Chapter 13
Revised Proposed Plan Amendments

13.1 Introduction

The State Water Resources Control Board (State Water Board) is considering amendments to the Bay-Delta Plan for the Sacramento River and its tributaries, Delta eastside tributaries (including the Calaveras, Cosumnes, and Mokelumne Rivers), and Delta for the reasonable protection of fish and wildlife beneficial uses, referred to as the Sacramento/Delta Update to the Bay-Delta Plan. In September 2023, the State Water Board released the *Draft Staff Report/Substitute Environmental Document in Support of Potential Updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary for the Sacramento River and Its Tributaries, Delta Eastside Tributaries, and Delta* (2023 draft Staff Report) evaluating the potential environmental, water supply, and economic effects of different alternatives for the Sacramento/Delta Update to the Bay-Delta Plan. The 2023 draft Staff Report evaluated the following: proposed Plan amendments that were based on the 2018 Framework for a possible Sacramento/Delta update to the Bay-Delta Plan (2018 Framework); proposed Voluntary Agreements (VAs), referred to as the Healthy Rivers and Landscapes (HRL) proposal; as well as Low Flow and High Flow alternatives and several modular alternatives that would modify the other alternatives. Proposed amendments to the Bay-Delta Plan were released in October 2024 (2024 draft Plan) that were based on the various alternatives identified in the 2023 draft Staff Report with modifications in consideration of public comments. Following a public comment period on the 2024 draft Plan, revised proposed Plan amendments were released in July 2025 (July 2025 revised draft Plan). The State Water Board delayed the public comment on that draft pending limited recirculation of the 2023 draft Staff Report. In December 2025, the State Water Board released this Chapter 13, *Revised Proposed Plan Amendments*, as a limited recirculation of the 2023 draft Staff Report (2025 partially recirculated draft Staff Report) together with the December 2025 revised draft Plan for public review and comment. The December 2025 revised draft Plan included minor edits to the July 2025 revised draft Plan. In August 2026, the State Water Board released a final draft Bay-Delta Plan that included refinements to the revised proposed Plan amendments based on public comments received on the December 2025 revised draft Plan. This chapter summarizes those changes and includes evaluation of the changes building on the original analyses included in the 2023 draft Staff Report as described further below.

Comments on the December 2025 revised draft Bay-Delta Plan and Chapter 13 of the 2025 partially recirculated draft Staff Report informed development of the final draft of the Plan and this final Staff Report. This final Staff Report contains responses to previously submitted comments on the 2023 draft Staff Report (including responsive edits to the Staff Report) as well as any additional comments on Chapter 13 in Volume 3, *Response to Comments*. This final Staff Report informs the Board's consideration of adoption of the Sacramento/Delta updates to the Bay-Delta Plan.

The 2023 draft Staff Report included the description of the proposed Plan amendments in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*. The environmental analysis for the proposed Plan amendments and a description and analysis of other project alternatives was provided in Chapter 7, *Environmental Analysis*. Because the State Water Board received the

proposed VAs after much of the 2023 draft Staff Report had been prepared, the proposed VAs were described and analyzed separately in Chapter 9, *Proposed Voluntary Agreements*.

The revised proposed Plan amendments for the Sacramento/Delta Update to the Bay-Delta Plan are evaluated in this chapter and include a regulatory pathway based on the proposed Plan amendments described in Chapter 5 with modifications and a voluntary agreement pathway (VA pathway) described in Chapter 9 that would provide a pathway for implementation of the HRL commitments. The revised proposed Plan amendments incorporate aspects of the other alternatives that were evaluated in the 2023 draft Staff Report. The VA pathway would apply for the water rights included in the approved VA pathway, and the regulatory pathway would apply for water rights not included as part of the approved VA pathway, with both pathways having regulatory effect if adopted. The revised proposed Plan amendments also incorporate Tribal Beneficial Uses (TBUs), designate Tribal Tradition and Culture (CUL) beneficial use, and include provisions for tribal outreach and engagement and incorporation of tribal feedback and Traditional Ecological Knowledge (TEK) into the Bay-Delta Plan update and implementation processes. Additional provisions for developing an implementation methodology and other general provisions are included in the revised proposed Plan amendments, including requirements for monitoring, evaluation, reporting, and special studies; the development of biological goals; and annual and periodic review.

The analysis of the revised proposed Plan amendments presented in Chapter 13 builds upon the analysis of the proposed Plan amendments, the proposed VAs, and the alternatives presented in earlier chapters, with revisions, including revisions made to Chapter 13 based on comments on the 2025 partially recirculated draft Staff Report. Chapter 13 provides the background for the planning process, a description of the revised proposed Plan amendments, and the analyses of the expected changes in hydrology and water supply, economic effects, beneficial environmental effects, and an analysis of potential environmental impacts. Chapter 13 also includes Water Code section 13241 and Public Trust analyses. For efficiency and to avoid redundancy, Chapter 13 references the environmental analyses, impact determinations, and associated mitigation measures from the 2023 draft Staff Report Chapters 7 and 9, and the economic analyses from Chapters 8 and 9 where applicable (see Section 13.7, *Environmental Analysis*, for a description of the approach to the environmental analysis).

Descriptions of the Chapter 13 sections are provided below to assist the reader.

- Section 13.1, *Introduction*, introduces the chapter.
- Section 13.2, *Planning Process*, describes the public process to develop and analyze the Sacramento/Delta updates to the Bay-Delta Plan.
- Section 13.3, *Revised Proposed Plan Amendments*, describes the revised proposed Plan amendments, including the regulatory pathway, the VA pathway, and other generally applicable requirements identified in the revised proposed Plan amendments.
- Section 13.4, *Changes in Hydrology and Water Supply*, describes the potential changes in hydrology and water supply associated with the revised proposed Plan amendments and presents Sacramento Water Allocation Model (SacWAM) output for the regulatory and VA pathways.

- Section 13.5, *Beneficial Environmental Effects*, provides the expected benefits of the regulatory and VA pathways of the revised proposed Plan amendments, using analytical methods developed in the Scientific Basis Reports.
- Section 13.6, *Public Trust and Water Code Section 13241 Analyses*, provides the Public Trust, Water Code section 13241, and antidegradation analyses for the revised proposed Plan amendments.
- Section 13.7, *Environmental Analysis,* presents the approach to the environmental analysis; environmental analyses of the revised proposed Plan amendments; an analysis of cumulative impacts, growth-inducing impacts, and significant irreversible environmental changes, relying in part on the analyses in Chapter 7, *Environmental Analysis*, and Chapter 9, *Proposed Voluntary Agreements*.
- Section 13.8, *Economic Analysis and Other Considerations*, evaluates the economic effects associated with the revised proposed Plan amendments, relying in part on the analyses in Chapter 8, *Economic Analysis and Other Considerations*, and Chapter 9, *Proposed Voluntary Agreements*.

