by 10 percent or more with substantially higher frequency below the Thermalito Afterbay Outlet and at the mouth (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values at all locations evaluated.

e) Similar smolt emigration (October through June) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 3.7 percent) and slight decreases (up to 1.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months of the evaluation period.

In consideration of the general similarity of impact indicators to all lifestages of spring-run Chinook salmon in the Feather River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Fall-run Chinook Salmon

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition would be expected to provide:

a) Generally similar adult immigration and staging (July through December) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 1.9 percent) and decreases (up to 2.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, except during July at the mouth when flows are higher by 10 percent or more with slightly higher frequency (3.0 percent) and during September below the Thermalito Afterbay Outlet and at the mouth when flows are lower by 10 percent or more with substantially higher frequency (12.1 percent and 9.1 percent, respectively); and (4) equivalent monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

b) Similar spawning (October through December) and embryo incubation (October through March) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some increases (up to 1.4 percent) and some decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) similar net changes in flow of 10 percent or more, except during October below the Thermalito Afterbay Outlet when flows are higher by 10 percent or more with slightly higher frequency (1.2 percent) and during December below the Thermalito Afterbay Outlet when flows are lower by 10 percent or more with slightly higher frequency (1.2 percent); (4) generally equivalent long-term average spawning WUA and average spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over the entire distribution, with spawning WUA always above 80 percent of maximum under both scenarios; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values.

c) Similar juvenile rearing and downstream movement (November through June) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 3.7 percent) and some decreases (up to 1.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more; and (4) generally equivalent probabilities of exceeding UO and UT WTI values.

In consideration of the general similarity of impact indicators to all lifestages of fall-run Chinook salmon in the Feather River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Steelhead

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition would be expected to provide:

a) Generally similar adult immigration (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 1.9 percent) and decreases (up to 2.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, except during September below the Thermalito Afterbay Outlet and at the mouth when flows are lower by 10 percent or more with substantially higher frequency (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values.

b) Similar adult holding (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 1.9 percent) and decreases (up to 2.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, except during September below the Thermalito Afterbay Outlet and at the mouth when flows are lower by 10 percent or more with substantially higher frequency (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values.

c) Similar spawning (January through April) and embryo incubation (January through May) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, except for a slight reduction (1.4 percent) during above-normal water years as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) similar long-term average spawning WUA and average spawning WUA by water year type; (4) over the annual spawning WUA exceedance distribution, similar amounts of spawning WUA over the entire distribution; and (5) equivalent or similar probabilities of exceeding both UO and UT WTI values.

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 1.9 percent) and decreases (up to 2.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time, except during September when flows are lower by 10 percent or more with substantially higher frequency (12.1 percent) below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values.

e) Similar smolt emigration (October through April) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 1.4 percent) and some slight decreases (up to 1.4 percent); (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values, but with a slightly decreased exceedance probability below the Thermalito Afterbay Outlet during November (1.3 percent).

In consideration of the general similarity of impact indicators to all lifestages of steelhead in the Feather River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Green Sturgeon

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition would be expected to provide:

a) Similar adult immigration and holding (February through November) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 3.7 percent) and decreases (up to 2.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, except during July at the mouth when flows are higher by 10 percent or more with slightly higher frequency (3.0 percent) and during September below the Thermalito Afterbay Outlet and at the mouth when flows are lower by 10 percent or more with substantially higher frequency (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent or similar monthly probabilities of exceeding both the specified WTI values.

b) Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows and generally equivalent or similar average monthly flows most of the time during all water year types, but with a slight increase of 1.9 percent in average monthly flow during August of dry water years as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value.

c) Similar juvenile rearing and downstream movement year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 3.7 percent) and some decreases (up to 2.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, except during July at the mouth when flows are higher by 10 percent or more with slightly higher frequency (3.0 percent) and during September below the Thermalito Afterbay Outlet and at the mouth when flows are lower by 10 percent or more with substantially higher frequency (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value, but with a slight reduction in exceedance during August below the Thermalito Afterbay Outlet (1.3 percent).

In consideration of the general similarity of impact indicators to all lifestages of green sturgeon in the Feather River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

River Lamprey

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition would be expected to provide:

a) Similar adult immigration (September through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 3.7 percent) and some decreases (up to 2.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, except during September below the Thermalito Afterbay Outlet and at the mouth when flows are lower by 10 percent or more with substantially higher frequency (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.

b) Similar spawning and embryo incubation (February through July) conditions due to: (1) generally equivalent long-term average monthly flows and generally equivalent or similar average monthly flows most of the time during all water year types, except for a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.

c) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 3.7 percent) and some decreases (up to 2.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during most months at both locations evaluated, except during July at the mouth when flows are higher by 10 percent or more with slightly higher frequency, and during September below the Thermalito Afterbay Outlet and at the mouth when flows are lower by 10 percent or more with substantially higher frequency (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent monthly probabilities of exceeding the specified WTI value at both locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of river lamprey in the Feather River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Pacific Lamprey

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition would be expected to provide:

a) Similar adult immigration (January through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with a slight decrease of 1.4 percent in average monthly flow during January of above-normal water years below the Thermalito Afterbay Outlet and a slight increase of 3.7 percent during May of below-normal water years at the mouth as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.

b) Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 3.7 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range.

c) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at both locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 3.7 percent) and decreases (up to 2.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during most months at both locations evaluated, except during July at the mouth when flows are higher by 10 percent or more with slightly higher frequency (3.0 percent), and during September below the Thermalito Afterbay Outlet and at the mouth when flows are lower by 10 percent or more with higher frequency (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent monthly probabilities of exceeding the specified WTI value at both locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of pacific lamprey in the Feather River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Hardhead

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition would be expected to provide:

a) Similar adult and other lifestage (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at both locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 3.7 percent) and decreases (up to 2.4 percent) in average monthly flow as well as a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during most months at both locations evaluated, except during July at the mouth when flows are higher by 10 percent or more with slightly higher frequency (3.0 percent), and during September below the Thermalito Afterbay Outlet and at the mouth when flows are lower by 10 percent or more with substantially higher frequency (12.1 percent and 9.1 percent, respectively); and (4) generally equivalent monthly probabilities of exceeding the specified WTI value at both locations evaluated.

b) Similar spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at both locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, except for a substantial increase in flow (16.0 percent) during May of below-normal water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.

In consideration of the general similarity of impact indicators to all lifestages of hardhead in the Feather River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Recreational Fisheries (Striped Bass, American Shad and White Sturgeon)

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

> Striped bass and American shad – generally similar adult immigration and spawning, and generally similar juvenile rearing and downstream movement conditions; and
>
> White sturgeon – similar adult immigration and holding, similar spawning and embryo incubation, and similar juvenile rearing and downstream movement conditions.

In consideration of the general similarity of impact indicators to all lifestages of striped bass, American shad and white sturgeon in the Feather River under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Sacramento-San Joaquin Delta and Yolo Bypass

Model results for Old and Middle River (OMR) flows and X2 location for Delta smelt and longfin smelt were examined. Delta outflow and water temperatures in the Sacramento River at Freeport for Delta smelt were also analyzed.

Additionally, model results for Sacramento River flows at Rio Vista, Yolo Bypass outflow, Delta outflow, and OMR flows for all runs of Central Valley Chinook salmon and Central Valley steelhead were examined. OMR flows for adult San Joaquin River fall- and late fall-run Chinook salmon were also analyzed.

Finally, Yolo Bypass outflow for Delta smelt, splittail, green sturgeon, and white sturgeon and examined X2 location for American shad and striped bass were considered. Results were examined for exports at the State Water Project (SWP) and Central Valley Project (CVP) export facilities year-round. 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 and decreases during some months of dry and critical water years; and (3) monthly exceedance distributions are generally similar year-round, but are slightly lower over potions of the distribution during August, and are slightly higher over portions of the distribution during September. For these reasons, no further evaluations were conducted to evaluate fish salvage at the SWP and CVP export facilities.

Delta Smelt in the Delta Region

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

a) Similar adult conditions due to: (1) equivalent or similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range (December through May), but with an increased probability (1.3 percent) during May; (2) generally similar probabilities of X2 occurring between 74 and 81 RKm during wet and above-normal water years (September through November); and (3) generally equivalent monthly probabilities of OMR flows being more negative than –5,000 cfs (December through February).

b) Similar adult spawning conditions in the Yolo Bypass (December through May) due to generally equivalent or similar net changes in Yolo Bypass outflow of 10 percent or more during the evaluation period.

c) Similar egg and embryo conditions (February through May) due to equivalent or similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range, but with an increased probability (1.3 percent) during May.

d) Similar larvae conditions (March through June) due to: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range, but with an increased probability (1.3 percent) during May; (2) during March through June of dry and critical water years, generally equivalent probabilities of mean monthly OMR flows being more negative than –1,500 cfs; and (3) and generally equivalent net changes of 10 percent or more in mean monthly Delta outflow.

e) Similar juvenile conditions (May through July) due to: (1) generally equivalent monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range, but with an increased probability (1.3 percent) during May; and (2) between RKm 65 and 80, X2 location moves upstream by 0.5 RKm or more with generally similar or somewhat reduced frequency (up to 7.3 percent).

In consideration of the general similarity of impact indicators to all lifestages of Delta smelt in the Delta under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Longfin Smelt in the Delta Region

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

a) Similar adult conditions (December through March) due to generally equivalent monthly probabilities of OMR flows being more negative than –5,000 cfs.

b) Generally similar larvae and juvenile conditions due to: (1) during April and May of dry and critical water years, the probabilities of mean monthly OMR flows being more negative than –1,500 cfs are generally equivalent, and the probabilities of mean monthly OMR flows being less than 0 are generally equivalent, but with an increased probability (3.3 percent) during April; (2) for all water years during January through June, mean monthly X2 location occurs downstream of 75 RKm with generally similar frequency during all months evaluated, but with slightly increased probability in January (1.2 percent) and slightly decreased probability in June (1.2 percent); and (3) for dry and critical water years mean monthly X2 location occurs downstream of 75 RKm with generally equivalent frequencies during all months evaluated.

c)

In consideration of the general similarity of impact indicators to all lifestages of longfin smelt in the Delta under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Winter-run Chinook Salmon in the Delta Region

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

a) Similar juvenile and emigration conditions (November through May) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more, except during January when flows are lower by 10 percent or more with slightly higher frequency (3.0 percent); (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during November when flows are lower by 10 percent or more with slightly higher frequency (2.4 percent); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more, except during November when flows are lower by 10 percent or more with slightly higher frequency (1.2 percent); and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

In consideration of the general similarity of impact indicators to all lifestages of winter-run Chinook salmon in the Delta under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Spring-run Chinook Salmon in the Delta Region

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

a) Similar juvenile and emigration conditions (November through June) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more, except during January when flows are lower by 10 percent or more with slightly higher frequency (about 3 percent); (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during November when flows are lower by 10 percent or more with slightly higher frequency (2.4 percent); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more, except during November when flows are lower by 10 percent or more with slightly higher frequency (1.2 percent); and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

In consideration of the general similarity of impact indicators to all lifestages of spring-run Chinook salmon in the Delta under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Fall-run and Late Fall-run Chinook Salmon in the Delta Region

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

a) Similar juvenile and emigration conditions (November through June) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more, except during January when flows are lower by 10 percent or more with slightly higher frequency (about 3 percent); (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during November when flows are lower by 10 percent or more with slightly higher frequency (2.4 percent); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more, except during November when flows are lower by 10 percent or more with slightly higher frequency (1.2 percent); and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

b) Generally similar San Joaquin River adult fall-run Chinook salmon conditions (December through February) due to generally similar probabilities of OMR flows being more negative than –5,000 cfs, but with a slightly increased probability during December (1.2 percent).

In consideration of the general similarity of impact indicators to all lifestages of fall-run and late fall-run Chinook salmon in the Delta under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Steelhead in the Delta Region

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

a) Similar juvenile and emigration conditions (October through July) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more, except during January when flows are lower by 10 percent or more with slightly higher frequency (about 3 percent); (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during November when flows are lower by 10 percent or more with slightly higher frequency (2.4 percent); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more, except during November when flows are lower by 10 percent or more with slightly higher frequency (1.2 percent); and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

In consideration of the general similarity of impact indicators to all lifestages of steelhead in the Delta under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Green Sturgeon in the Delta Region

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

a) Generally similar juvenile rearing and emigration conditions (year-round) due to generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during November when flows are lower by 10 percent or more with slightly higher frequency (2.4 percent).

In consideration of the general similarity of impact indicators to all lifestages of green sturgeon in the Delta under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

Splittail in the Delta Region

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide the following:

a) Similar adult spawning and embryo incubation conditions (February through May) due to generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more.

b) Similar juvenile rearing and emigration conditions (April through July) due to generally equivalent net changes in mean monthly Yolo Bypass outflow of 10 percent or more.

In consideration of the general similarity of impact indicators to all lifestages of splittail in the Delta under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

<u>Recreational Fisheries (White Sturgeon, American Shad and Striped Bass) in the Delta Region</u>

Relative to the No Action/No Project future condition, the Alternative 2 Forecast-informed Operations future condition scenario would be expected to provide generally similar egg and larval conditions for American shad and striped bass; and generally similar juvenile rearing and emigration conditions for white sturgeon.

In consideration of the general similarity of impact indicators to all lifestages of American shad, striped bass and white sturgeon in the Delta under the Alternative 2 future condition relative to the No Action/No Project future condition, no further evaluations are necessary.

1.1.5 Water Supply

This section discusses water supply comparisons between Alternative 2 – Forecast-informed Operations and No Action/No Project while using a future level of water demand condition in the CalSim II models. Significance criteria for water quality effects would be the same as discussed in section 4.7.2.

General Observations

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.

As shown in Table 5-46, model outputs for storage in Folsom Reservoir for Alternative 2, Future Level of Demand are higher than for the No Action future condition. The top-of-conservation-pool storage volumes computed from inflow-forecast-based operations and selective basin wetness corrections to the spring refill curve for Alternative 2, Future Level of Demand, prescribe higher maximum allowable storages in November through April months than for the No Action Alternative. As a result, the model is storing more water in these months and releasing it in summer. Releases in November through February are reduced accordingly. Storage in Folsom Reservoir is higher in May and September, implying better availability of water to meet summer water delivery obligations and higher Folsom Reservoir releases through the summer.

October mean monthly flows below Nimbus Dam are higher, relative to the basis of comparison. Flows in November and December show a decrease of 3 to 4 percent for the long-term average value; however, most of these decreases occur in the high-flow ranges and in wet and above-normal water years, and there is a slight increase in flow for the low-flow ranges. Reduced flows are because of the higher storages in the Folsom Reservoir for the same months. Sacramento

River flows below Keswick Dam and at Rio Vista are similar for the two scenarios and meet the MFR.

Table 1-23. Storages, Flows, and MFR for Alternative 2, Future Level of Demand vs. No Action.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Generalized Results
End of Month Storages (May and September)		
Folsom	Monthly exceedance distributions – Folsom storages as noted; Similar storages for others.	May and September – higher storages.
Shasta		✓
Oroville		✓
Mean Monthly Flows and MFR Compliance (October through December)		
Lower American River below Nimbus Dam	Monthly exceedance distributions – Similar flows; MFR met.	October - very small increases in flows. November – slight increases in below 2,000-cfs flow range; decreases in flows for 3,000–6,000-cfs range. December – increase in flows below 3,000-cfs range.
Sacramento River below Keswick Dam		✓
Sacramento River at Rio Vista		✓

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

As shown in Table 5-47, because of the higher Folsom Reservoir storages and changes in the allocations in the With-Project Alternative, Future Level of Demand CalSim II model, long-term average annual deliveries show a slight increase (10-TAF increase for long-term average of total CVP deliveries and 2 TAF decrease for long-term average of SWP deliveries). It is notable that the critical years average annual CVP deliveries show a slight increase of 4 TAF.

Deliveries to lower American River purveyors are generally similar with some increases and decreases (–240 AF to +1060 AF, about 1 to 8 percent) for the long-term average (Table 5-48). Largest of these long-term average changes occur in FWTP deliveries with decreases in February and August and increases in March through June. This is likely because of the increased storages in spring months. It should be noted that the minimum deliveries for Placer County Water Agency Pumping Plant for August show a reduction of 2,572 AF. Upon further investigation of the CalSim models, these changes in minimum deliveries occur in year 1977, a drought year that usually causes anomalies in the model. In August 1977, modeled Folsom Reservoir storage reaches dead pool, and therefore a difference in top-of-conservation-pool storage volume of 3 TAF that started in October 1975 causes this difference in deliveries.

Based on the Folsom Pumping plant and FWTP deliveries data for water delivery evaluation, 8 out of the 10 metrics were the same for the two models; 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 (Table 5-49).