This chapter was included in the 2025 partially recirculated draft Staff Report and has been revised as follows. In addition to the changes described below, several changes have been made to the revised proposed Plan amendments, which are summarized in Section 13.3, *Revised Proposed Plan Amendments* and incorporated into the final draft Bay-Delta Plan.

As described further in Section 13.4, *Changes in Hydrology and Water Supply*, on December 4, 2025, pursuant to direction included in Action 5 of federal Executive Order 14181, the U.S. Bureau of Reclamation (Reclamation) modified operational constraints included in the Record of Decision (ROD) for the Long-Term Operations (LTO) of the Central Valley Project (CVP) and State Water Project (SWP). Those modifications included adding flexibility to reduce Old and Middle River (OMR) reverse-flow restrictions and elimination of fall X2 requirements. In addition to the 2025 ROD changes, two amendments to the California Department of Fish and Wildlife (CDFW) Incidental Take Permit (ITP) issued for SWP operations pursuant to the California Endangered Species Act (CESA) were approved by CDFW in 2025 to change requirements for SWP operations, including: 1) a 1-year modification to remove the requirements for fall X2 in exchange for a summer food and habitat action, and 2) flexibility to reduce OMR flow restrictions at certain times. The California Department of Water Resources (DWR) has also submitted a 2026 ITP amendment request to CDFW to permanently remove the requirements for fall X2. In July 2026, CDFW approved an additional 1-year modification to the ITP. CDFW is continuing to process the request for a permanent amendment to the ITP and expects to make its decision on the request by December 2026.

Although the effects of possible changes to regulatory requirements, including changes to the LTO ROD of the CVP and SWP, were evaluated in Section 13.7.21.1, *Cumulative Impact Analysis*, the specific 2025 ROD and 2025 CDFW ITP changes (collectively, 2025 ROD/ITP) were not modeled and evaluated in the 2025 partially recirculated draft Staff Report released for public review and comment on December 12, 2025, because those changes occurred at nearly the same time as the release of the 2025 partially recirculated draft Staff Report. This final Staff Report has been updated to provide information on the possible effects of the 2025 ROD/ITP that is in addition to the information and analyses provided in Chapter 13 of the 2025 partially recirculated draft Staff Report. Several sections have been updated with new information about the possible changes that could occur under the revised proposed Plan amendments in combination with the 2025 ROD/ITP,

including Section 13.4, *Changes in Hydrology and Water Supply*; Section 13.5, *Beneficial Environmental Effects*; and Section 13.7, *Environmental Analysis*.

The HRL flows are intended to be additive to required flows under State Water Board Decision 1641 (D-1641) and resulting flows under the 2024 LTO ROD and 2024 National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) Biological Opinions (BiOps) rather than the 2025 ROD/ITP. As such, because changes under the 2025 ROD/ITP could reduce the base upon which the HRL flow commitments are intended to be added, the revised proposed Plan amendments include a new base flow balancing provision for CVP/SWP operations (referred to as the LTO base flow balancing provision), which is discussed in more detail in Section 13.3, *Revised Proposed Plan Amendments*. The provision requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The additional analyses presented in this chapter show the effects of not having the LTO base flow balancing provision. However, the LTO base flow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway.

The LTO base flow balancing provision would not apply under the regulatory pathway because the regulatory pathway flow requirements are not built on base flows but instead are requirements for tributary and Delta outflow levels based on unimpaired flows. However, increases in Delta outflows under the regulatory pathway could also be reduced due to the 2025 ROD/ITP at times that the prior fall X2 and OMR flow restrictions that were modified in the 2025 ROD/ITP would be controlling Delta outflows versus required instream flow under the regulatory pathway. This is more likely with water supply adjustments (WSAs) than without WSAs but could occur without WSAs, particularly in the fall. Chapter 13, *Revised Proposed Plan Amendments,* has been updated to evaluate these possible effects of changes to other regulatory requirements on the expected outcomes of the Bay-Delta Plan under the regulatory pathway. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the new narrative interior Delta flow objective, which is described in Section 13.3.6, *Interior Delta Flows*. Although the narrative objective is expected to be met through implementation of CESA and ESA requirements and compliance with the existing numeric interior Delta flow objectives in the Plan, as appropriate, during annual or periodic reviews of the Bay-Delta Plan and its implementation, the State Water Board will evaluate the effectiveness of the interior Delta flow objectives and implementation actions and assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

In addition to added information on the possible effects of the 2025 ROD/ITP, a new Section 13.6.3, *Antidegradation*, has been added to the Staff Report that describes that the revised proposed Plan amendments are consistent with the State Water Board's Statement of Policy with Respect to Maintaining High Quality Waters in California (Antidegradation Policy) (State Water Board Resolution No. 68-16). In addition, a new Section 13.7.1.4, *Alternatives Analysis*, and accompanying Appendix H4, *Impact Summary Table for Alternatives*, has been added to supplement the analysis of the environmental impacts of other project alternatives, which are described in Section 7.2, *Alternatives Description*, and evaluated in Section 7.24, *Alternatives Analysis*. Appendix H4 comprehensively details and compares the specific environmental impacts of the proposed Plan amendments described in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, Low Flow Alternative (Alternative 2), High Flow Alternative (Alternative 3), proposed Voluntary Agreements (Alternative 6), and No Project Alternative (Alternative 1) to the

environmental impacts of the revised proposed Plan amendments. This new analysis provides additional context and information concerning the environmental impacts of the revised proposed Plan amendments and each stand-alone project alternative but does not change the conclusions of the environmental analysis presented in Section 13.7. In addition, Section 13.7.1.4 provides a discussion of the environmentally superior alternative.

Finally, Chapter 13 has also been revised with additional minor changes, including clarifying edits, corrections, and editorial changes, including changes in responses to comments received on the 2025 partially recirculated draft Staff Report.

13.2 Planning Process

The Bay-Delta watershed encompasses California's two major river systems, the Sacramento and San Joaquin Rivers, as well as several other tributaries and branches to those rivers, the Delta and tributaries, Suisun Marsh, and San Francisco Bay. The Bay-Delta watershed supports a variety of beneficial uses of water including but not limited to: drinking water for more than two-thirds of Californians, irrigation to the largest agricultural economy in the United States, commercial and sport fishing, recreational opportunities in various waterways, and habitat in the largest estuarine ecosystem on the West Coast of the Americas which supports a diverse array of migratory and resident fish, birds, and other valued wildlife and plants. The Bay-Delta watershed is also home to numerous California Native American Tribes and small and large communities, including economically disadvantaged communities and black, Indigenous, and people of color communities. The Delta is the hub for California's water supply system, which is one of the most complex water conveyance systems in the country and serves as a source of water for the state's two largest water supply and delivery projects, as well as many other large and small diverters.

The State Water Board has the authority and responsibility to adopt statewide water quality control plans and adopts the Bay-Delta Plan because of its ecological and water supply importance to the state. The Bay-Delta Plan identifies beneficial uses of water, largely flow-based water quality objectives designed to protect those uses, and a program of implementation to achieve the objectives, as well as monitoring and evaluation provisions. Because the Bay-Delta Plan includes largely flow-based water quality objectives that are implemented largely through water right provisions, it is developed within the Division of Water Rights and adopted by the State Water Board. The Bay-Delta Plan is required to be reviewed and updated periodically to provide for the reasonable protection of beneficial uses of water in accordance with the California Porter-Cologne Water Quality Control Act and other laws. The Bay-Delta Plan is intended to work together with the two regional water quality control plans to provide the foundational requirements for protecting beneficial uses of the Bay-Delta watershed. The current Bay-Delta Plan water quality objectives that apply to the Sacramento/Delta watershed were last updated in 1995, based, in part, on an agreement between state and federal agencies regarding measures for ecosystem protection in the Bay-Delta watershed.

In response to fishery and ecosystem declines in the Bay-Delta watershed and its tributaries since the adoption of the 1995 updates to the Bay-Delta Plan, the State Water Board has been in the process of updating the Bay-Delta Plan to provide for the reasonable protection of fish and wildlife beneficial uses. The Bay-Delta Plan is being updated and implemented in separate processes focused on two distinct portions of the Bay-Delta watershed. The first process, known as the Lower San Joaquin/Southern Delta update, was completed in 2018 and is in the process of being implemented. The Lower San Joaquin/Southern Delta amendments to the Bay-Delta Plan established updated San Joaquin River and tributary flow requirements for the reasonable protection of fish and wildlife beneficial uses and also updated salinity requirements in the southern Delta for the reasonable protection of agricultural beneficial use. The second process, known as the Sacramento/Delta update, is focused on flows and other measures for the reasonable protection of fish and wildlife in the Sacramento River and its tributaries, Delta eastside tributaries, and the Delta. The following sections summarize relatively recent steps in the planning process for the Sacramento/Delta update to the Bay-Delta Plan since the release of the Scientific Basis Report for the Sacramento/Delta

updates to the Bay-Delta Plan in 2017 (*Scientific Basis Report in Support of New and Modified Requirements for Inflows from the Sacramento River and its Tributaries and Eastside Tributaries to the Delta, Delta Outflows, Cold Water Habitat, and Interior Delta Flows*). Throughout the planning process, the State Water Board provided many opportunities for interested parties to provide input on the Sacramento/Delta updates to the Bay-Delta Plan, and that valuable input was carefully considered and informed the revised proposed Plan amendments and this final Staff Report. For additional information on public participation, see Chapter 12, *Public Participation.*

13.2.1 Scientific Basis Report and Framework

In 2017, following public comment and peer review, the State Water Board completed a Scientific Basis Report (2017 Scientific Basis Report) for the Sacramento/Delta update that describes the science supporting possible Sacramento/Delta updates to the Bay-Delta Plan that were under consideration at that time. The 2017 Scientific Basis Report supports the need for updates to the Bay-Delta Plan to provide for the reasonable protection of native fish and other aquatic species, including the need for updated inflows and outflows that work together in a comprehensive framework with other complementary actions to protect the Bay-Delta ecosystem.

Based on the 2017 Scientific Basis Report, in July 2018, a framework for possible Sacramento/Delta updates to the Bay-Delta Plan was released that identified possible changes to the Bay-Delta Plan including narrative and numeric inflow requirements from the Sacramento River, its tributaries, and Delta eastside tributaries (the Cosumnes, Mokelumne, and Calaveras Rivers); narrative and numeric inflow-based Delta outflows that would require inflows from the Sacramento/Delta tributaries and San Joaquin River and tributaries to be provided as Delta outflow; narrative cold water habitat provisions; and narrative and numeric interior Delta flow requirements, as well as associated monitoring, reporting, and evaluation measures and other provisions.

13.2.2 Voluntary Agreement Pathway for Healthy Rivers and Landscapes Commitments

In March 2022, the State Water Board received a Memorandum of Understanding Advancing a Term Sheet for the Voluntary Agreements to Update and Implement the Bay-Delta Water Quality Control Plan, and Other Related Actions (hereafter referred to as the MOU). After the MOU was submitted and during the development of the 2023 draft Staff Report, the Voluntary Agreements (or VAs) were renamed Healthy Rivers and Landscapes, or HRL, by the VA proponents. Both terms are used in this document and associated documents. The term "HRL commitments" is generally used to refer to the flow and non-flow actions that are proposed in the MOU and its related documents, while the term "Voluntary Agreement Pathway" is used to refer to the regulatory provisions in the Bay-Delta Plan that would allow for implementation of the HRL flow and non-flow commitments. The VA pathway is described further in Section 13.3, *Revised Proposed Plan Amendments*.

The MOU included signatories from state and federal agencies, local water agencies, private companies, and a non-profit mutual benefit corporation (collectively referred to in the MOU as "Parties," "public water agencies," or "PWAs" and referred to in this chapter as "HRL participants"[1]) and proposed a combination of flow and non-flow habitat restoration actions on the American, Feather, Sacramento, Yuba, and Mokelumne Rivers; Putah Creek; and in the Delta. The HRL flow and

[1] The State Water Board is not a signatory to the MOU or other HRL documents.

non-flow measures described in the MOU were proposed by the HRL participants as an alternative for updating and implementing the Bay-Delta Plan to contribute to the reasonable protection of fish and wildlife beneficial uses. The MOU, along with a draft Strategic Plan, Governance Program, Science Plan, and an Early Implementation Project List, constitute the HRL as proposed by the participants at that time. Since 2022, the HRL participants submitted both new and updated documents to the State Water Board. Current and prior versions of updated VA documents are available on the State Water Board's website and also available on the California Natural Resources Agency website.[2]

The State Water Board received updates to the MOU in 2022 in August and November. The changes to the MOU included updated flow and non-flow commitments for the Mokelumne River and a proposal for the Tuolumne River. Though the Tuolumne River proposal was included in the updated MOU, it is being considered through a separate process from the Sacramento/Delta Update to the Bay-Delta Plan. The State Water Board received additional updates to the MOU in 2025 to include two new proposals on the Bear River, Yuba River, and Auburn Ravine, and one additional proposal on Putah Creek.