Table 1-24. CVP/SWP Deliveries for Alternative 2 vs. No Action/No Project future condition.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Generalized Results**					
CVP/SWP Deliveries							
Delivery Type	Long-term and water year type average annual deliveries – Generally similar long-term average annual deliveries and generally similar average annual deliveries most of the time during all water year types, but with some slight increases and/or decreases.	**Long-term and Water Year Type Average Annual Deliveries**					
		Long-term	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
CVP M&I NOD		✓	1 TAF increase	3 TAF increase	1 TAF decrease	2 TAF decrease	1 TAF increase
CVP agricultural NOD		3 TAF increase	5 TAF increase	9 TAF increase	3 TAF increase	✓	✓
CVP settlement NOD		✓	✓	1 TAF decrease	✓	✓	✓
CVP refuges NOD		✓	✓	✓	✓	✓	✓
CVP M&I SOD		✓	1 TAF increase	✓	✓	✓	✓
CVP agricultural SOD		6 TAF increase	5 TAF increase	14 TAF increase	7 TAF increase	2 TAF increase	4 TAF increase
CVP exchange Contractors		✓	✓	✓	✓	✓	✓
CVP refuges SOD		✓	✓	✓	✓	✓	✓
Total CVP deliveries		10 TAF increase	12 TAF increase	24 TAF increase	10 TAF increase	3 TAF increase	4 TAF increase
SWP contractors		2 TAF decrease	5 TAF decrease	2 TAF decrease	2 TAF increase	2 TAF decrease	1 TAF increase

Note: "✓" refers to the same value of the evaluation metric for both scenarios.
NOD = North of Delta
SOD = South of Delta

Table 1-25. American River Purveyors Deliveries for Alternative 2, Future Level of Demand vs. No Action.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Results**		
American River Purveyors Deliveries				
Purveyor Delivery Type	Long-term monthly average, maximum and minimum deliveries – Generally similar deliveries with some increases and decreases as noted.	**Monthly Average, Maximum, and Minimum Deliveries**		
		Average	**Maximum**	**Minimum**
American River Pump Station deliveries to PCWA		31 AF decrease for August.	✓	2572 AF decrease for August.
City of Folsom deliveries		Same for November through February; Up to 2 AF increase for all other months.	22 AF increase for April.	1 AF decrease for July.
City of Roseville deliveries		Up to 6 AF increase for all months.	✓	✓
San Juan Water District deliveries		Up to 4 AF increase for all months.	80 AF increase for April.	2 AF decrease for July.
SSWD deliveries from Folsom		N/A	N/A	N/A
Folsom Pumping Plant deliveries		Up to 23 AF increase for all months.	✓	10 AF decrease for July.
FWTP deliveries		Up to 1056 AF increase for March through June, September, November, and December. Up to 241 AF decrease in February and August.	1,763 and 485 AF increase in March and April.	✓
Freeport Regional Water Project deliveries		Up to 20 AF of increase in June through September, and November. Up to 51 AF decreases in February through May.	Up to 24 AF increase in March and September. 5 AF decrease in May.	13 AF and 23 AF increase in June and July. 2 AF and 20 AF decrease in February and March.
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.

SSWD deliveries in CalSim II are included in PCWA's diversion from the American River Pump Station for the FLD scenarios because: (1) SSWD does not have a long-term Warren Act contract for diversion from Folsom Reservoir; and (2) SSWD's surface water supplies are from PCWA's water right.

Table 1-26. American River Diversions and Consistency Formulation for Alternative 2, Future Level of Demand vs. No Action.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Results
American River Diversions - Folsom Pumping Plant and E.A. Fairbairn Water Treatment Plant (Consistency Formulation)		
Folsom Pumping Plant - April	Total occurrences where delivery fell below 95 percent of POR average of all Aprils – Same for both scenarios.	✓
Folsom Pumping Plant - April	Maximum number of years for any water year type where delivery fell below 95 percent of POR average of all Aprils – Same for both scenarios.	✓
Folsom Pumping Plant - July	Total occurrences where delivery fell below 95 percent of POR average of all Julys – Not the same for both scenarios.	✓
Folsom Pumping Plant - July	Maximum number of years for any water year type where delivery fell below 95 percent of POR average of all Julys – Same for both scenarios.	✓
FWTP - April	Total occurrences where delivery fell below 95 percent of POR average of all Aprils – Not the same for both scenarios.	51 for No Action/No Project future condition. 46 for With-Project Alternative, Future Level of Demand.
FWTP - April	Maximum number of years for any water year type where delivery fell below 95 percent of POR average of all Aprils – Same for both scenarios.	16 for No Action/No Project future condition. 15 for With-Project Alternative, Future Level of Demand.
FWTP - July	Total occurrences where delivery fell below 95 percent of POR average of all Julys – Same for both scenarios.	✓
FWTP - July	Maximum number of years for any water year type where delivery fell below 95 percent of POR average of all Julys – Same for both scenarios.	✓
Folsom Pumping Plant	Minimum diversion for any month – Same for both scenarios.	✓
FWTP	Minimum diversion for any month – Same for both scenarios.	✓

Note: "✓" refers to the same value of the evaluation metric for both scenarios.

As summarized in Table 5-50, summer months MFRs in the lower American River are slightly higher than for No Action. October through December MFRs are higher than for No Action. As described earlier in the previous comparisons, MFR flows in the American River below Nimbus Dam are based on the regulated hydrology of the respective models. Changes in the Folsom Reservoir storages are causing changes in the MFR.

Table 1-27. American River MFR for Summer and Fall Months for Alternative 2, Future Level of Demand vs. No Action.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Generalized Results
American River Minimum Release Requirement in Summer and Fall Months		
June through September	Monthly exceedance distributions – Similar MFR.	Slight increase in MFR for July through September
October through December	Monthly exceedance distributions.	MFR increases.

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

1.1.6 Hydropower

This section discusses hydropower comparisons between Alternative 2 – Forecast-informed Operations and No Action/No Project while using a future level of water demand condition in the CalSim II model. Significance criteria for hydropower effects would be the same as discussed in section 4.4.2.

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. Table 5-51 summarizes the results of the long-term and driest period hydropower effects evaluation. Table 5-52 summarizes the evaluation parameters and metrics for each monthly period. 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.

Evaluation of Effects

The CVP and SWP facilities' capacity and generation differences would be due in part to changes to the spring-refill WCD operations under Alternative 2, Future Level of Demand whereby the CalSim II model predicts higher maximum allowable storages in November-through-April and therefore storing more water in these months and releasing it in summer through early fall. The November-through-February releases are reduced accordingly in the CalSim II model. The resulting storage in Folsom Reservoir would be higher in May and September.

Due to the changes in the Folsom Reservoir operations and its effects on storages and releases for other CVP/SWP reservoirs, CVP energy generation, capacity, energy use, and net generation at load center would slightly increase, while the SWP facilities would show no change or decrease slightly for these parameters. The net generation at load center for SWP facilities would increase slightly. The magnitudes of these changes would be small, typically a difference of 1 percent or less.

Table 1-28. CVP-SWP Hydropower Summary for Alternative 2, Future Level of Demand vs. No Action/No Project Future Level of Demand.

Evaluation Parameters		**Long Term**			**Driest Periods**		
	Metric	**Change**		**percent Difference**	**Change**		**percent Difference**
CVP Long-Term and Driest Periods							
Increase or no change relative to the J604 FLD condition. Magnitude of changes are small, typically representing a difference of 1 percent or less. Driest Period shows slightly greater variability, but difference typically less than 1 percent.	Capacity	3	GWh	√	4	GWh	√
	Energy Generation	19	MW	√	-5	MW	√
	Energy Use	3	GWh	√	2	GWh	√
	Foregone Energy	-6	GWh	2 percent	0	GWh	√
	Net Generation	16	GWh	√	-7	GWh	√
SWP Long-Term and Driest Periods							
Slight increase relative to the J604 FLD condition. Magnitude of changes are small, typically representing a difference of 1 percent or less. Driest Period shows slightly greater variability, but difference typically less than 1 percent.	Capacity	0	GWh	√	0	GWh	√
	Energy Generation	-2	MW	√	5	MW	√
	Energy Use	-4	GWh	√	16	GWh	√
	Foregone Energy	0	GWh	√	1	GWh	√
	Net Generation	2	GWh	√	-11	GWh	√
Note: "√" refers to less than 1 percent difference in the evaluation metric for both scenarios or improvement relative to J604 FLD condition							

Table 1-29. CVP-SWP Hydropower Monthly Summary for Alternative 2, Future Level of Demand vs. No Action/No Project Future Level of Demand.

Evaluation Parameters	**Long Term (Max Decrease)**			**Long Term (Max Increase)**			**Driest Periods (Max Decrease)**			**Driest Periods (Max Increase)**		
	Change		**percent Difference**	**Change**		**percent Difference**	**Change**		**percent Difference**	**Change**		**percent Difference**
CVP Monthly Periods												
Energy Generation	-2	GWh	< 1 percent February	6	GWh	2 percent April	-10	GWh	5 percent September	4	GWh	2 percent April
Capacity	All Months Increase			6	MW	< 1 percent February	-2	MW	< 1 percent January	9	MW	< 1 percent September
Energy Use	-1	GWh	2.4 percent April	1	GWh	1 percent June	-3	GWh	4 percent July	2	GWh	3 percent August
Net Generation	-3	GWh	< 1 percent February	6	GWh	2 percent April	-9	GWh	7 percent September	4	GWh	1 percent May
SWP Monthly Periods												
Energy Generation	-1	GWh	1 percent November	1	GWh	< 1 percent May	-1	MW	1 percent February	2	GWh	2 percent October
Capacity	-3	MW	1 percent November	3	MW	< 1 percent January	-6	MW	2 percent November	4	GWh	1 percent January
Energy Use	-2	GWh	1 percent February	2	GWh	< 1 percent August	0	GWh	All Months Increase	5	GWh	2 percent October
Net Generation	-2	GWh	< 1 percent August	2	GWh	1 percent February	0	GWh	All Months Increase	3	GWh	1.5 percent October

1.1.7 Recreation

This section discusses comparisons between recreation conditions under Alternative 2 – Forecast-informed Operations and No Action/No Project while using a future level of water demand condition in the CalSim II model. Significance criteria for recreation effects would be the same as discussed in section 4.9.2.

Folsom Reservoir

The upper threshold of significance at an elevation of 466 feet would likely be met or exceeded more frequently with Alternative 2 future condition than with the No Action Alternative future condition in May through July (Table 5-53). The lower threshold of significance at elevation 435 feet would be met or exceeded more frequently with Alternative 2 future condition relative to the No Action future condition in every month except August and September (up to 4.8 percent less frequently).

Table 1-30. Key Reservoir Threshold Difference between the Alternative 2 Future Condition and the No Action Future Condition Probability of Exceedance.

Key Reservoir Elevations **Elevation (ft.)**	**Upper Threshold** **466**	**Lower Threshold** **435**
May	0.1 percent	0.8 percent
June	2.0 percent	0.3 percent
July	0.2 percent	1.1 percent
August	*	–1.7 percent
September	*	–4.8 percent

Note: * Threshold of significance is not crossed.

The thresholds of significance for the five boat ramps that provide access for on-lake recreation on Folsom Reservoir would generally be exceeded more frequently with the Alternative 2 future condition than with the No Action future condition (Table 5-54). Four of the five boat ramps would experience up to 3 months with a lower probability with the Alternative 2 future condition relative to the No Action future condition.

Table 1-31. Boat Ramp Access Threshold Difference between the Alternative 2 Future Condition and No Action future condition Probability of Exceedance.

Minimum Boat Ramp **Elevation (ft.)**	**Beal's Point** **420**	**Dike 8** **405**	**Brown's Ravine Main** **395**	**Hobie Cove** **375**	**Granite Bay** **360**
May	–0.5 percent	–0.6 percent	0.0 percent	0.0 percent	*
June	–1.5 percent	0.7 percent	0.0 percent	0.0 percent	–0.1 percent
July	–0.7 percent	0.7 percent	0.2 percent	0.0 percent	0.0 percent
August	3.1 percent	0.0 percent	1.5 percent	0.4 percent	0.5 percent
September	4.1 percent	0.3 percent	2.7 percent	–0.2 percent	1.0 percent

Note: * Threshold of significance is not crossed.

The majority of the upper and lower thresholds of significance for the two primary swimming locations would be exceeded less frequently with the Alternative 2 future condition than with the No Action future condition (Table 5-55). Nine of the 20 thresholds of significance (Granite Bay Oak Point swim beach in September) would be exceeded more frequently with the Alternative 2 future condition than with the No Action future condition.

Table 1-32. Reservoir Swim Access Threshold Difference between the Alternative 2 Future Condition and No Action Future Condition Probability of Exceedance.

Swim Beaches Minimum Elevation (ft.)	Granite Bay – Main Swim Beach 450	Granite Bay – Oak Point Swim Beach 440	Rattlesnake Bar – Jet Ski Cove 425	Rattlesnake Bar– Vista Shoreline Access 420
May	7.9 percent	3.5 percent	–1.5 percent	–0.5 percent
June	3.0 percent	1.4 percent	–0.6 percent	–1.5 percent
July	–3.1 percent	0.7 percent	–1.1 percent	–0.7 percent
August	–3.4 percent	–2.1 percent	5.2 percent	3.1 percent
September	–9.3 percent	–7.0 percent	0.2 percent	4.1 percent

Lower American River

The upper threshold of significance (the maximum optimal flow) for the lower American River would be met or exceeded at the same or higher frequency with the Alternative 2 future condition relative to the No Action future condition, except for July when it would be exceeded at a lower frequency (0.3 percent less frequently). Notably, the threshold would not be crossed in August and September.

Both the minimum optimal and minimum adequate flow thresholds of significance (3,000 cfs and 1,750 cfs, respectively) for the lower American River would be met or exceeded at a higher frequency with the Alternative 2 future condition relative to the No Action future condition, except in August for the minimum optimal flow (3,000 cfs) when it would be met or exceeded at a lower frequency (0.2 percent less frequently) and in July for the minimum adequate flow (1,750 cfs) when it would be met or exceeded at a lower frequency (2.4 percent less frequently) (Table 5-56).

Table 1-33. Lower American River Recreation Threshold Difference between the Alternative 2 future condition and No Action Future Condition Probability of Exceedance.

Lower American River Thresholds of Significance Flows (cfs)	Maximum Optimal 6,000	Minimum Optimal 3,000	Minimum Adequate 1,750
May	0.3 percent	2.0 percent	4.5 percent
June	3.1 percent	2.8 percent	5.3 percent
July	–0.3 percent	5.5 percent	–2.4 percent
August	*	–0.2 percent	5.1 percent
September	*	0.3 percent	2.1 percent

Note: * Threshold of significance is not crossed.

Shasta Reservoir

As indicated in Table 5-57, the upper threshold of significance, the optimum recreation WSE, at elevation 1,020 feet would be met or exceeded at the same or higher frequency in every month with the Alternative 2 future condition relative to the No Action future condition. The lower shoreline recreation WSE threshold of significance at elevation 1,007 feet would be met or exceeded at the same or lower frequency of time in every month with the Alternative 2 future condition relative to the No Action future condition except for August. The lowest threshold of significance, the minimum recreation WSE, at elevation 941 feet would be met or exceeded at the same or higher frequency in May through July with the Alternative 2 future condition relative to the No Action future condition.

Table 1-34. Key Shasta Reservoir Threshold Difference between the Alternative 2 Future Condition and No Action Future Condition Probability of Exceedance.

Key Reservoir Thresholds Elevation (ft.)	Optimum Shoreline Recreation 1,020	Lower Shoreline Recreation 1,007	Minimum Recreation 941
May	0.0 percent	–0.3 percent	0.1 percent
June	1.0 percent	0.0 percent	0.8 percent
July	1.0 percent	–0.1 percent	0.2 percent
August	0.0 percent	0.1 percent	–0.1 percent
September	0.0 percent	–1.6 percent	–0.03 percent

Sacramento River

The mean monthly flows on the Sacramento River below Keswick Dam would drop below the threshold of significance of 5,000 cfs during May and September. In May and September, the mean monthly flow probability of exceedance would not change with the With-Project alternative relative to the No Action future condition. The threshold of significance would not be crossed for the remainder of the recreation season.

The mean monthly flow on the Sacramento River at the Freeport gage would not drop below the threshold of significance of 5,000 cfs during the recreation season.

Evaluation of Effects

Folsom Reservoir

The Alternative 2 future condition would have minimal negative effects relative to the No Action future condition for the upper threshold of significance for Folsom Reservoir. The maximum water surface elevation (466 feet) would be met more frequently in May through July. Given that this threshold would not be exceeded, this effect is functionally equivalent. The Alternative 2 future condition would have a positive effect on the lower threshold of significance (435 feet). For May through July, the threshold would be met or exceeded at a greater frequency in all months, which equates to an increase in the amount of time for recreation activities compared to the No Action future condition. For August and September, the lower threshold of significance would experience a negative effect with the Alternative 2 future condition relative to the No Action future condition (up to 4.8 percent less).

Overall, the Alternative 2 future condition would have a positive effect in relation to the minimum thresholds for all of the reservoir boat ramps with an increase in the probability of exceedance in most months (up to a 4.1percent increase), which equates to an increase in the amount of time that the boat ramps would be usable. For the swim beaches, the Alternative 2 future condition would have a slightly positive effect in relation to the minimum thresholds with 11 of the 20 thresholds showing an increase in the probability of exceedance or an increase in the amount of time that the swim beaches would be usable.

Lower American River

Overall, the lower American River would experience positive effects with the Alternative 2 future condition relative to the No Action future condition for the minimal optimum and adequate flows, with the minimum optimal and adequate flows being exceeded more frequently and the maximum optimal flow being exceeded less frequently. Both of these scenarios equate to an increase in the amount of time above the minimum thresholds (1,750 and 3,000 cfs) and below the maximum threshold (6,000 cfs).

Shasta Reservoir

The differences in the probability of exceedance for the Shasta Reservoir elevations between the Alternative 2 future condition and the No Action future condition for all three thresholds are functionally equivalent with differences no higher than 1.6 percent and most at or near no change.

Sacramento River

The thresholds of significance for the Sacramento River would be exceeded at similar percentages for the two conditions for May and September below Keswick Dam. The remainder of the thresholds of significance for the Sacramento River at Keswick Dam and the Freeport gage would not crossed, a result that gives no indication of the benefit or detriment for either condition in this comparison.