13.2.3 Scientific Basis Report Supplement

In support of the State Water Board's process of evaluating and considering the HRL proposal as an alternate pathway for protection of fish and wildlife as part of the Sacramento/Delta Update to the Bay-Delta Plan, State Water Board staff, in collaboration with staff from the California Department of Water Resources (DWR) and the California Department of Fish and Wildlife (CDFW), drafted a Scientific Basis Report Supplement (*Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan*). The Scientific Basis Report Supplement is an addendum to the 2017 Scientific Basis Report that documents science supporting anticipated benefits of the HRL commitments. The report builds on the 2017 Scientific Basis Report to evaluate the HRL proposed flow and non-flow habitat restoration actions.

The draft Scientific Basis Report Supplement was released for public comment in January 2023. Following receipt of public comments, the draft was revised, and a final draft Scientific Basis Report Supplement was submitted for independent external scientific peer review. In February 2024, the State Water Board received the peer review responses. State Water Board staff revised the Scientific Basis Report Supplement in collaboration with staff from CDFW and DWR in response to peer reviewers' comments and finalized the report in 2026. The final draft Scientific Basis Report Supplement was included with the 2023 draft Staff Report as Appendix G2, and the final Scientific Basis Report Supplement is included as an updated Appendix G2 to this final Staff Report in support of the Sacramento/Delta Update to the Bay-Delta Plan.

[2] The VA documents include a Memorandum of Understanding and Term Sheet; Cover Memo; Strategic Plan; Governance Program; Science Plan; Early Implementation Project List; Flow Accounting; Non-Flow Measure Accounting; Funding Plan; Science Committee Charter; Global, Implementing, and Enforcement Agreements; Memorandum Regarding Healthy Rivers and Landscapes Habitat Restoration Design Criteria; and a Proposed Alternative to Modular Alternative 6a for New or Expanded Diversion Projects.

13.2.4 Draft Staff Report

In September 2023, the State Water Board released for public review and comment the 2023 draft Staff Report, which identified and evaluated proposed Plan amendments based on the 2018 Framework and identified the possible inclusion of a VA pathway for the HRL commitments, as well as other alternatives.

The proposed Plan amendments are described in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, of the 2023 draft Staff Report and include the following objectives and implementation measures for the protection of fish and wildlife:

1. Inflows from the Sacramento River/Delta tributaries that would require 55 percent unimpaired flow, with an adaptive range from 45 percent to 65 percent unimpaired flow.
2. Inflow-based Delta outflows that would require that the required inflows, including inflows required as part of the 2018 updates to the Bay-Delta Plan, are provided as Delta outflow.
3. Cold water habitat provisions that would require reservoirs to be operated in a manner that provides needed cold water habitat for salmonids or other measures to protect cold water habitat.
4. Interior Delta flows to reasonably protect native fish populations migrating through and rearing in the Delta, including expanding the existing Bay-Delta Plan export constraints based on San Joaquin River inflows to include all of April and May and variable exports based on hydrologic conditions; incorporation of Old and Middle River (OMR) flow constraints; and addition of October to the possible time period when the Delta Cross Channel (DCC) Gates are required to be closed.

The other alternatives that were evaluated in the 2023 draft Staff Report included the following: No Project Alternative (Alternative 1), a Low Flow Alternative (Alternative 2), a High Flow Alternative (Alternative 3), and the Proposed Voluntary Agreements Alternative (Alternative 6). The No Project Alternative was included to provide a comparison of the environmental impacts of approving the project with the impacts of not approving the project. The Low Flow and High Flow Alternatives would require lower or higher amounts of inflow to the Delta but otherwise would have been consistent with the proposed Plan amendments.

The 2023 draft Staff Report also evaluated modular alternatives, including: Alternatives for Interior Delta Flows/Fall Delta Outflow (Alternatives 4a, 4b, and 4c); Drought Alternatives (Alternatives 5a and 5b); and Alternatives for Protection of Voluntary Agreement Flows (Alternative 6a).

Alternative 4a would exclude from the proposed Plan amendments and the Low and High Flow Alternatives interior Delta flow and fall Delta outflow provisions originating from the Record of Decision (ROD) and associated U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BiOp) for the Long-Term Operations (LTO) of the Central Valley Project (CVP) and CDFW Incidental Take Permit (ITP) for operation of the State Water Project (SWP). Alternative 4b would require installation of a Head of Old River Barrier (HORB) or alternative mechanisms to prevent San Joaquin River-origin anadromous fish from being drawn into the Delta export facilities. Alternative 4c would require additional export constraints as a function of San Joaquin River flows (commonly referred to as the *San Joaquin River inflow to export ratio* or *I:E*). The modular drought alternative includes two variations to help address limited water supplies during drought. Alternative 5a would require water diverters (in addition to DWR and Reclamation) to bypass water needed to meet existing

water quality objectives during drought circumstances similar to existing standard water right Term 91; Alternative 5b would require all water users to reduce their use during drought conditions.

The proposed VAs were described as Alternative 6 in the 2023 draft Staff Report and were analyzed in Chapter 9, *Proposed Voluntary Agreements*, and include a combination of commitments over 8 years (with the possibility of extension), including varying amounts of commitments to additive or modified tributary flows and Delta outflows, depending on water year type, and non-flow habitat restoration actions intended to improve conditions for native fish species. The flow and non-flow habitat restoration actions were proposed as implementation measures for an existing and a new narrative water quality objective in the Bay-Delta Plan, including: the existing narrative salmon protection objective (which the HRL participants propose to contribute to achieving by 2050); and a new narrative objective to achieve the viability of native fish populations proposed by the HRL participants. Since that time the VA pathway would also implement narrative inflow, cold water habitat, Delta outflow, and interior Delta flow objectives.

The release of the 2023 draft Staff Report was followed by a 113-day public comment period, two staff workshops, and a multi-day State Water Board hearing, and resulted in the receipt of approximately 308 written comment letters (totaling approximately 29,600 pages) and an additional 646 form letters (i.e., the same letter provided by multiple commenters). The input received throughout the comment period informed revisions to the proposed Plan amendments.

In April 2024, the State Water Board held a multi-day workshop on the Voluntary Agreements/HRL. In advance of this workshop, HRL participants submitted additional and revised documents in support of the HRL to the State Water Board in March and April of 2024. These included a Cover Memo; Global, Implementing, and Enforcement Agreements; Flow Accounting; and Non-Flow Measure Accounting documents. In October of 2024, the HRL participants provided additional new and updated documents, including an updated Cover Memo, Strategic Plan, Governance Program, Science Plan, Early Implementation Project List, Flow Accounting, Non-Flow Measure Accounting, a new Funding Plan, and a new Science Committee Charter. The State Water Board provided notice of these new documents, which were made available to the public on the State Water Board's website. The State Water Board is not a party to the HRL proposals, nor bound by the HRL documents and did not incorporate them by reference. However, the State Water Board considered the HRL documents and other comments received and exercised its independent judgment as it developed the VA pathway described in the 2024, 2025, and final drafts of the Bay-Delta Plan (including the flow and non-flow accounting provisions included in Appendix B), which provides an alternate implementation pathway to implement the HRL commitments in lieu of the regulatory pathway for an 8-year period that may be extended if shown to be effective.

13.2.5 Draft Bay-Delta Plan (October 2024)

In October 2024, the State Water Board released draft amendments to the Bay-Delta Plan for public review and comment. The 2024 draft Plan identified a regulatory pathway including inflow, cold water habitat, and inflow-based Delta outflow provisions based on the proposed Plan amendments described in the 2023 draft Staff Report. The 2024 draft Plan also included changes to the proposed Plan amendments described in the 2023 draft Staff Report, including removal of numeric components of the interior Delta flow objectives consistent with Modular Alternative 4a and specification of numeric carryover storage requirements. The 2024 draft Plan included an option for a VA pathway for the HRL flow and non-flow habitat commitments, based on the proposed VAs evaluated in Chapter 9 of the 2023 draft Staff Report. The 2024 draft Plan also included generally

applicable provisions, including provisions for an implementation methodology, biological goals, monitoring and reporting, and annual and periodic review. The 2024 draft Plan also included the possibility of other options for updating the Bay-Delta Plan that were described in the 2023 draft Staff Report (e.g., an option for Modular Alternative 5a, Protection of Base Delta Outflow During Drought, and Modular Alternative 6a, Possible Alternatives for Protecting the VA Flow Base) with revisions based on public comments.

The 2024 draft Plan identified possible inflow provisions under the regulatory pathway that would require 55 percent of unimpaired flow within an adaptive range of 45 to 65 percent of unimpaired flow from the Sacramento River, its tributaries, and Delta eastside tributaries (the Calaveras, Cosumnes, and Mokelumne Rivers). The inflow provisions included adaptive implementation options and dry hydrology adjustments. The 2024 draft Plan also included proposed cold water habitat and carryover storage provisions that included requirements for reservoirs to be operated in a manner that provides cold water flows or alternate protective measures to ensure that fish below dams are kept in good condition. The proposed inflow-based Delta outflow provisions would require that the required inflows from the Sacramento/Delta tributaries and San Joaquin River and tributaries be provided as outflows. The interior Delta flows components included a narrative objective to reasonably protect native fish populations migrating through and rearing in the Delta and updates to the DCC gate requirements.

The 2024 draft Plan identified the possible inclusion of a VA pathway that would allow for implementation of the HRL flow and non-flow actions as an alternative implementation pathway to implement certain water quality objectives for fish and wildlife beneficial uses.

The 2024 draft Plan also incorporated Tribal and Subsistence Fishing Beneficial Uses including: Tribal Tradition and Culture (CUL), Tribal Subsistence Fishing (T-SUB), and Subsistence Fishing (SUB) beneficial uses as they relate to the reasonable protection of fish and wildlife. The 2024 draft Plan identified that the State Water Board was considering designation of CUL in the Bay-Delta watershed as part of the current update to the Bay-Delta Plan or through a subsequent appropriate process and specifically solicited public input on that decision.

The public comment period for the 2024 draft Plan lasted 77 days. Public comments and input on the 2024 draft Plan included approximately 142 written comment letters (totaling approximately 9,200 pages), an additional 297 form letters (i.e., the same letter provided by multiple commenters), a multi-day public workshop, eleven working meetings, and coordination with HRL participants.

In January 2025, the HRL participants submitted a Proposed Alternative to Modular Alternative 6a for New or Expanded Diversion Projects. The HRL participants' proposal for Modular Alternative 6a was presented to the State Water Board on January 23, 2025, at the workshop on draft updates to the Bay-Delta Plan. In April 2025, CDFW submitted a memorandum regarding Healthy Rivers and Landscapes habitat restoration design criteria (CDFW 2025). The memorandum is posted to the State Water Board's website and was considered by the State Water Board in revisions to the 2024 draft Plan.

13.2.6 Revised Draft Bay-Delta Plan (July 2025)

In July 2025, the State Water Board released revised draft updates to the Bay-Delta Plan. The July 2025 revised proposed Plan amendments incorporated changes responding to public comments received on the 2023 draft Staff Report and the 2024 draft Plan, updated information submitted by the HRL participants, and continued coordination with the HRL participants. An abbreviated

summary of the July 2025 revised draft Plan and changes from the 2024 draft Plan are provided in this section.

The July 2025 revised draft Plan included the VA pathway as an alternative for implementation of HRL commitments that would apply for HRL water rights in lieu of implementing other provisions for tributary inflow, cold water habitat, and inflow-based Delta outflows, and a regulatory pathway that would apply to water rights not included in the VA pathway and would also apply to HRL water rights no longer covered under the VA pathway. Both pathways would have regulatory effect upon adoption of Plan amendments. The July 2025 revised draft Plan included revisions to the proposed new objectives from the 2024 draft Plan and 2023 draft Staff Report. The July 2025 draft included proposed narrative objectives that would be implemented through both the VA and regulatory pathways. The narrative objectives include the new narrative fish viability objective from the 2024 draft Plan and revisions to the other new narrative objectives as they were proposed in the 2024 draft Plan for Sacramento/Delta tributary inflows, Sacramento/Delta cold water habitat, Delta outflows, inflow-based Delta outflows, and interior Delta flows. The numeric portion of the Sacramento/Delta tributary inflow objective was relocated to the program of implementation as a numeric flow requirement applicable within the regulatory pathway.