1.1.8 Cultural Resources

This section discusses differences in effects to cultural resources between Alternative 2 – Forecast-informed Operations and No Action/No Project while using a future level of water demand condition in the CalSim II models. Significance criteria for cultural resources effects would be the same as discussed in section 4.10.2.

Cultural resources site specific effects cannot be determined that this time. Due to the large geographic area of the project the identification, NRHP eligibility evaluation, alternative effects evaluation, and potential mitigation of adverse effects will be determined through the process of execution of the PA.

Appendix I: Fixed-400,000 af Flood Storage Operation

1.0 FIXED-400,000 AF FLOOD STORAGE OPERATION

This operation set provides a comparison of operations before the SAFCA/Reclamation interim agreement in 1995 to the proposed operation for the Manual Update. As discussed in section 2.2, although USACE still prescribes operational decisions based on the 1986 WCD, the more conservative flood risk operation reflected in the SAFCA/Reclamation interim agreement is what Reclamation operates to today.

1.1 Comparison of Alternative 2 – Forecast-informed Operations to Cumulative Past Operation - Fixed-400,000 af Flood Storage

1.1.1 Hydrology and Hydraulics

This section compares period of record hydrology and evaluation of hydraulic effects between Alternative 2 – Forecast-informed Operations and the 1986 Fixed-400,000 af Flood Storage Operations scenario using an existing level of water demand in the CalSim II model. Significance criteria for hydrology and hydraulics effects would be the same as discussed in section 4.2.2.

When comparing the Alternative 2 modeled daily discharge frequencies to the Fixed-400,000 af operation, there was a slight increase in the discharge frequency of the 10,000 cfs to 30,000 cfs range and in the 70,000 cfs to 90,000 cfs range, as shown in Table 5-1. The modeling also indicates a slight decrease in discharge frequency in the 90,000 cfs to 115,000 cfs range. Overall, however, Alternative 2 – Forecast-informed operation discharges and effects on channel stability would be considered similar to those under the Fixed-400,000 af flood storage operation.

As Figure 5-1 shows, only 1 percent of the 82-year period of record are the flows greater than 20,000 cfs. In addition, flow exceedance probabilities appear to be much closer under these two operation scenarios than under the No Action/No Project, deviating less than 0.5 percent of the time. For the vast majority of the time, flows are within channel and less than 20,000 cfs. 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.

Table 1-1. Modeled Average Daily Discharge Frequencies for Fixed-400,000 af Flood Storage Operation and Alternative 2 – Forecast-informed Operation

Discharge (cfs)	Fixed-400,000 af Flood Storage Operation Discharge Frequencies (# of days)	Alternative 2 – Forecast-informed Operation Discharge Frequencies (# of days)
< 10,000	28329	28312
10,000 to < 20,000	953	976
20,000 to < 30,000	139	147
30,000 to < 40,000	64	53
40,000 to < 50,000	27	28

50,000 to < 60,000	19	12
60,000 to < 70,000	8	8
70,000 to < 80,000	3	5
80,000 to < 90,000	1	4
90,000 to < 100,000	2	1
100,000 to 115,000	6	3

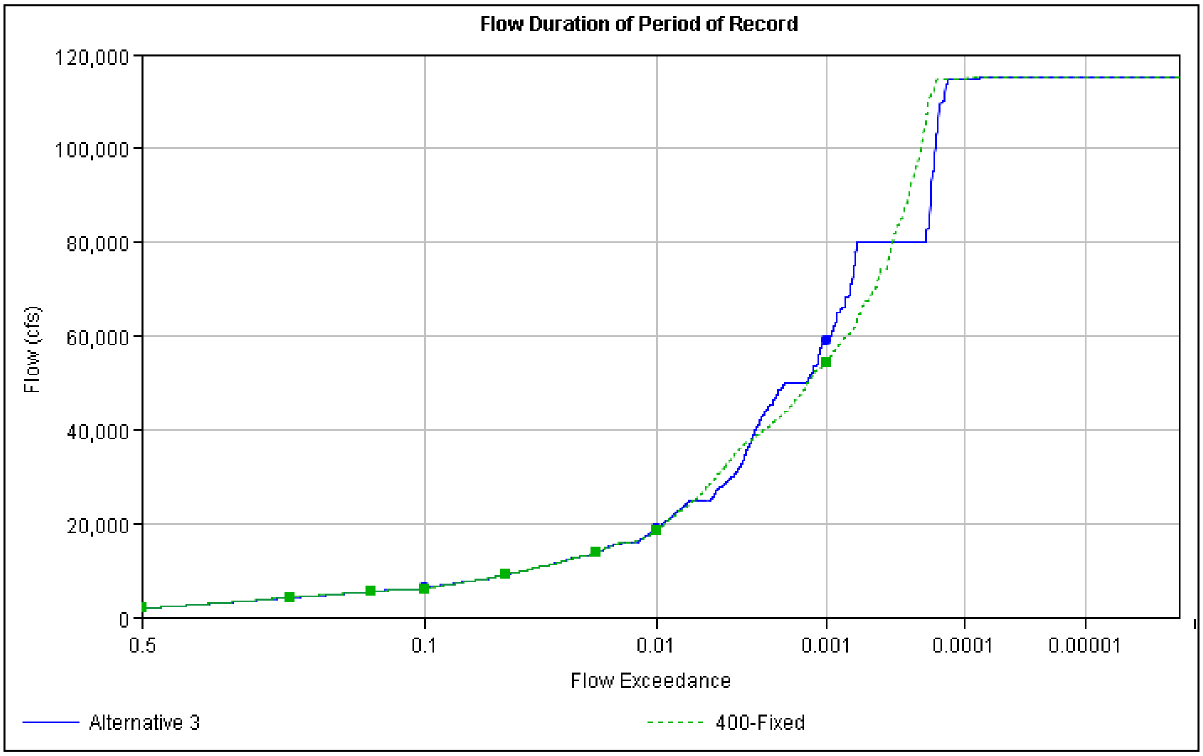


Figure 1-1: Probability of Flow Exceedance for Alternative 2 and Fixed-400,000 af Condition

As shown in Figure 4-6, 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 the Fixed-400,000 af Flood Storage operation (E503p). The modeling results that Figure 4-6 depicts demonstrates that flood risk reduction for the Sacramento area is improved the most from Alternative 2 than any of the other modeled Folsom Dam operation scenarios. In particular, the 1 in 200 AEP event would be contained within the existing channel of the lower American River. For the Fixed-400,000 af flood storage operation, the levees would be overtopped before the 1 in 150 AEP event.

Considering more frequent events, the regulated flow-frequency curves in Figure 4-6 indicate that Alternative 2 (J602F3) annual maximum peak flows track closely with the Fixed-400,000 af flood storage operation (E503P) up to the 1/7 AEP, with some minor increases in flows to the 1/15 AEP. However, after that frequency, flows would be consistently less than or equal to modeled flows for the Fixed-400,000 af operation. In general, flows for more frequent events in the lower American River under Alternative 2 would be consistent with those expected under the

Fixed-400,000 af flood storage operation, while flows for larger events would in general be reduced for Alternative 2.

Channel Stability and Sediment

Since modeled Folsom Dam releases are consistent between Alternative 2 and Fixed-400,000 af operations, the channel widening and degradation/aggradation trends discussed in Section 4.2 would similarly apply to the Fixed-400,000 af operation as well.

Folsom Lake Bank Erosion

The percentage of days with water surface elevations above 466 feet would be lower with Alternative 2 forecast-informed operations (0.27 percent) than with the Fixed-400,000 af flood storage operation (0.88 percent). The percentage of days with water surface elevations below 395 feet would also be slightly lower with Alternative 2 (8.34 percent) than with the Fixed-400,000 af operation (8.24 percent). This data is illustrated in Figure 5-2.

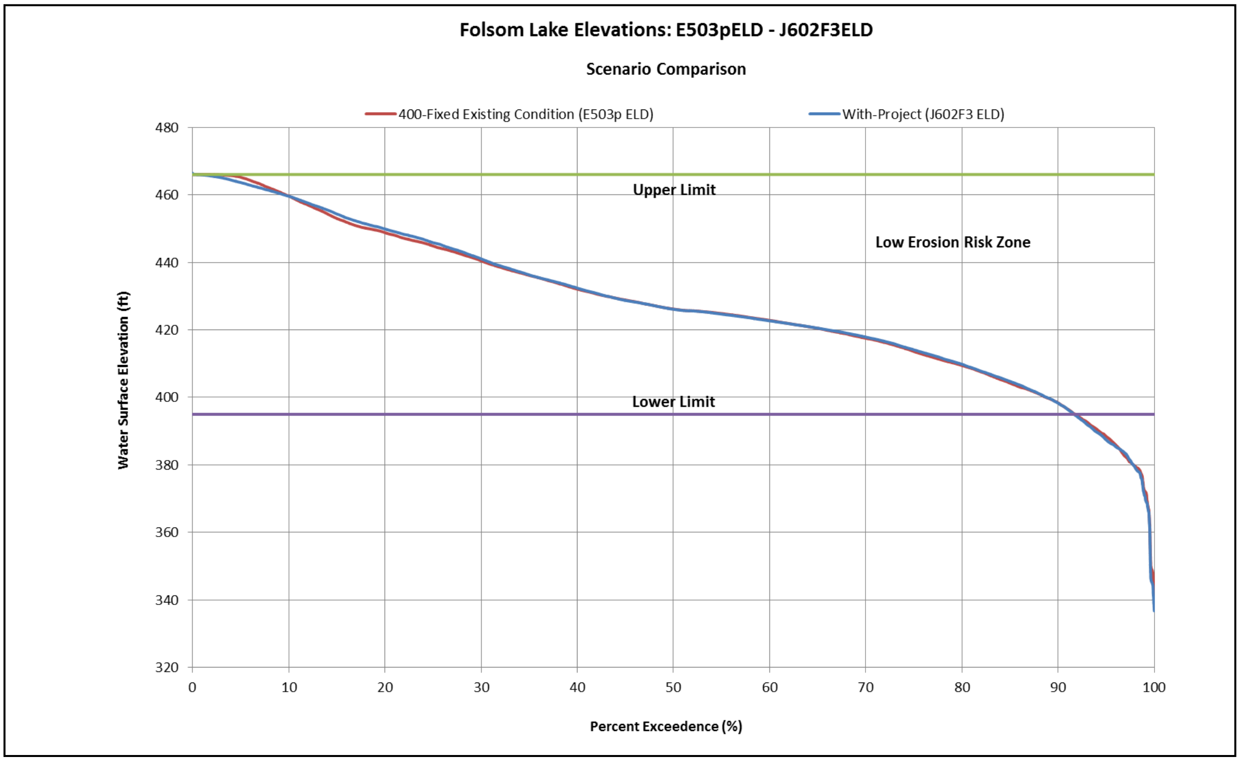


Figure 1-2. Folsom Lake Pool Levels Comparison of Fixed-400,000 af Flood Storage Operation and Alternative 2 - Forecast-informed Operations.

Based on the modeled period of record water surface elevations at Folsom Lake, bank erosion rates under Alternative 2 would be considered consistent with the Fixed-400,000 af operation.

1.1.2 Water Quality

This section discusses water quality comparisons between Alternative 2 – Forecast-informed Operations and the 1986 Fixed-400,000 af Flood Storage Operation using an existing level of water demand in the CalSim II model. Significance criteria for water quality effects would be the same as discussed in section 4.4.2.

General Observations

Delta water quality modeling indicates that, in general, the parameters show some differences between the Fixed-400,000 af flood storage operation and Alternative 2 Forecast-informed Operation, as summarized in Table 5-2.

Table 1-2. Differences in Delta Outflow, E/I Ratio, and X2 Location for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation.

Delta Outflow Summary of Results	Evaluation Parameters	Differences by Water Year Type					
		Long-term	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Long-term and water year type average Delta Outflow – Generally similar long-term average Delta outflows and generally similar average Delta outflow most of the time during all water year types (±2.0 percent).	Monthly Maximum Reduction	√	√	√	√	–2.0 percent	√
	Delta Outflow March–May	√	√	√	√	√	√
	Delta Outflow Objectives	NA	√	√	√	√	√
E/I Ratio Summary of Results	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Long-term and water year type average E/I Ratio – Generally similar long-term average and generally similar most of the time during all water year types. The maximum change seen is (±3.1 percent) in Critical year types.	E/I Ratio	√	√	–1.5 percent to +0.6 percent	√	–0.9 percent to +1.1 percent	–3.1 percent to +1.0 percent
X2 Location Summary of Results	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
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.	X2 Location (km)	Up to +0.1	–0.1 to 0.0	±0.1	±0.1	–0.1 to +0.2	–0.1 to 0.0
	X2 Location Count 81 km	NA	√	√	√	√	√
	X2 Location Count 74 km	NA	√	√	1	√	–1
	X2 Location Count 64 km	NA	√	√	√	1	√

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

Even though Alternative 2 - Forecast-informed Operations results show a maximum of 2 percent decrease in average monthly values for March of dry water years, the magnitude of differences in Delta outflow is within a range of ±0.4 percent for the full simulation period average monthly outflow. Long-term average March through May outflow shows a 0.1 percent reduction over the full simulation period with a maximum 0.8 percent reduction observed in dry water years.

Long-term average monthly E/I ratios show very little absolute difference for the two operations compared, in the range of ±0.1 percent. The relative difference ranges from -0.4 percent in average monthly values for January to 0.5 percent in average monthly values for March and June.

The X2 location in general shows minimal difference for the two operations. Long-term average X2 locations show no change for all months, except a 0.1 km increase in April. The water year type differences are typically ±0.1 km or less, with an exception of 0.2 km in average monthly values for April of dry water years. The maximum year-to-year change for each month in the 82-year period of record monthly change ranges from 0.1 km in February, July and August to1.2 km in April and May. Minimum monthly change observed ranges from –1.2 km in June to –0.1 km in April and August. Both operations have X2 locations greater than those required by September standards while meeting October X2 standards. Both operations meet the Delta outflow objectives for July through January. Results indicate that the scenarios are similar with respect to the fall X2 standards.

As shown in Table 5-3, with Alternative 2 the X2 moves east of the control point four more times than the Fixed-400,000 af flood storage operation: at the 74 km control point in two years in June of below-normal water year types, in one year in April of critical water year types, and in one year at the 64 km control point in April of dry water year types. A 1 km or greater shift was noted for Alternative 2 - Forecast-informed Operations three times: once in April and twice in May. Although Alternative 2 - Forecast-informed Operations would not be considered similar with Fixed-400,000 af flood storage operation, these differences would be considered less than significant because of the small increase in occurrences of these shifts. In addition, typical CVP/SWP operations would be managed to prevent those minor shifts in X2 location. Finally, the instances of those shifts occur during the modified spring refill at Folsom Dam under Alternative 2, presenting more potential conservation storage that could be applied to address these shifts in X2 as necessary by CVP/SWP operators.

Table 1-3. Difference in X2 Location Evaluation Parameters for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation

X2 Location	Evaluation Parameters	Change
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 April - June (±1.2 km).	Change in X2 Location Monthly Maximum Value km	0.1 east
	Change in X2 Location Monthly Minimum Value km	0
	X2 Location Relative Change km (Maximum)	1.2
	X2 Location Relative Change km (Minimum)	–1.2
	X2 Exceeding Fall Standards (Count)	√
	X2 Location Shift	**Count**
	> or = 1 km	3
	0.5–1.0 km	5
	0.25–0.5 km	7

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

For occurrences of salinity levels of greater than 150 mg/L at the CCWD Rock Slough intake, Alternative 2 model outputs show a decrease in one year in October of dry water years and in one year in September of critical water years compared to Fixed-400,000 af operations, as shown in Table 5-4. The salinity levels also show an increase in October of water year 1992 year, a critical water year. The maximum difference in salinity was an increase of 7.49 mg/L (from

218.92 mg/L to 226.41 mg/L). Although a difference of >3 mg/L means that Alternative 2 - Forecast-informed Operations is considered “not consistent” with Fixed-400,000 af flood storage operation outputs; however, typical CVP/SWP operations would be managed to prevent those minor shifts in salinity at the Rock Slough intake. Overall, effects to Rock Slough intake water quality under Alternative 2 operations would be less than significant when compared to the Fixed-400,000 af operation.

Table 1-4. Difference in Rock Slough Intake Salinity Parameters for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation

		Differences by Water Year Type					
Salinity Rock Slough	**Evaluation Parameters**	**Long-term**	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
Water year type Salinity at Rock Slough Intake – Generally similar long-term average and generally similar most of the time during all water year types.	Salinity Rock Slough (Change in Count >150 mg/L)	NA	√	√	√	o	1, o
	Salinity Rock Slough Max Change (>150 mg/L: 7.49 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.

1.1.3 Vegetation and Wildlife

This section discusses comparisons between vegetation and wildlife conditions, including special status plants and animals, for Alternative 2 – Forecast-informed Operations and the 1986 Fixed-400,000 af Flood Storage Operations scenario using an existing level of water demand in the CalSim II model. Significance criteria for vegetation and wildlife effects, including special status plants and animals, would be the same as discussed in section 4.5.2. A detailed analysis of potential differences in cottonwood growth and backwater recharge along the lower American River is provided in Appendix C.

Lower American River

The lower American River terrestrial assessment focuses on cottonwood growth and backwater recharge. This section includes a summary of the results.