Under the regulatory pathway, the narrative objectives would be implemented by flow, cold water habitat, and related requirements described in the program of implementation. The numeric inflow provisions for the regulatory pathway were changed from the 2024 draft Plan in response to public comments to include adjustments to the required percent of unimpaired flow based on hydrologic conditions during initial implementation of the Plan that would reduce water supply impacts and allow more water to be stored in reservoirs. Carryover storage requirements were adjusted in the July 2025 revised draft Plan to include a range of carryover storage levels and to allow reservoir owners and operators to propose carryover storage levels within or outside that range for Board approval.

Under the VA pathway, the narrative objectives would be implemented by flow, habitat, and related HRL commitments that would become regulatory requirements after State Water Board adoption. Two new HRL proposals were included in the July 2025 revised draft Plan for Nevada Irrigation District (NID) and South Sutter Water District (SSWD) on the Bear River, Yuba River, and Auburn Ravine. The July 2025 revised draft Plan also included partially developed accounting procedures for flow and non-flow commitments in the VA pathway and a list of the water rights that would be part of the VA pathway in Appendix B.1.

The July 2025 revised draft Plan included the designation of CUL beneficial uses throughout the Bay-Delta watershed as they relate to the reasonable protection of fish and wildlife. The July 2025 revised draft Plan also included provisions for monitoring, assessment, and special studies, biological goals, developing an implementation methodology, and periodic and annual reviews. Some optional components of the 2024 draft Plan, such as the provision for Modular Alternative 5a, were not included in the July 2025 revised draft Plan. As explained in more detail in the following section, limited, additional revisions were made to the July 2025 revised draft Plan, which was released in December 2025 for public comment.

In August 2025, the State Water Board provided supplemental modeling results for the regulatory pathway described in the July 2025 revised draft Plan and notified the public that the State Water Board had received term sheets for additional HRL commitments from NID and SSWD specific to the Bear River, Yuba River, and Auburn Ravine.

13.2.7 Revised Draft Plan (December 2025) and Chapter 13

In September 2025, the State Water Board rescinded the Notice of Opportunity for public review and comment on the July 2025 draft Plan to make further revisions to the revised draft Plan and to allow comments on the revised draft Plan to be coordinated and submitted with comments on the recirculated portions of the 2023 draft Staff Report (Chapter 13). In November 2025, the State Water Board received an additional HRL proposal from Yolo County Flood Control and Water Conservation District and incorporated it in the further revisions.

In December 2025, the State Water Board released the 2025 partially recirculated draft Staff Report together with the December 2025 revised draft Plan for public review and comment, including the opportunity for written comments and a multi-day State Water Board hearing to receive oral comments on both documents. The public review and comment period ended in February 2026 and lasted 52 days, with the State Water Board receiving approximately 151 written comment letters (totaling approximately 7,500 pages). Comments on the December 2025 revised draft Bay-Delta Plan and Chapter 13 of the 2025 partially recirculated draft Staff Report have informed development of the final draft of the Plan and this final Staff Report. This final Staff Report contains responses to previously submitted comments on the 2023 draft Staff Report (including responsive edits to the Staff Report) as well as additional comments on Chapter 13. Both the final Staff Report and final draft of the Plan will be considered for adoption by the State Water Board at a future Board meeting.

13.3 Revised Proposed Plan Amendments

13.3.1 Introduction

The revised proposed Plan amendments would add new narrative objectives for tributary inflows, Delta outflows, cold water habitat, interior Delta flows, and fish viability, as well as an inflow-based Delta outflow objective for the protection of fish and wildlife to the Bay-Delta Plan and a program of implementation to achieve those objectives. The program of implementation includes a regulatory pathway that would apply to water rights that are not included in the list of Healthy Rivers and Landscapes (HRL) water rights identified in Appendix B.1. The regulatory pathway could also apply to rights identified in Appendix B.1 for which the voluntary agreement (VA) pathway is discontinued. The regulatory pathway is based on the proposed Plan amendments described in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, and analyzed in Chapter 6, *Changes in Hydrology and Water Supply*; Chapter 7, *Environmental Analysis*; and Chapter 8, *Economic Analysis and Other Considerations*, with changes, including incorporation of flows identified in the Low Flow Alternative (35 and 45 percent of unimpaired flow). The VA pathway is based on the proposed VAs analyzed in Chapter 9, *Proposed Voluntary Agreements*, with revisions, including changes to the water quality objectives that the VA pathway would implement, the addition of new HRL participants and associated commitments, and other refinements. Both the regulatory and VA pathway would have regulatory effect upon implementation. The revised proposed Plan amendments would also designate Tribal Tradition and Culture (CUL) beneficial uses throughout the Bay-Delta watershed and the program of implementation would include general provisions that apply regardless of the regulatory or VA pathway, including an implementation methodology, monitoring and evaluation, and other provisions.

Section 13.3.2, *Water Quality Objectives for Fish and Wildlife Uses*, describes the proposed new objectives of the revised proposed Plan amendments. The objectives are based on the proposed new water quality objectives described in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, and Chapter 9, *Proposed Voluntary Agreements*, with refinements based on public comments received throughout the planning process (see Section 13.1, *Introduction*).

The regulatory pathway of the revised proposed Plan amendments is described in Section 13.3.3, *Regulatory Pathway*. The regulatory pathway is the implementation pathway for water rights not covered by the VA pathway for the narrative inflow and cold water habitat objectives and the inflow-based Delta outflow objective. In response to public comments expressing concerns that the inflow requirements of the proposed Plan amendments would have significant water supply impacts and could result in drawing down reservoir storage, with associated temperature impacts, modifications to the starting point for the inflows under the regulatory pathway were incorporated into the revised proposed Plan amendments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These modifications are referred to as water supply adjustments and provide for lowering the required percent of unimpaired flow during all but the wettest hydrologic conditions down to 45 or 35 percent of unimpaired flow, with additional tributary specific water supply adjustments for three rainfall and municipal supply dominated tributaries (the Mokelumne and Calaveras Rivers and Putah Creek).

The VA pathway of the revised proposed Plan amendments is described in Section 13.3.4, *Voluntary Agreement Pathway*. The VA pathway is the alternative implementation pathway for HRL commitments that apply to the HRL water rights identified in Appendix B.1 of the revised proposed Plan amendments. In addition to explicitly incorporating the VA pathway, the revised proposed Plan amendments add three additional HRL participants and associated flow commitments to the VA pathway for the Yuba River, Bear River, Auburn Ravine, and Putah Creek, as well as additional non-flow actions. The revised proposed Plan amendments also include other modifications to the VA pathway from the VA proposal described in Chapter 9 of the 2023 draft Staff Report, including updates to the water quality objectives they would implement, a new provision for protection of the base flows to which HRL flows are intended to be additive that replaces options under consideration as part of Alternative 6a of the 2023 draft Staff Report, flow and habitat accounting, changes to the description of HRL flow and habitat commitments based on accounting provisions, and updates to provisions for science and monitoring, reporting, and governance under the VA pathway.

In addition to the regulatory and VA pathways, the revised proposed Plan amendments include provisions that would apply regardless of pathway. These include provisions for an implementation methodology; interior Delta flows; monitoring, evaluation, reporting, and special studies; biological goals; annual and periodic review; and other general provisions, based on the provisions described in Chapter 5 of the 2023 draft Staff Report, with modifications based on public comments received during the planning process. These provisions are described below under Section 13.3.5, *Implementation Methodology*; Section 13.3.6, *Interior Delta Flows*; Section 13.3.8, *General Provisions*; and Section 13.3.9, *Monitoring and Evaluation*.

In response to significant feedback received throughout the Sacramento/Delta Update process from tribal representatives, leaders, and tribal organizations (see Chapter 11, *Tribal Engagement, Traditional Ecological Knowledge and Tribal Beneficial Uses*), the revised proposed Plan amendments incorporate Tribal Beneficial Uses (TBUs) and the designation of CUL beneficial uses for the Bay-Delta watershed, as well as provisions for a Tribal Advisory Group and other measures to facilitate tribal participation and feedback in the State Water Board's Bay-Delta planning and implementation efforts. The incorporation of TBUs and provisions for tribal outreach and engagement are described below under Section 13.3.7, *Designation of Tribal Tradition and Culture (CUL) and Incorporation of Tribal and Subsistence Fishing Beneficial Uses*.

The revised proposed Plan amendments also include non-substantive changes to the Bay-Delta Plan to improve readability and clarity. Tables 1, 2, 3, and 4, which include the water quality objectives, are revised and reformatted to remove footnotes and incorporate the substance of those footnotes into the table or into the program of implementation. No existing objectives are changed; however, some minor non-substantive edits are proposed to implementation measures to update those measures and better integrate them with other processes as appropriate. In addition, the title of the Bay-Delta Plan is updated to replace "Estuary" with "Watershed" and minor editorial changes are made to clarify language, remove outdated language, and reflect actions that have been completed.

13.3.2 Water Quality Objectives for Fish and Wildlife Uses

Chapter 5 includes a description and discussion of the proposed Plan amendments, including water quality objectives and a description of the program of implementation designed to meet the objectives. Several objectives have been revised from the draft objectives included in Chapter 5 of the 2023 draft Staff Report. In addition, a fish viability objective that was described in Chapter 9 of

the 2023 draft Staff Report is explicitly incorporated, with revisions, in the revised proposed Plan amendments.

This section describes the revised proposed water quality objectives for fish and wildlife beneficial uses. The revised proposed Plan amendments include new objectives for Sacramento/Delta inflow, cold water habitat, Delta outflow, interior Delta flows, and fish viability. In addition, the revised proposed Plan amendments are intended to contribute to implementing the existing salmon protection objective. Under the regulatory pathway, these objectives would be implemented by flow, cold water habitat, and related requirements included in the program of implementation. Under the VA pathway, the objectives would be implemented by the flow, habitat, and other required and enforceable HRL commitments included in the program of implementation.

13.3.2.1 Sacramento River/Delta Tributary Inflows

To improve ecosystem functions on tributaries, and to connect flows from throughout the watershed with the Delta to support native estuarine species, the revised proposed Plan amendments include a narrative inflow objective. There are salmonid species in the Sacramento/Delta year-round as well as other aquatic species that require adequate flows from the tributaries for their protection (see Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*). As such, the inflow objective is proposed to be year-round. The proposed narrative inflow objective has been revised from the proposed Plan amendments identified in the 2023 draft Staff Report (see Chapter 5) and is as follows:

> *Maintain water quality conditions including inflow conditions from the Sacramento River/Delta tributaries, together with other measures in the watershed, sufficient to support and maintain the natural production of viable native fish populations. Conditions and measures that reasonably contribute toward maintaining viable native fish populations include the relative magnitude, duration, timing, quality and spatial extent of flows as they would naturally occur.*

The numeric portion of the inflow objective has been modified from the draft objective included in Chapter 5 and has been relocated to the revised proposed program of implementation.

13.3.2.2 Sacramento River/Delta Cold Water Habitat

The narrative cold water habitat objective of the revised proposed Plan amendments is intended to minimize potential temperature-related impacts of the flow objectives and to address other existing and potential future temperature management concerns on the tributaries for the protection of salmonids and other native species. As a complementary measure to the inflow objective to protect salmonids and other native species in the tributaries, the narrative cold water habitat objective is proposed to be year-round. The proposed narrative cold water habitat objective is as follows:

> *Maintain streamflows and reservoir storage conditions on Sacramento/River Delta tributaries to protect cold water habitat for sensitive native fish species, including Chinook salmon, steelhead, and other native cold water fish species. Cold water habitat conditions to be protected include maintaining sufficient quantities of habitat with suitable temperatures on streams to support passage, holding, spawning, incubation, and rearing while preventing stranding and dewatering due to flow fluctuations.*

13.3.2.3 Delta Outflow

The revised proposed Plan amendments include a narrative Delta outflow objective and an inflow-based Delta outflow objective. The narrative Delta outflow objective describes the outflow conditions that protect native fish and aquatic species populations and provides a description of the

conditions the inflow-based Delta outflow and other outflows are intended to produce, along with other measures in the watershed. In recognition that outflows are largely a product of inflows and that inflows from tributaries are necessary to provide both the quantities of needed outflows as well as functioning migratory corridors, the proposed inflow-based Delta outflow objective would link the inflow and outflow objectives.

The narrative Delta outflow objective has been revised and is as follows:

> *Maintain water quality conditions including Delta outflows, together with other measures in the watershed, sufficient to support and maintain the natural production of viable fish populations. Conditions and measures that reasonably contribute toward maintaining viable native fish populations include, but may not be limited to, flows that support fish species, including the relative magnitude, duration, timing, quality and spatial extent of flows. Indicators of viability include population abundance, spatial extent, distribution, structure, genetic and life history diversity, and productivity.*

The inflow-based Delta outflow objective is as follows:

> *The inflows required for the Sacramento/Delta tributaries and San Joaquin River tributaries are required as outflows with adjustments for downstream natural depletions and accretions.*

The proposed Plan amendments described in the 2023 draft Staff Report originally included a fall Delta outflow objective (see Chapter 5). Consistent with Alternative 4a, an objective for fall Delta outflow is not included in the revised proposed Plan amendments.