Cottonwood Growth

Alternative 2 - Forecast-informed Operations results indicate that average daily lower American River flows under the 1,765-cfs threshold could decrease between 1.4 to 4.7 average days per month over a 4-consecutive-month period during the cottonwood growing season relative to Fixed-400,000 af flood storage operation. Relative to Fixed-400,000 af flood storage operation, this change would provide additional flows for cottonwood radial growth, resulting in a potential benefit during the cottonwood growing season. However, when looking at change under the 3,000-cfs threshold comparison, cottonwood maintenance and optimal growth would stay relatively consistent during the cottonwood growing season between Fixed-400,000 af flood storage operation and Alternative 2 - Forecast-informed Operations. 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 and Fixed-400,000 af flood storage operation.

Backwater Recharge

Relative to Fixed-400,000 af flood storage operation, Alternative 2 - Forecast-informed Operations would result in a minimal change in the average number of days when average daily flows are below the thresholds during winter and spring. Given the minimal difference between Fixed-400,000 af flood storage operation and Alternative 2 - Forecast-informed Operations, average daily flows are projected to remain essentially the same. As a result, there would be essentially no change to the magnitude and frequency of flows to substantially alter the existing backwater habitats dependent on the lower American River.

Folsom Reservoir

With Alternative 2 - Forecast-informed Operations, 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). Folsom Reservoir 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 lower than those with Fixed-400,000 af flood storage operation.

Special Status Plant and Animal Species

USFWS has designated the Parkway as critical habitat for VELB, and this species has been recorded in elderberry shrubs near backwater ponds along the lower American River. Sanford’s arrowhead, western pond turtle, and tri-colored blackbirds are special-status species known to occur in several backwater pond areas along the lower American River. However, these flows would not be reduced by sufficient magnitude and frequency to substantially alter existing water fluctuations (pond levels) and vegetation dependent on these ponds. Because effects on backwater habitats with Alternative 2 - Forecast-informed Operations would be less than significant, effects on elderberry shrubs and special-status species that depend on these habitats would also be less than significant.

Alternative 2 - Forecast-informed Operations 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 463 feet msl. 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.

1.1.4 Fisheries

This section discusses comparisons between conditions for fisheries under Alternative 2 – Forecast-informed Operations and the 1986 Fixed-400,000 af Flood Storage Operations scenario using an existing level of water demand in the CalSim II model. Significance criteria for fisheries effects would be the same as discussed in section 4.6.2.

Lower American River

For salmonid and other fish species, daily flow and water temperature model results on a monthly basis 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 potential 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.

Flows

Generally, flows are similar most of the time during October through February, lower more often during March, April, July, and August, and higher more often during May, June, and September, as described in more detail below, and shown in Table 5-5.

Long-term average monthly flows below Nimbus Dam under Alternative 2 – Forecast-informed operations relative to Fixed-400,000 af flood storage operation are generally similar during most months of the year, but are slightly higher during November, May, June, and September, and slightly lower during March, April, July, and August. Average monthly flows during wet water years are similar during most months, with slight reductions during February, April, July, and August, and slight increases during December, June, and September. Average monthly flows during above-normal water years are generally slightly higher during October, November, January, May, and September, are substantially higher during June, and are lower during December, March, April, July, and August. During below-normal water years, average monthly flows are higher during January, February, June, and August, and lower during October, March, April, and July. During dry water years, average monthly flows are higher during January, February, and May through August, and are substantially lower during March and April. During critical water years, average monthly flows are higher during November, January through March, and July, and are lower during October, December, April, and August. 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 Fixed-400,000 af flood storage operation demonstrate that flows are generally similar most of the time during October through February, but are lower more often during March, April, July and August, and are higher more often during May, June and September (Figures 5-3 through 5-14). In addition, flows generally increase during a portion of the lowest-flow conditions (i.e., lowest 25 percent of the monthly distribution) during October through March, and July. By contrast, flows decrease during the lowest-flow conditions during April.

Table 1-5. Average Monthly Flows below Nimbus Dam under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation

Long-term and Water Year Type Average Lower American River Flow below Nimbus Dam Under J602F3 ELD relative to E503p ELD

Analysis Period	Flow (cfs)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Long-term												
Full Simulation Period²												
400-fixed Existing Condition (E503p ELD)	2,172	3,074	3,477	4,596	4,945	4,348	3,686	3,622	3,507	3,518	2,468	2,577
With-Project (J602F3 ELD)	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	-18	32	20	14	31	-106	-162	58	191	-47	-88	34
Percent Difference³	-0.8	1.0	0.6	0.3	0.6	-2.4	-4.4	1.6	5.4	-1.3	-3.6	1.3
Water Year Types¹												
Wet												
400-fixed Existing Condition (E503p ELD)	2,352	3,838	5,812	8,564	8,428	7,150	5,826	6,156	5,924	3,607	3,485	3,836
With-Project (J602F3 ELD)	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	-17	26	80	-55	-100	50	-89	-3	287	-78	-252	39
Percent Difference³	-0.7	0.7	1.4	-0.6	-1.2	0.7	-1.5	0.0	4.8	-2.2	-7.2	1.0
Above Normal												
400-fixed Existing Condition (E503p ELD)	2,070	3,567	3,313	5,692	6,898	6,125	3,891	3,418	2,685	4,290	2,270	3,727
With-Project (J602F3 ELD)	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	24	167	-61	60	57	-134	-161	138	302	-312	-108	163
Percent Difference³	1.2	4.7	-1.8	1.1	0.8	-2.2	-4.1	4.0	11.2	-7.3	-4.8	4.4
Below Normal												
400-fixed Existing Condition (E503p ELD)	2,049	2,584	2,403	2,349	3,788	2,829	3,464	3,128	2,566	4,499	1,940	1,847
With-Project (J602F3 ELD)	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	-21	-11	20	39	145	-142	-261	24	245	-106	25	-13
Percent Difference³	-1.0	-0.4	0.8	1.7	3.8	-5.0	-7.5	0.8	9.5	-2.4	1.3	-0.7
Dry												
400-fixed Existing Condition (E503p ELD)	2,262	2,650	1,953	1,704	1,735	2,192	2,012	1,653	2,182	3,257	2,016	1,532
With-Project (J602F3 ELD)	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	-6	-17	5	60	80	-387	-249	165	59	74	43	12
Percent Difference³	-0.3	-0.6	0.3	3.5	4.6	-17.7	-12.4	10.0	2.7	2.3	2.1	0.8
Critical												
400-fixed Existing Condition (E503p ELD)	1,830	2,040	1,619	1,234	1,119	1,166	1,116	1,263	1,551	1,741	1,513	1,017
With-Project (J602F3 ELD)	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	-72	60	-32	47	107	28	-77	8	-13	154	-16	1
Percent Difference³	-3.9	2.9	-2.0	3.8	9.6	2.4	-6.9	0.6	-0.8	8.8	-1.1	0.1

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

2 Based on the entire simulation period

3 Relative difference of the monthly average

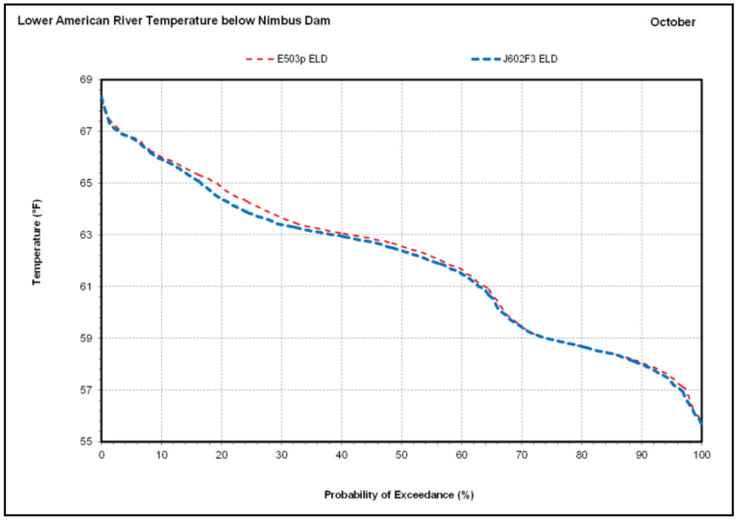


Figure 1-3. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for October under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation.

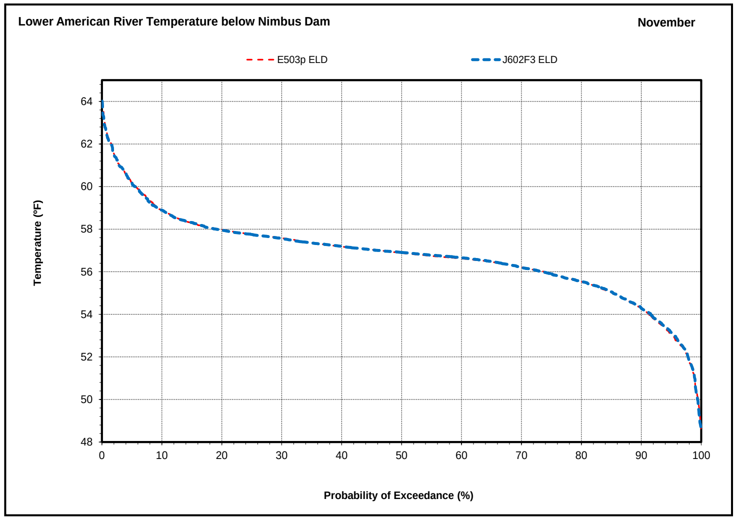


Figure 1-4. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for November under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation.

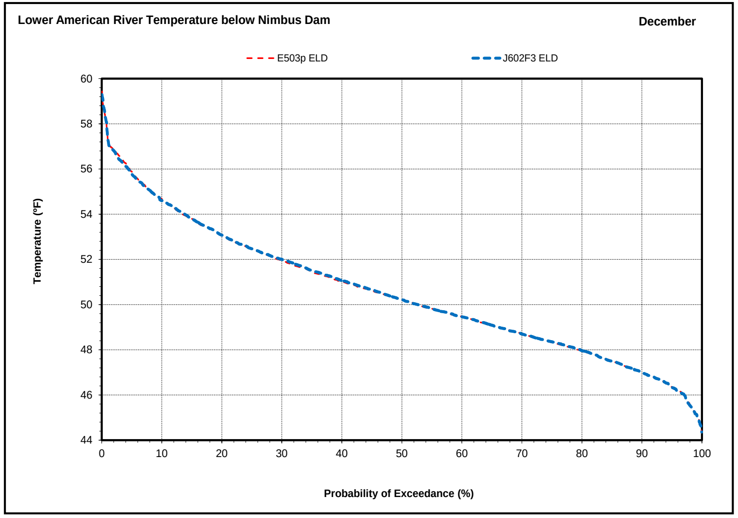


Figure 1-5. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for December under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation

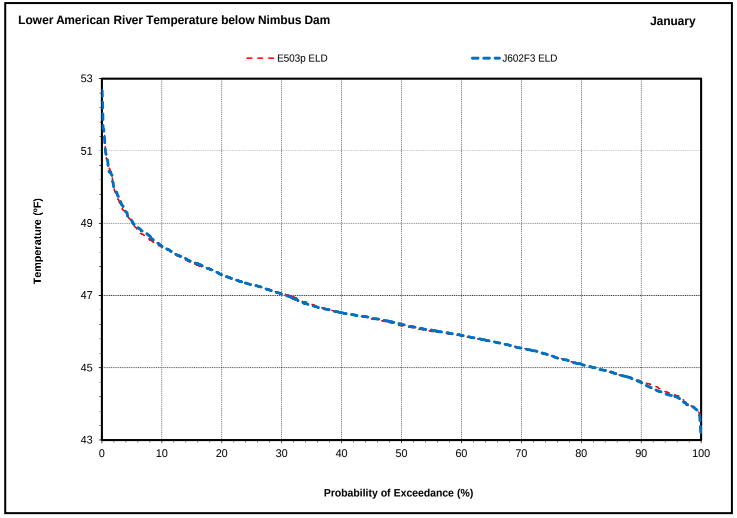


Figure 1-6. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for January under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation

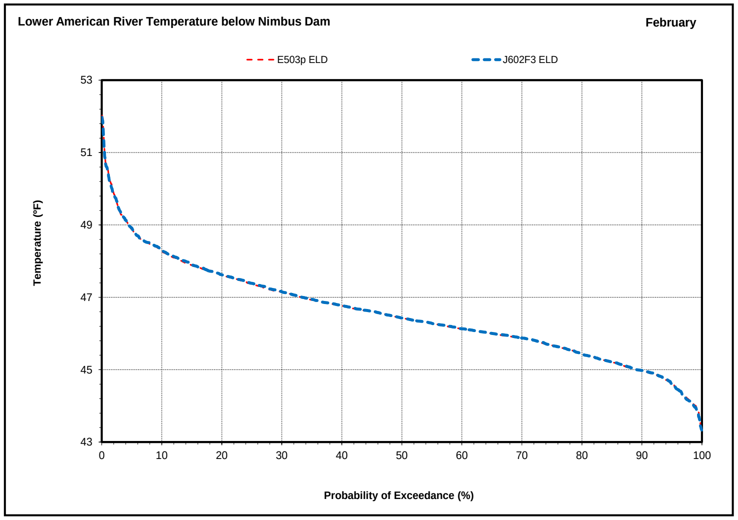


Figure 1-7. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for February under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation.

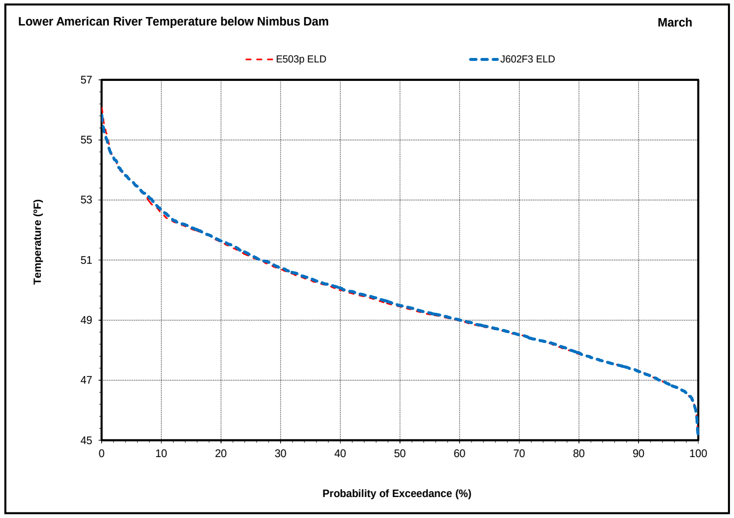


Figure 1-8. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for March under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation.

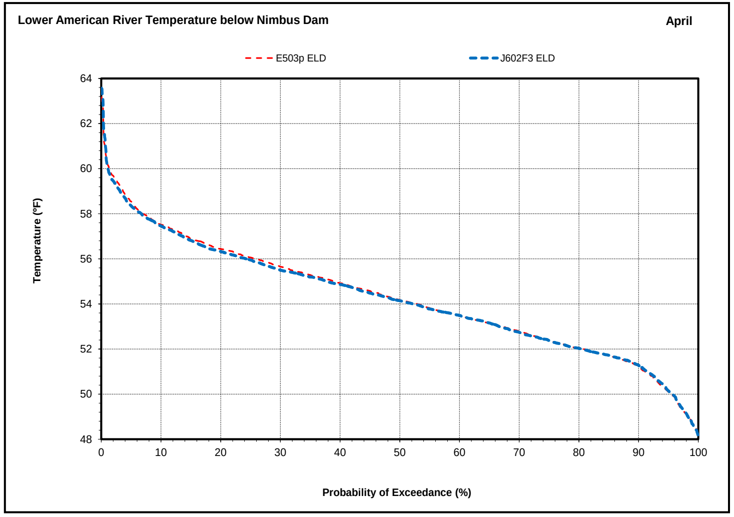


Figure 1-9. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for April under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation ELD.

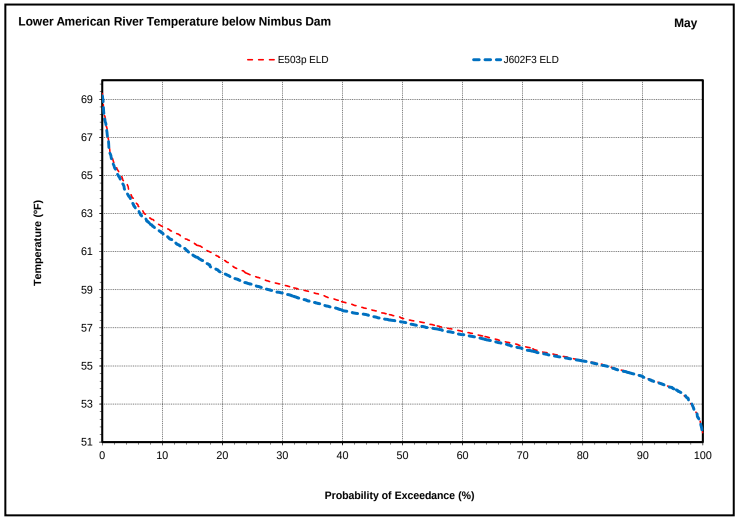


Figure 1-10. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for May under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation.

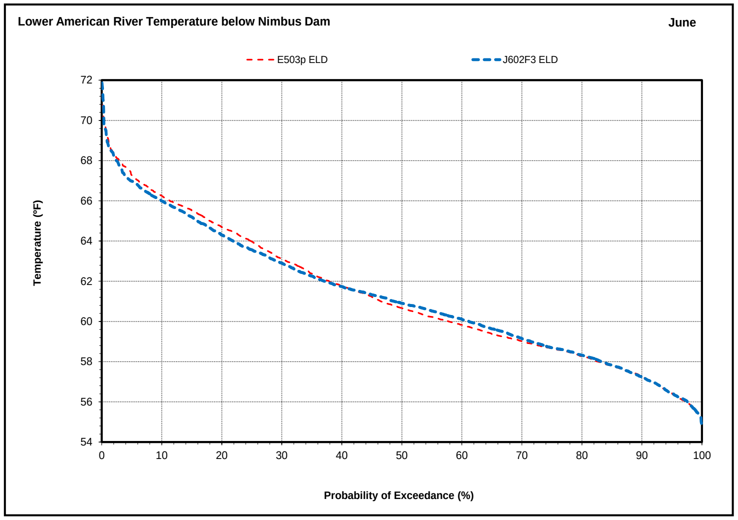


Figure 1-11. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for June under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation.

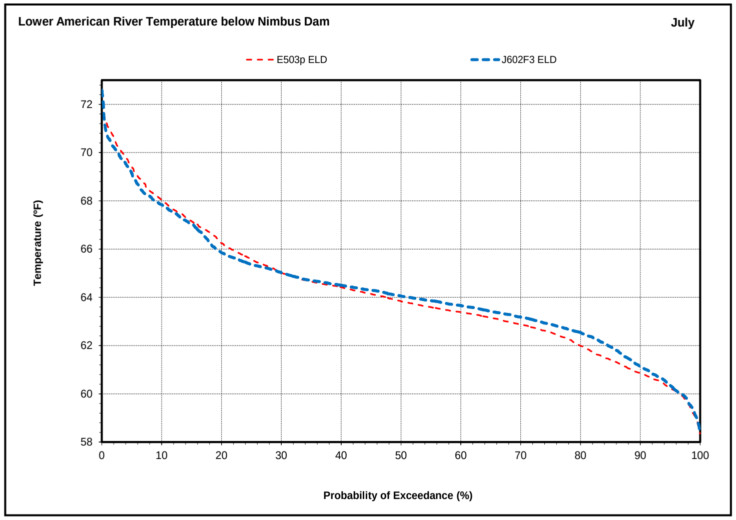


Figure 1-12. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for July under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation.

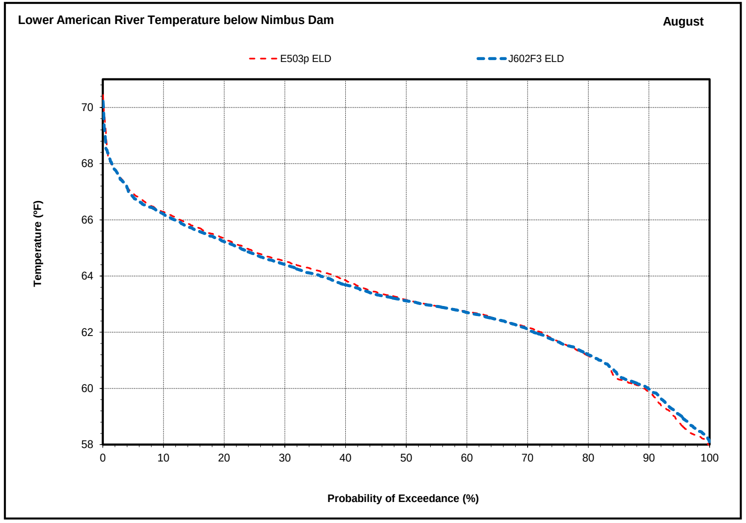


Figure 1-13. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for August under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation.

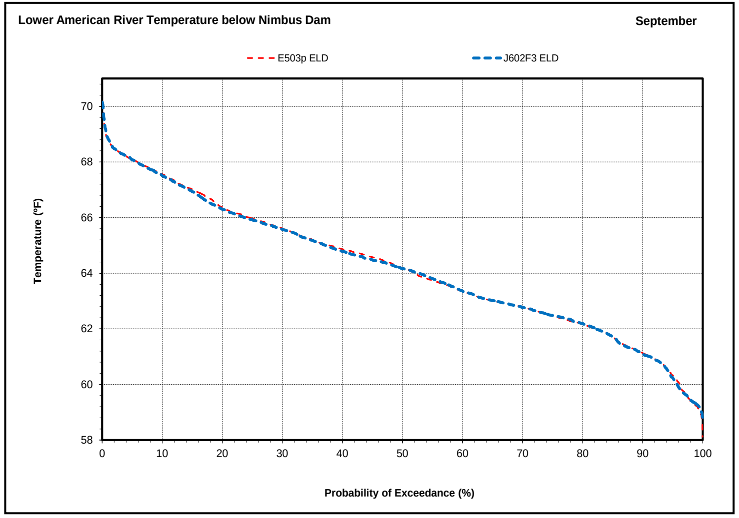


Figure 1-14. Lower American River Flow Probability of Exceedance Distributions below Nimbus Dam for September under Alternative 2 - Forecast-informed Operations and Fixed-400,000 af flood storage operation.

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.

Under Alternative 2 - Forecast-informed Operations relative to Fixed-400,000 af flood storage operation, net changes in flow at all three locations of 10 percent or more over the entire monthly distributions are generally similar (i.e., less than 5 percent) during August through January (Table 5-6). Flows increase by 10 percent or more with higher frequency during July, and with generally substantially higher frequency (i.e., 10 percent or more) during February, May and June. By contrast, flows decrease by 10 percent or more with substantially higher frequency during March and April.

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 September (Table 5-7). Net increases in flow of 10 percent or more occur with higher or substantially higher frequency during October through March, July and August, while a net decrease in flow of 10 percent or more occurs substantially more often during April under Alternative 2 - Forecast-informed Operations relative to Fixed-400,000 af flood storage operation.

Table 1-6. 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 J602F3 ELD relative to E503p ELD											
	Description	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean Daily Flow (cfs)	American River below Nimbus Dam	10	All Years	3	4	4	4	12	-11	-20	10	12	6	0	-1
	American River at Watt Avenue	10	All Years	3	4	4	3	10	-10	-18	11	12	7	0	-1
	Mouth of the American River (RM 1)	10	All Years	3	4	3	-1	9	-10	-17	9	12	7	1	-1

Table 1-7. 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 J602F3 ELD relative to E503p ELD											
	Description	%		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Mean Daily Flow (cfs)	American River below Nimbus Dam	10	Lower 40%	8	10	10	9	11	8	-19	0	0	10	6	-2
	American River at Watt Avenue	10	Lower 40%	8	10	10	10	11	8	-18	0	0	12	7	-2
	Mouth of the American River (RM 1)	10	Lower 40%	8	10	7	0	6	7	-13	0	-1	12	7	-1

Based on the general changes in flows (described above) and water temperatures (see Riverine Temperature section below), as well as fish species and lifestage-specific flow and water temperature–related impact indicators presented below, potential changes in species and lifestage-specific suitabilities under Alternative 2 - Forecast-informed Operations relative to Fixed-400,000 af flood storage operation are described in the following sections.

Riverine Temperatures

Simulated monthly water temperatures at representative nodes in the rivers in the local project area indicate that water temperatures under Alternative 2 - Forecast-informed Operations relative to Fixed-400,000 af flood storage operation are generally: (1) equivalent or similar most of the time in the Sacramento River, but are measurably cooler more often during August below Keswick Dam and during May at Freeport and are measurably warmer more often during July at Bend Bridge; (2) equivalent or similar most of the time in the Feather River below the Thermalito Afterbay Outlet and at the mouth; and (3) similar during most months in the lower American River, but with some measurably cooler water temperatures during late spring and early summer.

Changes in simulated water temperatures within each evaluated water body under Alternative 2 - Forecast-informed Operations relative to Fixed-400,000 af flood storage operation are summarized in Table 5-8 through Table 5-10 below.

Table 1-8. Riverine Water Temperatures for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation - Long-term Average and Average by Water Year Type

River and Location	Evaluation metrics and Summary of Effects	Results					
		Long-term and Water Year Type Average Water Temperature					
		Long-term	Wet	Above Normal	Below Normal	Dry	Critical
American River below Nimbus Dam	Generally similar long-term average water temperatures and average water temperatures by water year type during most months at all locations.	✓	✓	✓	✓	Cooler in May	✓
American River at Watt Avenue		✓	Warmer in Jul	Cooler in May	✓	Cooler in May	Cooler in Jul
American River at the mouth		✓	Warmer in Jul	Cooler in May	✓	Cooler in May	Cooler in Jul

Table 1-9. Riverine Water Temperatures for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation - Net Measurable Differences over Entire Monthly Exceedance Distributions

River and Location	Evaluation metrics and Summary of Effects	Results
		Entire Monthly Exceedance Distributions
American River below Nimbus Dam	Generally similar water temperatures over most of the monthly exceedance distributions at all locations.	Net measurable reductions in May & Jun
American River at Watt Avenue		Net measurable reduction in May
American River at the mouth		Net measurable increase in May & Jun; net increase in Aug

Table 1-10. Riverine Water Temperatures for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation - Net Measurable Differences over Warmest 25 percent of Monthly Exceedance Distributions

River and Location	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 at all locations.	Net measurable reductions in May–Jul & Oct
American River at Watt Avenue		Net measurable reductions in May–Jul
American River at the mouth		Net measurable reductions in May– Jul

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

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 similar during all months except for measurably cooler water temperatures during May of dry water years. Monthly water temperature exceedance probability distributions would be generally similar most of the time during all months, but are cooler during May through July and October.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent of the time during May and June. 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 May through July and October.

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 similar during all months, except for measurably cooler water temperatures during May of above-normal and dry water years and July of critical water years, and measurably warmer water temperatures during July of wet water years. Monthly water temperature exceedance probability distributions would be similar most of the time during all months, but are cooler for May through July.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent of the time 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 May through July.

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 similar during all months, but would be measurably warmer during July of wet water years and measurably cooler during May of above-normal and dry water years and July of critical water years. Monthly water temperature exceedance probability distributions would be generally similar, but are slightly cooler for May through July and are slightly warmer for August.

Over the entire monthly distributions, net measurable decreases in water temperature would occur over 10 percent or more in the distributions during May and June, and a net measurable increase in water temperature would occur over 10 percent of the time during August. 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 May, June, and July.

Based on the general changes in flows (described above) and water temperatures (see Water Temperature section), as well as fish species and lifestage-specific flow and water temperature–related impact indicators presented below, potential changes in species and lifestage-specific suitabilities under Alternative 2 - Forecast-informed Operations relative to Fixed-400,000 af flood storage operation are described in the following sections.

Fish Species-specific Effects

Steelhead

Relative to the Fixed-400,000 af flood storage operation scenario, the With-Project Alternative 2 scenario would be expected to provide similar conditions for:

a) Similar adult immigration (November through March) conditions, due similar flows during most months over the evaluation period, but with lower flows more often during March, and higher flows more often during February.

b) Similar adult holding (November through March) conditions, due to the monthly flow exceedance distributions, similar flows during most months over the evaluation period, but with lower flows more often during March, and similar or higher flows more often during February. Over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially greater frequency at both locations during March, and are higher by 10 percent or more with substantially higher frequency during February, with minor net changes in flow of 10 percent or more during November through January.

c) Similar spawning conditions (January through mid-April [peaking during February]) due to similar long-term average spawning WUA and similar average spawning WUA during all water year types. Additionally, over the annual spawning WUA exceedance distribution, there was similar probability of spawning WUA equal to or greater than 80 percent of maximum spawning WUA, and generally similar spawning WUA over the distribution when spawning WUA is less than 80 percent of maximum under both scenarios. Embryo incubation (January through May [peaking during March]) conditions were similar due to similar long-term average annual redd dewatering index and similar average redd dewatering index during all water year types, and similar annual redd dewatering index over most of the exceedance distribution.

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: monthly flow exceedance distributions which show similar flows during October through January, but with higher flows more often during February, May, June, and September at most locations, and lower flows more often during March, April, July, and August at all locations. Flows are lower by 10 percent or more with substantially higher frequency during March and April at all locations, and are higher by 10 percent or more with higher or substantially higher frequency during February, and May through July at most locations and generally similar probabilities of exceeding UO and UT WTI values at all locations during most months, but with some slight decreases in exceedance probabilities during October, May, June, and August, and slight increases in exceedance during July and August at Watt Avenue and the mouth.

e) Similar smolt emigration (December through April [peaking during January]) conditions over the monthly flow exceedance distributions include similar flows most of the time during December and January, higher flows more often during February, and lower flows more often during March and April at both locations. Flows are lower by 10 percent or more with substantially higher frequency during March and April, and are higher by 10 percent or more with higher or substantially higher frequency during February (no net difference in flow changes of 10 percent or more occur during December and January). During low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, and are higher by 10 percent or more with generally substantially higher frequency during December through March with generally similar water temperatures during all months of the evaluation period; and similar probabilities of exceeding UO and UT WTI values during all months at both locations, with the exception of a slight increase in the probability of exceeding the UO WTI value during March at the mouth.

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 similar for steelhead under the Alternative 2 - Forecast-informed Operation.

Fall-run Chinook Salmon

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). Additional flow and water temperature nodes were used to simulate potential redd dewatering (i.e., daily water temperatures by river mile).

Relative to the Fixed-400,000 af flood storage operation scenario, the With-Project would be expected to provide:

a) Similar adult immigration and staging (August through December [peaking during November]) conditions due to similar flows during October through December, lower flows during August, and similar or higher flows during September with minor net differences in flow changes of 10 percent or more during all months at all locations. During low-flow conditions, higher flows by 10 percent or more with substantially higher frequency during all months of the evaluation period, except during September when minor net differences in flow changes of 10 percent or more occur, and generally similar temperatures over the evaluation period, except during August at Watt Avenue and the mouth when temperatures are warmer. Similar monthly probabilities of exceeding both UO and UT WTI values at all locations, but with some slight reductions in exceedance during October and August, and a slight increase during August at the mouth.

b) Similar spawning (mid-October through December [peaking during November]) conditions are generally equivalent to long-term average spawning WUA and average spawning WUA by water year type, and over the annual spawning WUA exceedance distribution, similar probability of spawning WUA equal to or greater than 80 percent of maximum spawning WUA, and generally similar spawning WUA when spawning WUA is less than 80 percent of maximum. Similar water temperatures occurred over the evaluation period, except for lower temperatures more often during October below Nimbus Dam. Similar probabilities of exceeding both UO and UT WTI values are expected during all months evaluated at both locations.

c) Similar embryo incubation conditions (mid-October through March) were generally similar but slightly higher long-term average annual redd dewatering index and similar average redd dewatering index during most water year types, except for a slight increase during critical water years, along with similar or slightly higher annual redd dewatering index over most of the exceedance distribution. Similar water temperature over most of the monthly distributions, but with slightly lower temperatures more often during October below Nimbus Dam; and similar probabilities of exceeding both UO and UT WTI values are expected during all months evaluated at both locations.

d) Similar annual long-term average early lifestage mortality and average annual early lifestage mortality by water year type and similar or slightly lower early lifestage annual mortality over most of the exceedance distribution.

e) Similar juvenile rearing and downstream movement (January through May [peaking during February]) conditions due to similar flows during January, higher flows more often at most locations during February and May, and lower flows more often during March and April at all locations. Over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency during March and April, and are higher by 10 percent or more with higher or substantially higher frequency during February and May, with minor net differences in flow changes of 10 percent or more during January. During low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, and are higher by 10 percent or more with higher or substantially higher frequency during January through March at most locations, with minor net differences in flow changes of 10 percent or more during May. Similar water temperatures more often over the evaluation period, except for lower temperatures during May at all locations, and similar probabilities of exceeding WTI values most of the time at all locations, but with slightly lower probabilities of exceedance during May at all locations.

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 salmonids in the lower American River, habitat conditions are expected to be generally similar for fall-run Chinook salmon under the Alternative 2 - Forecast-informed Operation.

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

Flow and water temperature model results were examined for the lower American River near the mouth of the lower American River (i.e., RM 1) for non-natal juvenile rearing.

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation would be expected to provide less suitable non-natal juvenile rearing (November through April) conditions due to generally higher flows more often and lower flows more often with similar monthly frequency over the monthly flow exceedance distributions. During low flow conditions, generally slightly lower net changes in flow of 10 percent or more during January, March, and April, and higher flows by 10 percent or more with higher frequency during February would be expected. Overall, in consideration of all flow and water temperature-related impact indicators, habitat conditions are expected to be similar for spring-run Chinook salmon.

River Lamprey

Flow and water temperature model results were examined for the lower American River at Watt Avenue and near the mouth of the lower American River (i.e., RM 1).

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation would be expected to provide:

a.) Similar adult immigration (September through June) conditions due to: (1) over the monthly flow exceedance distributions, similar flows during October through January, but with higher flows more often during February, May, and June, and lower flows more often during March and April; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency during March and April, and are higher by 10 percent or more with higher or substantially higher frequency during February, May, and June; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, and are higher by 10 percent or more with higher or substantially higher frequency during October through December, February, and March; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during October through April, and September at most locations, lower water temperatures more often during May and June, and higher water temperatures more often during August at most locations; and (5) similar probabilities of water temperatures occurring within the specified range during all months evaluated at both locations, but with a slighter higher probability of occurring within the range during May at Watt Avenue.

b.) Similar spawning and embryo incubation (February through July) conditions, due to generally lower flows more often over the monthly flow exceedance distributions. During low flow conditions, lower flows by 10 percent or more with higher frequency during March and April, and higher flows by 10 percent or more with higher frequency during February, June and July; and generally similar monthly probabilities of water temperatures occurring within the specified range at both locations most of the time, but occurring within the specified range less often during February and May, and more often during July.

c.) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) over the monthly flow exceedance distributions, similar flows during October through January, but with higher flows more often during February, May, June, and September, and lower flows more often during March, April, July, and August; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency during March and April, and are higher by 10 percent or more with higher or substantially higher frequency during February, and May through July; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, and are generally higher by 10 percent or more with higher or substantially higher frequency during October through March, July, and August; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during October through April and during September, lower water temperatures more often during May and June, and higher water temperatures more often during August; and (5) similar monthly probabilities of exceeding the WTI value during all months evaluated at both locations.

Overall, in consideration of all flow and water temperature–related impact indicators, as well as peak lifestage-specific temporal considerations, habitat conditions are expected to be similar for river lamprey under Alternative 2 relative to the fixed 400,000 af flood storage operation condition.

Pacific Lamprey

Flow and water temperature model results were examined for the lower American River at Watt Avenue and near the mouth of the lower American River (i.e., RM 1).

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation would be expected to provide:

a) Similar adult immigration (January through June) conditions due to: (1) over the monthly flow exceedance distributions, similar flows during January, but with higher flows more often during February, May, and June, and lower flows more often during March and April; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency during March and April, and are higher by 10 percent or more with higher or substantially higher frequency during February, May, and June; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, and are higher by 10 percent or more with higher or substantially higher frequency during January through March; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during January through April, and lower water temperatures more often during May and June; and (5) similar probabilities of water temperatures occurring within the specified range at both locations during all months evaluated, but with a slight increase in the probability of occurring within the range during May at Watt Avenue.

b) Similar spawning and embryo incubation (March through August) conditions, as generally lower flows more often over the monthly flow exceedance distributions. During low flow conditions, lower flows by 10 percent or more with higher frequencies during March and April, and higher flows by 10 percent or more with higher frequencies during June and July; and generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.

c) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) over the monthly flow exceedance distributions, similar flows during October through January, but with higher flows more often during February, May, June, and September, and lower flows more often during March, April, July, and August; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency during March and April, and are higher by 10 percent or more with higher or substantially higher frequency during February, and May through July; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, and are generally higher by 10 percent or more with higher or substantially higher frequency during October through March, July, and

August; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during October through April and during September, lower water temperatures more often during May and June, and higher water temperatures more often during August; and (5) similar monthly probabilities of exceeding the WTI value at both locations during all months.

Overall, in consideration of all flow and water temperature–related impact indicators, as well as peak lifestage-specific temporal considerations, habitat conditions are expected to be similar for Pacific lamprey under Alternative 2 relative to the fixed 400,000 af flood storage operation condition.

Hardhead

Flow and water temperature model results were examined for the lower American River at Watt Avenue.

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation would be expected to provide:

a.) Similar adult and other lifestage (year-round) conditions due to: (1) over the monthly flow exceedance distributions, similar flows during October through January, but with higher flows more often during February, May, June, and September, and lower flows more often during March, April, July, and August; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency during March and April, and are higher by 10 percent or more with higher or substantially higher frequency during February and during May through July; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, and are generally higher by 10 percent or more with higher or substantially higher frequency during October through March, July, and August; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during October through April and during September, lower water temperatures more often during May and June, and higher water temperatures more often during August; and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months, but with a slight reduction in the probability of occurring within the range during May (due to a reduction in water temperatures under Alternative 2).

b.) Similar spawning (April through June) conditions due to: (1) over the monthly flow exceedance distributions, higher flows more often during May and June, and lower flows more often during April; (2) over the entire flow exceedance distributions, flows are lower by 10 percent or more with substantially higher frequency during April, and are higher by 10 percent or more with higher or substantially higher frequency during May and June; (3) during low-flow conditions, flows are lower by 10 percent or more with substantially higher frequency during April, with minor net differences in flow changes of 10 percent or more during May and June; (4) over the monthly water temperature exceedance distributions, similar water temperatures most of the time during April, and lower water temperatures more often during May and June; and (5) similar monthly probabilities of water temperatures occurring within the specified range during all months evaluated, but with a slight increase in the probability of occurring within the range during April.

Overall, in consideration of all flow and water temperature–related impact indicators, as well as peak lifestage-specific temporal considerations, habitat conditions are expected to be similar for hardhead under Alternative 2 relative to the fixed 400,000 af flood storage operation condition.

Recreational Fisheries (Striped Bass and American Shad)

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation Striped bass and American shad would be expected to have similar adult attraction, adult immigration and spawning, and juvenile rearing and downstream movement conditions. White sturgeon would be expected to have similar adult immigration and holding, spawning and embryo incubation, and juvenile rearing and downstream movement conditions.

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 striped bass and American shad in the lower American River, habitat conditions are expected to be similar for these species under the Alternative 2 - Forecast-informed Operation.

Spawning Gravel Mobilization

As shown in Table 5-11, the number of days when flows would equal or exceed 30,000 cfs and 50,000 cfs would decrease with Alternative 2 compared to Fixed-400,000 af operations.

The minor decrease in flows that exceed 30,000 cfs (0.05 percent decrease) 50,000 cfs (0.02 percent decrease) would indicate that spawning gravel mobilization could experience a slight decrease when compared to the Fixed-400,000 af flood storage operation. However, the HEC-6T model indicates that regardless of how Folsom Dam is operated, the channel is likely to experience significant loss of gravel size sediment. Therefore, regardless of how Folsom Dam is operated, periodic gravel injection will be needed to replenish the gravel in the channel. It is inconclusive from the available information if the frequency of gravel injection would increase or decrease. Overall, effects of Alternative 2 on mobilization of lower American River spawning gravel would be considered less than significant compared to Fixed-400,000 af flood storage operations.

Table 1-11. Spawning Gravel Mobilization Flows Comparison of Fixed-400,000 af Flood Storage Operation and Alternative 2 - Forecast-informed operations.

	Fixed-400,000 af Flood Storage Operation		Alternative 2 - Forecast-informed operations	
	Number of Days	percent of Period of Record	Number of Days	percent of Period of Record

Number of days with American River flows below Nimbus Dam in excess of 30,000 cfs	130	0.44 percent	114	0.39 percent
Number of days with American River flows below Nimbus Dam in excess of 50,000 cfs	39	0.13 percent	33	0.11 percent

Sacramento River

For salmonid species, flow and water temperature model results were examined for the Sacramento River 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 were examined for spawning habitat availability (weighted usable area, or WUA) for salmonid species. Modeling results for other fish species are described separately.

The species and lifestage-specific interpretive comparisons below are based on numerous outputs 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.

Winter-run Chinook Salmon

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration (November through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, but with some slight increases (up to 1.6 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) at all locations except Freeport; and (4) generally equivalent monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

b) Similar adult holding (November through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up 1.4 percent) and decreases (up to 1.3 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at both locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) at both locations; and (4) generally equivalent monthly probabilities of exceeding both UT and UO WTI values at both locations evaluated.

c) Similar spawning (April through August) and embryo (April through September) incubation conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 1.3 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent or similar net changes in flow of 10 percent or more during all months at both locations evaluated, except during July when flows are lower by 10 percent or more with slightly higher frequency (1.2 percent); (4) generally equivalent or similar long-term average spawning WUA and similar spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over most of the distribution, with slightly more spawning WUA over about 20 percent of the middle portion of the distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, with slightly reduced exceedance probabilities below Keswick Dam (1.8 percent) during September and at Bend Bridge during August (2.4 percent), and slightly increased (1.3 percent) exceedance probabilities at Ball’s Ferry during September .

d) Similar juvenile rearing and downstream movement (July through March) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) at all locations except Freeport; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations, but with a slightly higher probability of exceedance during October at Freeport.

In consideration of the general similarity of impact indicators to all lifestages of winter-run Chinook salmon in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation, no further evaluations are necessary.

Spring-run Chinook Salmon

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) at all locations except Freeport; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

b) Similar adult holding (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 1.3 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at both locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) at both locations; and (4) generally equivalent or similar monthly probabilities of exceeding both UT and UO WTI values at both locations evaluated.

c) Similar spawning (September and October) and embryo incubation (September through January) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types but with some slight increases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during all months at both locations; and (4) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, but with slightly increased (1.3 percent) exceedance probabilities at Ball's Ferry during September and slightly decreased (1.8 percent) exceedance probabilities below Keswick Dam during September.

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and slightly lower average monthly flow during March and April at Freeport, and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) at all locations evaluated; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations.

e) Generally equivalent smolt emigration (October through May) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values at all locations evaluated during all months of the evaluation period.

In consideration of the general similarity of impact indicators to all lifestages of spring-run Chinook salmon in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Fall-run Chinook Salmon

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration and staging (July through December) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and some slight decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (about 3 percent) below Keswick Dam and at Verona; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated, except for a slightly increased probability of exceedance during July at Red Bluff (1.4 percent).
b) Similar spawning (October through December) and embryo incubation (October through March) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during all months at both locations; (4) generally similar long-term average spawning

WUA and similar spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations.

c) Similar juvenile rearing and downstream movement (December through July) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) at Bend Bridge and Verona; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations.

In consideration of the general similarity of impact indicators to all lifestages of fall-run Chinook salmon in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

<u>Late Fall-run Chinook Salmon</u>

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration and staging (October through April) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

b) Similar spawning (January through April) and embryo incubation (January through June) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with a slight increase of 1.4 percent in average monthly flow below Keswick Dam during May of above-normal water years; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during all months at both locations; (4) generally similar long-term average spawning WUA and similar spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations.

c) Similar juvenile rearing and downstream movement (April through December) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period, except for slightly lower average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below Keswick Dam and at Verona; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations.

In consideration of the general similarity of impact indicators to all lifestages of late fall-run Chinook salmon in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Steelhead

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

b) Similar adult holding (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and slight decreases (up to 1.2 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent or similar net changes in flow of 10 percent or more during all months at both locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding both UT and UO WTI values at both locations evaluated.

c) Similar spawning (December through April) and embryo incubation (December through May) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more during all months at both locations; (4) generally equivalent long-term average spawning WUA and spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values most of the time at all locations, except for a slightly (2.4 percent) reduced probability of exceedance at Bend Bridge during May.

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time at all locations, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) at all locations; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months at all locations.

e) Similar smolt emigration (January through June) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values at all locations evaluated during all months of the evaluation period, except for a slightly higher probability of exceedance during March at Freeport (2.4 percent).

In consideration of the general similarity of impact indicators to all lifestages of steelhead in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Green Sturgeon

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration and holding (February through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below Keswick Dam; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

b) Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 1.8 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below Keswick Dam; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

c) Similar adult post-spawning holding and emigration (July through November) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and some slight decreases (up to 1.3 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below Keswick Dam; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 2.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value at all locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of green sturgeon in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

River Lamprey

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration (September through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, but with a slightly lower probability of occurring within the specified range at Wilkins Slough during October.

b) Similar spawning and embryo incubation (February through July) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 2.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below Keswick Dam; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified ranges at all locations evaluated, except for a slightly higher probability of occurring within the specified range during March below Keswick Dam (1.3 percent) and a slightly lower probability of occurring within the specified range during July at Red Bluff (1.4 percent).

c) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 2.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below Keswick Dam; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of river lamprey in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Pacific Lamprey

Relative to the Fixed-400,000 af flood storage operation scenario, Alternative 2 – Forecast-informed operations is expected to provide:

a) Similar adult immigration (January through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range at all locations evaluated.

b) Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.4 percent) and decreases (up to 2.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below Keswick Dam; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at all locations evaluated, except for a slightly higher probability of occurring within the specified range during March below Keswick Dam and a slightly lower probability of occurring within the specified range during July at Red Bluff.

c) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 2.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below Keswick Dam; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values at all locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of Pacific lamprey in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Hardhead

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult and other lifestage (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during July when flows are lower by 10 percent or more with somewhat higher frequency (3 percent) below Keswick Dam and at Verona; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range at all locations evaluated.

b) Similar spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated, except for slightly lower average monthly flow during April at Freeport, and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight increases (up to 1.6 percent) and decreases (up to 1.1 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range at all locations evaluated.

In consideration of the general similarity of impact indicators to all lifestages of hardhead in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Recreational Fisheries (White Sturgeon, Striped Bass and American Shad)

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation Striped bass and American shad would be expected to have similar adult immigration, juvenile rearing and downstream movement conditions. White sturgeon would be expected to have similar adult immigration and holding, spawning and embryo incubation, and juvenile rearing and downstream movement conditions.

In consideration of the general similarity of impact indicators to all lifestages of white sturgeon, striped bass and American shad in the Sacramento River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Feather River

Flow and water temperature model results were examined for the Feather River below the Fish Barrier Dam, below the Thermalito Afterbay Outlet, and at the mouth of the Feather River. In addition to flow and water temperature modeling, Model results were examined for spawning habitat availability (WUA) for salmonid species.

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. 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 baseline scenarios. Although these results are not repeated for the discussions below, the model results were considered for the Low Flow Channel below the Fish Barrier Dam along with the information presented below and incorporated them into the impact determinations for spring-run Chinook salmon, fall-run Chinook salmon, steelhead, river lamprey, Pacific lamprey, and hardhead.

Spring-run Chinook Salmon

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Generally similar adult immigration (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows by water year type most of the time during all water year types, but with some increases (up to 3.0 percent) and decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with somewhat higher frequency during June below the Thermalito Afterbay Outlet and at the mouth and during September below the Thermalito Afterbay Outlet (3 percent) and with higher flows by 10 percent or more with somewhat higher frequency (about 3 percent–6.1 percent) during August at both the above locations; and (4) generally equivalent monthly probabilities of exceeding both UO and UT WTI values.

b) Similar adult holding (March through September) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows by water year type most of the time during all water year types, but with an increase of 3.0 percent and decrease of 1.4 percent in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with slightly higher frequency (about 3 percent) during June and September below the Thermalito Afterbay Outlet, and with higher flows by 10 percent or more with somewhat higher frequency (about 6.1 percent) during September below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values.

c) Similar spawning (September through October) and embryo incubation (September through February) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with an increase of 3 percent and decrease of 2.9 percent in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent or similar net changes in flow of 10 percent or more, except for an decrease in flow of 10 percent or more with slightly higher frequency (1.2 percent) during September below the Thermalito Afterbay Outlet; (4) generally equivalent long-term average spawning WUA and equivalent or similar average spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over the entire distribution, with spawning WUA always above 80 percent of maximum under both scenarios; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values.

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time but with lower flows by 10 percent or more with somewhat higher frequency (3 percent) during June at the mouth and during June and September below the Thermalito Afterbay Outlet, and with higher flows by 10 percent or more with higher frequency during August at the mouth (3 percent) and below the Thermalito Afterbay Outlet (6.1 percent); and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values, except for slightly reduced probabilities of exceedance during September below the Thermalito Afterbay Outlet.

e) Similar smolt emigration (October through June) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but some decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with slightly higher frequency (3 percent) during June at both locations; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values during all months of the evaluation period.

In consideration of the general similarity of impact indicators to all lifestages of spring-run Chinook salmon in the Feather River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Fall-run Chinook Salmon

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar spawning (October through December) and embryo incubation (October through March) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types, but with a slight decrease of about 2.9 percent in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent or similar net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with slightly higher frequency (2.4 percent) during November below the Thermalito Afterbay Outlet; (4) generally equivalent long-term average spawning WUA and average spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar spawning WUA over the entire distribution, with spawning WUA always above 80 percent of maximum under both scenarios; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values.

b) Similar juvenile rearing and downstream movement (November through June) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with slightly higher frequency (3 percent) during June at both locations; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values.

In consideration of the general similarity of impact indicators to all lifestages of fall-run Chinook salmon in the Feather River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Steelhead

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Generally similar adult immigration (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with higher flows by 10 percent or more with somewhat higher frequency (about 3 percent–6.1 percent) during August below the Thermalito Afterbay Outlet and at the mouth and lower flows by 10 percent or more with slightly higher frequency (3 percent) during September below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values.

b) Similar adult holding (August through March) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows by water year type most of the time, but with some slight increases (up to 3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, generally equivalent net changes in flow of 10 percent or more most of the time, but with higher flows by 10 percent or more with somewhat higher frequency (about 3 percent–6.1 percent) during August below the Thermalito Afterbay Outlet and at the mouth and lower flows by 10 percent or more with slightly higher frequency (3 percent) during September below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar monthly probabilities of exceeding both UO and UT WTI values.

c) Similar spawning (January through April) and embryo incubation (January through May) conditions due to: (1) generally equivalent long-term average monthly flows during the evaluation period and generally equivalent or similar average monthly flows during all water year types; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) equivalent net changes in flow of 10 percent or more; (4) generally equivalent long-term average spawning WUA and equivalent or similar average spawning WUA by water year type; (5) over the annual spawning WUA exceedance distribution, generally equivalent or similar amounts of spawning WUA over the entire distribution; and (6) equivalent or similar probabilities of exceeding both UO and UT WTI values.

d) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with some increases (up to 3 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more most of the time, but with lower flows by 10 percent or more with slightly higher frequency (3 percent) during June and September below the Thermalito Afterbay Outlet, and with higher flows by 10 percent or more with higher frequency (6.1 percent) during August below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values at both locations throughout the evaluation period.

e) Similar smolt emigration (October through April) conditions due to: (1) generally equivalent long-term average monthly flows over the evaluation period and generally equivalent or similar average monthly flows by water year type most of the time, but with a some slight decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent or similar net changes in flow of 10 percent or more; and (4) generally equivalent or similar probabilities of exceeding UO and UT WTI values throughout the evaluation period.

In consideration of the general similarity of impact indicators to all lifestages of steelhead in the Feather River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Green Sturgeon

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration and holding (February through November) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some increases (up to 3.0 percent) and decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with somewhat higher frequency (3 percent) at both locations during June and below the Thermalito Afterbay Outlet in September, and higher flows of 10 percent or more with somewhat higher frequency at the mouth of the lower Feather River (3 percent) and below the Thermalito Afterbay Outlet (6.1 percent) during August; and (4) generally equivalent or similar monthly probabilities of exceeding both the specified WTI value at both locations throughout the evaluation period.

b) Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months evaluated, except during June when flows are lower by 10 percent or more with higher frequency (3 percent) and flows are higher by 10 percent or more with higher frequency (6.1 percent) during August; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value.

c) Similar juvenile rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some increases (up to 3 percent) and some decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with somewhat higher frequency (3 percent) at both locations during June and below the Thermalito Afterbay Outlet in September, and higher flows of 10 percent or more with somewhat higher frequency at the mouth of the lower Feather River (3 percent) and below the Thermalito Afterbay Outlet (6.1 percent) during August; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value.

In consideration of the general similarity of impact indicators to all lifestages of green sturgeon in the Feather River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

River Lamprey

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration (September through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some increases (up to 3 percent) and some decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with higher frequency (3 percent) at both locations during June and below the Thermalito Afterbay Outlet during September; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range, except for a slight decrease (1.3 percent) in the probability of occurring within the range during May below the Thermalito Afterbay Outlet.

b) Similar spawning and embryo incubation (February through July) conditions due to: (1) generally equivalent long-term average monthly flows and generally equivalent or similar average monthly flows most of the time during all water year types, but with a decreases of 1.4 percent in average monthly flow during June of dry years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during June when flows are lower by 10 percent or more with slightly higher frequency (3 percent) below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.

c) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some increases (up to 3 percent) and some decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with somewhat higher frequency (3 percent) at both locations during June and below the Thermalito Afterbay Outlet in September, and higher flows of 10 percent or more with somewhat higher frequency at the mouth of the lower Feather River (3 percent) and below the Thermalito Afterbay Outlet (6.1 percent) during August; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value.

In consideration of the general similarity of impact indicators to all lifestages of river lamprey in the Feather River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Pacific Lamprey

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult immigration (January through June) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some slight decreases (up to 1.4 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with higher frequency (3 percent) at both locations during June; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range but with a slight decrease in probability of 1.3 percent during May below the Thermalito Afterbay Outlet.

b) Similar spawning and embryo incubation (March through August) conditions due to: (1) generally equivalent long-term average monthly flows and generally equivalent or similar average monthly flows most of the time during all water year types, but with a decrease of 1.4 percent in average monthly flow during June of dry water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more during all months at all locations evaluated, except during June when flows are lower by 10 percent or more with higher frequency (3 percent) below the Thermalito Afterbay Outlet and during August when flows are higher by 10 percent or more with higher frequency (3 percent) below the Thermalito Afterbay Outlet; and (4) generally equivalent monthly probabilities of water temperatures occurring within the specified range.

c) Similar ammocoete rearing and downstream movement (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some increases (up to 3 percent) and some decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with somewhat higher frequency (3 percent) at both locations during June and below the Thermalito Afterbay Outlet in September, and higher flows of 10 percent or more with somewhat higher frequency at the mouth of the lower Feather River (3 percent) and below the Thermalito Afterbay Outlet (6.1 percent) during August; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value.

In consideration of the general similarity of impact indicators to all lifestages of Pacific lamprey in the Feather River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Hardhead

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult and other lifestage (year-round) conditions due to: (1) generally equivalent long-term average monthly flows at all locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with some increases (up to 3 percent) and some decreases (up to 2.9 percent) in average monthly flow; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, but with lower flows of 10 percent or more with somewhat higher frequency (3 percent) at both locations during June and below the Thermalito Afterbay Outlet in September, and higher flows of 10 percent or more with somewhat higher frequency at the mouth of the lower Feather River (3 percent) and below the Thermalito Afterbay Outlet (6.1 percent) during August; and (4) generally equivalent or similar monthly probabilities of exceeding the specified WTI value.

b) Similar spawning (April through June) conditions due to: (1) generally equivalent long-term average monthly flows at both locations evaluated and generally equivalent or similar average monthly flows most of the time during all water year types, but with a

> decrease of 1.4 percent in average monthly flow during June of dry water years below the Thermalito Afterbay Outlet; (2) generally equivalent or similar flows most of the time over the monthly flow exceedance distributions; (3) during low-flow conditions, equivalent net changes in flow of 10 percent or more most of the time, except for a reduction in flow by 10 percent or more with higher frequency (3 percent) during June below the Thermalito Afterbay Outlet; and (4) generally equivalent or similar monthly probabilities of water temperatures occurring within the specified range.

In consideration of the general similarity of impact indicators to all lifestages of hardhead in the Feather River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Recreational Fisheries (White Sturgeon, Striped Bass and American Shad)

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation Striped bass and American shad would be expected to have similar adult immigration, juvenile rearing and downstream movement conditions. White sturgeon would be expected to have similar adult immigration and holding, spawning and embryo incubation, and juvenile rearing and downstream movement conditions.

In consideration of the general similarity of impact indicators to all lifestages of white sturgeon, striped bass and American shad in the Feather River under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Sacramento-San Joaquin Delta and Yolo Bypass

Old and Middle River (OMR) flows and X2 location for Delta smelt and longfin smelt were modeled. Delta outflow and water temperatures in the Sacramento River at Freeport for Delta smelt were also examined.

Model results for Sacramento River flows at Rio Vista, Yolo Bypass outflow, Delta outflow, and OMR flows for all runs of Central Valley Chinook salmon and Central Valley steelhead were examined. OMR flows were also examined for adult San Joaquin River fall- and late fall-run Chinook salmon.

In addition, the Yolo Bypass outflow for Delta smelt, splittail, green sturgeon, and white sturgeon, as well as the X2 location for American shad and striped bass were examined. Exports at the SWP and CVP export facilities year-round were modeled. The model results showed that: (1) long-term average monthly total SWP and CVP Delta exports would be generally equivalent year-round; (2) average total Delta exports by water year type would be generally equivalent, except for some slight increases (up to 1.5 percent) and decreases (up to 3.8 percent) during some months of dry and critical water years; and (3) monthly exceedance distributions would be generally similar year-round. For these reasons, no further evaluations were conducted to evaluate fish salvage at the SWP and CVP export facilities.

Delta Smelt in the Delta Region

Relative to the Fixed-400,000 af flood storage operation scenario, Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult conditions due to: (1) equivalent or similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range (December through May); (2) equivalent probabilities of X2 occurring between 74 and 81 river kilometers (RKm) during wet and above-normal water years (September through November); and (3) generally equivalent monthly probabilities of OMR flows being more negative than –5,000 cfs (December through February).

b) Similar adult spawning conditions in the Yolo Bypass (December through May) due to generally equivalent or similar net changes in Yolo Bypass outflow of 10 percent or more during the evaluation period, with the exception of January when flows would be reduced by 10 percent or more with a higher (8.5 percent) frequency. However, all of the 10 percent or greater reductions in flow over the exceedance distribution would occur when Yolo Bypass outflow is less than about 40 cfs; therefore, these reductions are not expected to affect inundation extent or frequency in the Yolo Bypass.

c) Similar egg and embryo conditions (February through May), because of equivalent or similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range.

d) Similar larvae conditions (March through June) due to: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; (2) during March through June of dry and critical water years, generally equivalent probabilities of mean monthly OMR flows being more negative than –1,500 cfs; and (3) and generally equivalent net changes of 10 percent or more in mean monthly Delta outflow.

e) Similar juvenile conditions (May through July) due to: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; and (2) between 65 and 80 RKm, X2 location moves upstream by 0.5 RKm or more with generally similar frequency, including a 1.2-percent reduction in frequency during May and a 2.4-percent increase in frequency during June.

In consideration of the general similarity of impact indicators to all lifestages of Delta smelt in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Longfin Smelt in the Delta Region

Relative to the 400-fixed Flood Storage Operation Existing Condition scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult conditions (December through March), because of generally equivalent monthly probabilities of OMR flows being more negative than -5,000 cfs.

b) Generally similar larvae and juvenile conditions, because: (1) during April and May of dry and critical water years, the probabilities of mean monthly OMR flows being more negative than –1,500 cfs would be generally equivalent, and the probabilities of mean monthly OMR flows being less than 0 would be generally equivalent; (2) for all water years during January through June, mean monthly X2 location would occur downstream of 75 RKm with generally similar frequency during all months evaluated; and (3) for dry and critical water years only during January through June, mean monthly X2 location would occur downstream of 75 RKm with generally equivalent frequencies during all months evaluated.

In consideration of the general similarity of impact indicators to all lifestages of longfin smelt in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

<u>Winter-run Chinook Salmon in the Delta Region</u>

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar juvenile and emigration conditions (November through May) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more; (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during January when flows would be lower by 10 percent or more with higher frequency (8.5 percent; see the previous discussion for Delta smelt); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more; and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

In consideration of the general similarity of impact indicators to all lifestages of winter-run Chinook salmon in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

<u>Spring-run Chinook Salmon in the Delta Region</u>

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar juvenile and emigration conditions (November through June) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more; (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during January when flows would be lower by 10 percent or more with higher frequency (8.5 percent; see the previous discussion for Delta smelt); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent;

and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

In consideration of the general similarity of impact indicators to all lifestages of spring-run Chinook salmon in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Fall-run and Late Fall-run Chinook Salmon in the Delta Region

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar juvenile and emigration conditions (November through June) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more; (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during January when flows would be lower by 10 percent or more with higher frequency (8.5 percent; see the previous discussion for Delta smelt); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more; and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

b) Generally similar San Joaquin River adult fall-run Chinook salmon conditions (December through February), because of generally similar probabilities of OMR flows being more negative than -5,000 cfs, with a slightly decreased probability during December.

In consideration of the general similarity of impact indicators to all lifestages of fall-run and late fall-run Chinook salmon in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Steelhead in the Delta Region

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar juvenile and emigration conditions (October through July) due to: (1) generally equivalent net changes in mean monthly Rio Vista flows of 10 percent or more; (2) generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during January when flows would be lower by 10 percent or more with slightly higher frequency (8.5 percent; see the previous discussion for Delta smelt); (3) generally equivalent or similar net changes in mean monthly Delta outflow of 10 percent or more; and (4) generally equivalent probabilities of OMR flows being more negative than –2,500 cfs.

In consideration of the general similarity of impact indicators to all lifestages of steelhead in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Green Sturgeon in the Delta Region

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Generally similar juvenile rearing and emigration conditions (year-round), because of generally equivalent or similar net changes in mean monthly Yolo Bypass outflow of 10 percent or more, except during September when flows would be higher by 10 percent or more with higher frequency (3.7 percent) and during January when flows would be lower by 10 percent or more with higher frequency (about 8.5 percent).

In consideration of the general similarity of impact indicators to all lifestages of green sturgeon in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

White Sturgeon in the Delta Region

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Generally similar juvenile rearing and emigration conditions (April through June), because of generally equivalent net changes in mean monthly Yolo Bypass outflow of 10 percent or more.

In consideration of the general similarity of impact indicators to all lifestages of white sturgeon in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

Splittail in the Delta Region

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Similar adult spawning and embryo incubation conditions (February through May), because of generally equivalent net changes in mean monthly Yolo Bypass outflow of 10 percent or more.

b) Similar juvenile rearing and emigration conditions (April through July), because of generally equivalent net changes in mean monthly Yolo Bypass outflow of 10 percent or more.

In consideration of the general similarity of impact indicators to all lifestages of splittail in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

<u>American Shad in the Delta Region</u>

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Generally similar egg and larval conditions (April through June), because of generally equivalent or similar net changes of 1 RKm or more in X2 location.

In consideration of the general similarity of impact indicators to all lifestages of American shad in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation scenario, no further evaluations are necessary.

<u>Striped Bass in the Delta Region</u>

Relative to the Fixed-400,000 af flood storage operation scenario, the Alternative 2 - Forecast-informed Operation is expected to provide:

a) Generally similar egg and larval conditions (April through June), because of generally equivalent or similar net changes of 1 RKm or more in X2 location.

In consideration of the general similarity of impact indicators to all lifestages of striped bass in the Delta under the Alternative 2 - Forecast-informed Operation relative to the Fixed-400,000 af flood storage operation, no further evaluations are necessary.

1.1.5 Water Supply

This section discusses water supply comparisons between Alternative 2 – Forecast-informed Operations and the 1986 Fixed-400,000 af Flood Storage Operations scenario using an existing level of water demand in the CalSim II model. Significance criteria for water quality effects would be the same as discussed in section 4.7.2.

General Observations

CalSim II model outputs for Fixed-400,000 af flood storage operation and Alternative 2 - Forecast-informed Operations indicate that, overall, Alternative 2 - Forecast-informed Operations would be generally similar to Fixed-400,000 af flood storage operation. There could be some occurrences of slight increases and decreases in evaluation metrics, as expected with any changes in the CalSim II models.

Folsom Reservoir storages for Alternative 2 - Forecast-informed Operations are higher than for Fixed-400,000 af flood storage operation for March through June and are lower for February. March and April releases are reduced accordingly. As indicated in Table 5-12, storage in

Folsom Reservoir is higher in May and similar in September, implying better availability of water to meet summer water delivery obligations and higher Folsom Reservoir releases through the summer. Similar storages were seen for the other reservoirs.

Fall mean monthly flows below Nimbus Dam show very slight changes (±1 percent), relative to the basis of comparison, and meet the MRR. Sacramento River flows below Keswick Dam and at Rio Vista are similar for the two scenarios and meet the MRR.

Table 1-12. Storages, Flows, and MFR for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Generalized Results
End of Month Storages (May and September)		
Folsom	Monthly exceedance distributions – Folsom storages as noted; Similar storages for others.	May – higher storages. September – similar storages.
Shasta		✓
Oroville		✓
Mean Monthly Flows and MFR Compliance (October through December)		
Lower American River below Nimbus Dam	Monthly exceedance distributions – Similar flows; MFR met.	October - very small decreases in flows. November and December – very small increases in flows.
Sacramento River below Keswick Dam		✓
Sacramento River at Rio Vista		✓

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

Because of changes in the Folsom Reservoir storages and allocations from Alternative, long-term average annual CVP deliveries show a slight increase (1 TAF), while long-term average annual SWP deliveries are same for the two scenarios, as summarized in Table 5-13. It is notable that the average annual CVP deliveries for the dry years show a slight increase of 7 TAF, while those for the critical years are the same. Deliveries to lower American River purveyors are generally similar with some increases and decreases (± 45 AF) for the long-term average (Table 5-14).

Table 1-13. CVP/SWP Deliveries for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Generalized Results**					
CVP/SWP Deliveries							
Delivery Type		**Long-term and Water Year Type Average Annual Deliveries**					
		Long-term	**Wet**	**Above Normal**	**Below Normal**	**Dry**	**Critical**
CVP M&I NOD	Long-term and water year type average annual deliveries – Generally similar long-term average annual deliveries and generally similar average annual deliveries most of the time during all water year types, but with some slight increases and/or decreases.	✓	✓	1 TAF increase	✓	✓	✓
CVP agricultural NOD		1 TAF increase	✓	1 TAF increase	1 TAF decrease	2 TAF increase	✓
CVP settlement NOD		✓	✓	✓	✓	✓	✓
CVP refuges NOD		✓	✓	✓	✓	✓	✓
CVP M&I SOD		✓	✓	✓	✓	✓	✓
CVP agricultural SOD		1 TAF increase	✓	1 TAF increase	3 TAF decrease	5 TAF increase	✓
CVP exchange contractors		✓	✓	✓	✓	✓	✓
CVP refuges SOD		✓	✓	1 TAF decrease	✓	✓	✓
Total CVP deliveries		1 TAF increase	✓	3 TAF increase	4 TAF decrease	7 TAF increase	✓
SWP contractors		✓	✓	✓	4 TAF decrease	4 TAF increase	4 TAF decrease

Note: "✓" refers to the same value of the evaluation metric for both scenarios.
NOD = North of Delta
SOD = South of Delta

Table 1-14. American River Purveyors Deliveries for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation.

Evaluation Parameters	**Evaluation Metrics and Summary of Effects**	**Results**		
American River Purveyors Deliveries				
Purveyor Delivery Type	Long-term monthly average, maximum and minimum deliveries – Generally similar deliveries with some increases and decreases as noted.	**Monthly Average, Maximum, and Minimum Deliveries**		
		Average	**Maximum**	**Minimum**
American River Pump Station deliveries to PCWA		✓	✓	✓
City of Folsom deliveries		✓	✓	1 AF increase for July and August. 1 AF decrease for April.
City of Roseville deliveries		1 AF decrease for March. 1–2 AF increase for all other months.	✓	6 AF decrease for April.
San Juan Water District deliveries		✓	✓	✓
SSWD deliveries from Folsom		✓	✓	✓
Folsom Pumping Plant deliveries		2 AF decrease for March. 1–2 AF increase for all other months.	✓	6 and 5 AF increase for July and August. 8 AF decrease for April
FWTP deliveries		3 AF increase for July.	✓	✓
Freeport Regional Water Project deliveries		1 AF increase in March and July. 44 AF decrease in August. 1 AF decrease in April and May.	5 AF increase for November. 13 AF decrease for 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.

Based on the deliveries data for the water delivery evaluation summarized in Table 5-15, 10 out of the 10 metrics were the same for the two models; therefore, the deliveries produced by Alternative 2 - Forecast-informed Operations were determined to be ‘consistent’ with deliveries from Fixed-400,000 af flood storage operation.

Table 1-15. American River Diversions and Consistency Formulation for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Results
American River Diversions - Folsom Pumping Plant and E.A. Fairbairn Water Treatment Plant (Consistency Formulation)		
Folsom Pumping Plant - April	Total occurrences where delivery fell below 95 percent of POR average of all Aprils – Same for both scenarios.	✓
Folsom Pumping Plant - April	Maximum number of years for any water year type where delivery fell below 95 percent of POR average of all Aprils – Same for both scenarios.	✓
Folsom Pumping Plant - July	Total occurrences where delivery fell below 95 percent of POR average of all Julys – Not the same for both scenarios.	✓
Folsom Pumping Plant - July	Maximum number of years for any water year type where delivery fell below 95 percent of POR average of all Julys – Not the same for both scenarios.	✓
FWTP - April	Total occurrences where delivery fell below 95 percent of POR average of all Aprils – Same for both scenarios.	✓
FWTP - April	Maximum number of years for any water year type where delivery fell below 95 percent of POR average of all Aprils – Same for both scenarios.	✓
FWTP - July	Total occurrences where delivery fell below 95 percent of POR average of all Julys – Same for both scenarios.	✓
FWTP - July	Maximum number of years for any water year type where delivery fell below 95 percent of POR average of all Julys – Same for both scenarios.	✓
Folsom Pumping Plant	Minimum diversion for any month – Same for both scenarios.	✓
FWTP	Minimum diversion for any month – Same for both scenarios.	✓

Note: “✓” refers to the same value of the evaluation metric for both scenarios.

As described earlier in the previous comparisons, MFR flows in the American River below Nimbus Dam are based on the regulated hydrology of the respective models. Changes in the Folsom Reservoir storages would cause changes in the fall MFR. However, as summarized in Table 5-16, for the two operations being compared here, the summer and October MFRs are similar. November through December show a very slight increase in MFR flows.

Given the consistency seen between Alternative 2 and the Fixed-400,000 af operation in storages, deliveries, and MFRs, it would be expected that water supply and delivery operations under Alternative 2 would be similar to operations under the Fixed-400,000 af operation.

Table 1-16. American River MFR for Summer and Fall Months for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation.

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Generalized Results
American River Minimum Release Requirement in Summer and Fall Months		

Evaluation Parameters	Evaluation Metrics and Summary of Effects	Generalized Results
June through September	Monthly exceedance distributions – Similar MFR.	✓
October through December	Monthly exceedance distributions.	MFR increases slightly for November and December.

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

1.1.6 Hydropower

This section discusses hydropower comparisons between Alternative 2 – Forecast-informed Operations and the 1986 Fixed-400,000 af Flood Storage Operations scenario using an existing level of water demand in the CalSim II model. Significance criteria for hydropower effects would be the same as discussed in section 4.4.2.

USACE used Reclamation's LTGen and DWR's SWPGen models for CVP and SWP facilities, respectively, to quantify the hydropower generation and pumping energy under Fixed-400,000 af flood storage operation. USACE ran the respective models, as described in Section 3.2, for an 81-year POR extending from water year 1922 through water year 2002. 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.

General Observations

Hydropower model outputs indicate that the CVP facilities' long-term and driest-periods' energy generation, capacity, and pumping energy use under Alternative 2 - Forecast-informed Operations would slightly increase or not change relative to Fixed-400,000 af flood storage operation. The long-term net generation at load center would slightly decrease. The magnitude of the change would be small, typically a difference of 1 percent or less. CVP foregone energy would not change for the long-term or the driest periods. Table 5-17 summarizes the results of the long-term and driest period hydropower effects evaluation. Table 5-18 summarizes the evaluation parameters and metrics for each monthly period.

The SWP facilities' long-term and monthly key quantities and metrics for energy generation and project use would slightly decrease; however, the net energy generation at load center would increase. The magnitude of the change would be small, typically less than 1 percent. During the SWP monthly driest-periods' capacity, energy generation, pumping energy use, and net energy generation at load center would slightly decrease, a less than 1-percent difference. Foregone energy for SWP during the driest periods showed an increase in water bypassing the powerplants, representing an 18-percent difference between the two scenarios.

Table 1-17. CVP-SWP Hydropower Summary for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation.

Evaluation Parameters		Long Term			Driest Periods		
	Metric	Change		percent Difference	Change		percent Difference
CVP Long-Term and Driest Periods							
Decrease to no change relative to the Fixed-400,000 af flood storage operation ELD condition. Magnitude of changes are small, typically representing a difference of 1 percent or less. Driest Period shows slightly greater variability, but difference typically less than 1 percent.	Capacity	0	MW	√	1	MW	√
	Energy Generation	0	GWh	√	1	GWh	√
	Energy Use	1	GWh	√	1	GWh	√
	Foregone Energy	0	GWh	√	0	GWh	√
	Net Generation	-1	GWh	√	0	GWh	√
SWP Long-Term and Driest Periods							
Slight increase to no change relative to the Fixed-400,000 af flood storage operation ELD condition. Magnitude of changes are small, typically representing a difference of 1 percent or less. Driest Period shows slightly greater variability, but difference typically less than 1 percent.	Capacity	-1	GWh	√	-2	GWh	√
	Energy Generation	-1	MW	√	-3	MW	√
	Energy Use	-2	GWh	√	-1	GWh	√
	Foregone Energy	1	GWh	1 percent	3	GWh	18 percent
	Net Generation	1	GWh	√	-1	GWh	√
Note: "√" refers to less than 1 percent difference in the evaluation metric for both scenarios							

Evaluation of Effects

The CVP and SWP facilities' capacity and generation differences would be due in part to changes to the spring-refill WCD operations under Alternative 2 - Forecast-informed Operations whereby the CalSim II model predicts higher maximum allowable storages in spring and therefore storing more water in spring and releasing it in summer through early fall.

The changes are most apparent for the driest periods for the CVP facilities, which show a slight decrease in energy generation in spring and August followed by an increase in fall. The maximum reduction in energy generation would occur in March and August with the maximum increase occurring in November under the driest periods. These differences are due to the effect of adjusted spring-refill WCD operations under Alternative 2 - Forecast-informed Operations.

Comparisons of the hydropower metrics for the driest periods for the SWP facilities show a general decrease in all parameters. Under Alternative 2 - Forecast-informed Operations, foregone energy would increase slightly in the long term by 1 percent and would be most pronounced in the driest periods, showing an increase of 18 percent in foregone energy under Alternative 2 - Forecast-informed Operations.

Table 1-18. CVP-SWP Hydropower Monthly Summary for Alternative 2 - Forecast-informed Operations vs. Fixed-400,000 af flood storage operation.

Evaluation Parameters		**Long Term**			**Driest Periods**		
CVP Long-Term and Driest Periods	**Metric**	Change		percent Difference	Change		percent Difference
Decrease to no change relative to the Fixed-400,000 af flood storage operation ELD condition. Magnitude of changes are small, typically representing a difference of 1 percent or less. Driest Period shows slightly greater variability, but difference typically less than 1 percent.	Capacity	0	MW	√	1	MW	√
	Energy Generation	0	GWh	√	1	GWh	√
	Energy Use	1	GWh	√	1	GWh	√
	Foregone Energy	0	GWh	√	0	GWh	√
	Net Generation	-1	GWh	√	0	GWh	√
SWP Long-Term and Driest Periods							
Slight increase to no change relative to the Fixed-400,000 af flood storage operation ELD condition. Magnitude of changes are small, typically representing a difference of 1 percent or less. Driest Period shows slightly greater variability, but difference typically less than 1 percent.	Capacity	-1	GWh	√	-2	GWh	√
	Energy Generation	-1	MW	√	-3	MW	√
	Energy Use	-2	GWh	√	-1	GWh	√
	Foregone Energy	1	GWh	1 percent	3	GWh	18 percent
	Net Generation	1	GWh	√	-1	GWh	√
Note: "√" refers to less than 1 percent difference in the evaluation metric for both scenarios							

The increase in foregone energy can be attributed to a slightly more rapid drawdown of Oroville Lake during drier years under Alternative 2 - Forecast-informed Operations, leading to spills at the Oroville Dam more frequently. The incremental foregone loss on an average annual basis represents 0.02 percent of the historical average annual generation at Oroville Dam, and the incremental impact is marginal when compared against the overall scale of the project footprint. In addition, as noted in Section 2.2.2, 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.

1.1.7 Recreation

This section discusses comparisons between recreation conditions under Alternative 2 – Forecast-informed Operations and the 1986 Fixed-400,000 af Flood Storage Operations using an existing level of water demand in the CalSim II model. Significance criteria for recreation effects would be the same as discussed in section 4.9.2.

General Observations

<u>Folsom Reservoir</u>

As shown in Table 5-19, the upper threshold of significance at an elevation of 466 feet would likely be met or exceeded less frequently with the Alternative 2 - Forecast-informed Operations than with the existing Fixed-400,000 af flood storage operation condition. The lower threshold of significance at elevation 435 feet would be met or exceeded at a lower frequency with the Alternative 2 - Forecast-informed Operations relative to the 400-fixed existing condition except for July and August.

Table 1-19. Key Reservoir Threshold Difference between the With-Project Alternative and Fixed-400,000 af flood storage operation Probability of Exceedance.

Key Reservoir Elevations Elevation (ft.)	Upper Threshold 466	Lower Threshold 435
May	0.1 percent	–1.1 percent
June	–5.3 percent	–1.0 percent
July	–2.6 percent	2.1 percent
August	*	1.4 percent
September	*	–0.4 percent

Note: * Threshold of significance is not crossed.

The thresholds of significance for the five boat ramps that provide access for on-lake recreation on Folsom Reservoir would generally be exceeded more frequently with the Alternative 2 - Forecast-informed Operations than with the 400-fixed existing condition (Table 5-20). Each of the five boat ramps would experience at least 1 month with a lower probability of exceedance with Alternative 2 - Forecast-informed Operations than with the 400-fixed existing condition.

Table 1-20. Boat Ramp Access Threshold Difference between the Alternative 2 and Fixed-400,000 af flood storage operation Probability of Exceedance.

Minimum Boat Ramp Elevation (ft.)	Beal's Point 420	Dike 8 405	Brown's Ravine Main 395	Hobie Cove 375	Granite Bay 360
May	–0.2 percent	0.0 percent	0.0 percent	*	*
June	1.1 percent	0.0 percent	0.0 percent	*	*
July	0.6 percent	–0.1 percent	–0.7 percent	–0.1 percent	*
August	1.2 percent	0.1 percent	–1.3 percent	0.0 percent	–0.1 percent
September	0.1 percent	0.2 percent	–0.7 percent	–0.2 percent	0.0 percent

Note: * Threshold of significance is not crossed.

The majority of the minimum thresholds of significance for the four primary swimming locations would be exceeded more frequently with the Alternative 2 - Forecast-informed Operations than with the 400-fixed existing condition (Table 5-21). The thresholds of significance would be exceeded less frequently for 1 month at each location with the Alternative 2 - Forecast-informed Operations relative to the 400-fixed existing condition.

Table 1-21. Reservoir Swim Access Threshold Difference between Alternative 2-Forecast-informed operations and Fixed-400,000 af flood storage operation Probability of Exceedance.

Swim Beaches Minimum Elevation (ft.)	Granite Bay – Main Swim Beach 450	Granite Bay – Oak Point Swim Beach 440	Rattlesnake Bar – Jet Ski Cove 425	Rattlesnake Bar – Vista Shoreline Access 420

May	6.9 percent	–1.1 percent	0.0 percent	–0.2 percent
June	5.2 percent	0.2 percent	–0.1 percent	1.1 percent
July	0.4 percent	2.0 percent	1.2 percent	0.6 percent
August	0.5 percent	0.0 percent	0.4 percent	1.2 percent
September	–0.7 percent	0.2 percent	0.2 percent	0.1 percent

Lower American River

The upper threshold of significance (the maximum optimal flow) for the lower American River would be met or exceeded at a higher frequency with the Alternative 2 - Forecast-informed Operations relative to the 400-fixed existing condition (Table 5-22). Notably, the threshold would not be crossed in August and September. The minimum optimal threshold of significance for the lower American River would be met or exceeded at a lower frequency in July and at a higher frequency in other months with the Alternative 2 - Forecast-informed Operations relative to the 400-fixed operation. The minimum adequate flow threshold of significance for the lower American River would be met or exceeded at a higher frequency with the Alternative 2 - Forecast-informed Operations relative to the 400-fixed existing condition in every month.

Table 1-22. Lower American River Recreation Threshold Difference between the Alternative 2 and Fixed-400,000 af flood storage operation Probability of Exceedance.

Lower American River Thresholds of Significance Flows (cfs)	**Maximum Optimal 6,000**	**Minimum Optimal 3,000**	**Minimum Adequate 1,750**
May	0.3 percent	1.7 percent	18.2 percent
June	2.8 percent	1.8 percent	9.3 percent
July	1.0 percent	–2.6 percent	1.2 percent
August	*	0.0 percent	10.0 percent
September	*	1.8 percent	1.9 percent

Note: * Threshold of significance is not crossed.

Shasta Reservoir

The upper threshold of significance and the optimum recreation WSE (1,020 feet) would be met or exceeded at the same or higher frequency in every month with the Alternative 2 - Forecast-informed Operations to the 400-fixed existing condition (Table 5-23). The lower threshold of significance, the minimum recreation WSE, at elevation 941 feet, and the shoreline recreation WSE threshold of significance (1,007 feet) would be met or exceeded more frequently in every month with the Alternative 2 - Forecast-informed Operations than with the 400-fixed operation, except in May for the minimum recreation WSE (941 feet) and in June and August for the lower shoreline recreation WSE (1,007 feet).

Table 1-23. Key Shasta Reservoir Threshold Difference between the Alternative 2 and Fixed-400,000 af flood storage operation Probability of Exceedance.

Key Reservoir Thresholds Elevation (ft.)	**Optimum Shoreline Recreation**	**Lower Shoreline Recreation**	**Minimum Recreation**

	1,020	**1,007**	**941**
May	0.0 percent	0.0 percent	–0.1 percent
June	0.0 percent	–0.6 percent	0.0 percent
July	1.0 percent	0.1 percent	0.2 percent
August	0.0 percent	–0.2 percent	0.2 percent
September	*	1.0 percent	0.0 percent

Sacramento River

The mean monthly flows on the Sacramento River below Keswick Dam would drop below the threshold of significance of 5,000 cfs during May and September. In May, the mean monthly flow probability of exceedance would not change with the Alternative 2 - Forecast-informed Operations relative to the 400-fixed existing condition. In September, the mean monthly flow probability of exceedance would change by –1.2 percent with the Alternative 2 - Forecast-informed Operations relative to the 400-fixed existing condition. The threshold of significance would not be crossed for the remainder of the recreation season.

The mean monthly flow on the Sacramento River at the Freeport gage would not drop below the threshold of significance of 5,000 cfs during the recreation season.

Evaluation of Effects

Folsom Reservoir

The Alternative 2 - Forecast-informed Operations would have minimal positive effects relative to the 400-fixed existing condition for the upper threshold of significance for Folsom Reservoir. The maximum water surface elevation (466 feet) would be met less frequently for June and July (up to 5.3 percent less) and not crossed at all in August and September. The decrease in frequency would indicate an increase in time at the maximum elevation for recreational activities.

With the Alternative 2 - Forecast-informed Operations, the probability of exceeding the lower threshold of significance (435 feet) would increase in 2 months (up to 2.1 percent) and decrease for 3 months (1.1 percent or less). The differences between the two conditions are functionally equivalent.

In general, the probability of exceeding the minimum elevation at which the various reservoir boat ramps and swim beaches would be usable would increase by up to a 1.2 percent at boat ramps and 6.9 percent at swim beaches with the Alternative 2 - Forecast-informed Operations. The general increase in the probability of exceedance indicates an increase in the amount of time that the boat ramps and swim beaches would be usable.

Lower American River

The lower American River would experience mostly positive effects with the Alternative 2 - Forecast-informed Operations relative to the 400-fixed existing condition. The probability of exceeding the lower thresholds of significance (minimum, adequate, and optimal) would increase with the Alternative 2 - Forecast-informed Operations over the 400-fixed existing condition up to 18.2 percent, indicating a positive effect for on-river recreation. The only negative effect would be relative to the maximum optimal flow (6,000 cfs) where the probability of exceeding the threshold of significance is higher, but only slightly (up to 2.8 percent).

Shasta Reservoir

The differences in the probability of exceedance for the Shasta Reservoir elevations between the Alternative 2 - Forecast-informed Operations and the 400-fixed existing condition for all three thresholds would be functionally equivalent (1.0 percent or less).

Sacramento River

The thresholds of significance for the Sacramento River would be exceeded at similar frequencies for the two conditions for May and September below Keswick Dam. The remainder of the thresholds of significance for the Sacramento River at Keswick Dam and the Freeport gage would not be crossed, a result that gives no indication of the benefit or detriment for either condition in this comparison.

1.1.8 Cultural Resources

This section discusses the cumulative effects to cultural resources including both the anticipated effects of the Alternative 2 – Forecast-informed Operations, as discussed in Chapter 4.9, and the effects that were incurred under the 1986 Fixed-400,000 af Flood Storage Operations scenario. In addition, Alternative 2 is compared to the No Action/No Project while using a future level of water demand condition in the CalSim II model. Significance criteria for cultural resources effects would be the same as discussed in section 4.9.2.