13.3.2.4 Interior Delta Flows

Chapter 5 of the 2023 draft Staff Report identified the possible inclusion of new narrative and numeric interior Delta flow objectives, including provisions based on constraints that have been included in Biological Opinions (BiOps) and Incidental Take Permits (ITPs) including: expansion of numeric State Water Project (SWP) and Central Valley Project (CVP) export constraints based on San Joaquin River flows (referred to as the San Joaquin River I:E); new limitations on Old and Middle River reverse flows; and modification of Delta Cross Channel Gate closure requirements. Consistent with Alternative 4a, the expansion of the San Joaquin River I:E and new Old and Middle River reverse flow limitations have been removed from the revised proposed Plan amendments as explicit interior Delta flows objectives. In addition, the proposed changes to the closure periods for the Delta Cross Channel Gates objective have been removed from the revised proposed Plan amendments. However, updates are retained to the Delta Cross Channel Gates decision-making process. The narrative interior Delta flows objective and the minor modifications to the Delta Cross Channel Gates objective are incorporated in the revised proposed Plan amendments. The narrative interior Delta flows objective would apply year-round and has been modified as follows:

> *Maintain water quality conditions, including flow conditions in the interior Delta, together with other measures in the watershed, sufficient to support and maintain the natural production of viable native fish populations. Conditions and measures that reasonably contribute toward maintaining viable native fish populations include the relative magnitude, duration, timing, quality, and spatial extent of flows. Indicators of viability include population abundance, spatial extent, distribution, structure, genetic and life history diversity, and productivity.*

13.3.2.5 Suisun Marsh

As described in Chapter 5, there are no proposed revisions to the text of the Brackish Tidal Marshes of Suisun Bay narrative objective and the Eastern Suisun Marsh Salinity numeric objective but there are minor proposed revisions to the compliance locations. The revised proposed Plan amendments

would remove stations S-35 "Goodyear Slough at Morrow Island Clubhouse," S-97 "Cordelia Slough at Ibis Club," and "Water supply intakes for waterfowl management areas on Van Sickle and Chipps islands" as compliance locations for the Western Suisun Marsh Salinity objective. These stations would continue to be required monitoring locations. The monitoring location for "Water supply intakes for waterfowl management areas on Van Sickle and Chipps islands" is identified in the revised proposed Plan amendments as station S71 and renamed "Montezuma Slough at Roaring River."

13.3.2.6 Fish Viability

The revised proposed Plan amendments incorporate the new fish viability objective that was described in Chapter 9 for supporting and maintaining the natural production of viable native fish populations. The narrative fish viability objective is proposed to apply year-round. The narrative fish viability objective has been revised and is as follows:

> *Maintain water quality conditions, including flow conditions in and from tributaries and into and out of the Delta, together with other measures in the watershed, sufficient to support and maintain the natural production of viable native fish populations. Conditions and measures that reasonably contribute toward maintaining viable native fish populations include, but may not be limited to (1) flows that support native fish species, including the relative magnitude, duration, timing, temperature, and spatial extent of flows; and (2) conditions within water bodies that enhance spawning, rearing, growth, and migration in order to contribute to improved viability. Indicators of viability include population abundance, spatial extent, distribution, structure, genetic and life history diversity, and productivity. Flows provided to meet this objective shall be managed in a manner to avoid causing significant adverse impacts to fish and wildlife beneficial uses at other times of the year.*

13.3.2.7 Salmon Protection

The revised proposed Plan amendments retain the existing salmon protection objective unchanged from the 1995 Bay-Delta Plan. However, additional implementation measures for the objective are added as described in the sections below. The salmon protection objective is as follows:

> *Water quality conditions shall be maintained, together with other measures in the watershed, sufficient to achieve a doubling of natural production of Chinook salmon from the average production of 1967–1991, consistent with the provisions of State and federal law.*

13.3.3 Regulatory Pathway

13.3.3.1 Description of the Regulatory Pathway

The requirements under the regulatory pathway are based on the proposed Plan amendments described in Chapter 5 of the 2023 draft Staff Report with refinements as described further below.

13.3.3.2 Sacramento/Delta Tributary Inflows

The inflow objective is proposed to apply throughout the watershed on all Sacramento/Delta tributaries that support or contribute to the protection of anadromous fish species. These include tributaries in the Sacramento River watershed (i.e., the mainstem Sacramento River, Clear Creek, Cow Creek, Bear Creek, Cottonwood Creek, Battle Creek, Paynes Creek, Antelope Creek, Mill Creek, Elder Creek, Deer Creek, Thomes Creek, Big Chico Creek, Stony Creek, Feather River, Butte Creek, Yuba River, Bear River, Cache Creek, Putah Creek, the American River) and Delta eastside tributaries (i.e., the Cosumnes River, Mokelumne River, Calaveras River). The narrative inflow objective would

be implemented through the numeric requirements described below in this section under the regulatory pathway and the requirements described in Section 13.3.4 under the VA pathway, as well as other complementary actions.

Under the regulatory pathway, the numeric inflow requirements would apply to all water rights on these tributaries, except those with a *de minimis* effect on flows (i.e., diversions of 10 acre-feet per year [AF/yr] or less), other approved exceptions, or those water rights listed in Appendix B.1 as part of the VA pathway. Those numeric requirements include bypass flow requirements based on a percentage of unimpaired flow. The revised proposed Plan amendments retain the required unimpaired flow levels from prior drafts of the Plan of 55 percent of unimpaired flow year-round on a 7-day running average within an adaptive range of 45 to 65 percent. However, upon initial implementation, water supply adjustments would apply to water rights obtained before the end of 2025 requiring lower unimpaired flow levels during all but the wettest conditions that would reduce water supply impacts and reservoir storage and associated temperature impacts. The Board could modify these water supply adjustments in the future within the 45 to 65 percent of unimpaired flow range and the applicable water supply adjustments. Two types of water supply adjustments would apply during initial implementation based on hydrological conditions, including watershed-wide adjustments that apply to the entire watershed and tributary-specific adjustments that apply to rainfall-dominated tributaries and tributaries that primarily supply municipalities, including Putah Creek and the Mokelumne and Calaveras Rivers. Water supply adjustments would not apply for new water supply projects,[3] although they could be considered during annual or periodic review based on any necessary scientific and environmental documentation.

For the watershed-wide water supply adjustments, the required percent of unimpaired flow would be based on the best available estimate of the cumulative sum of the prior 12 months of the Sacramento Valley Four River Index (four river index).[4] At the outset of implementation, the watershed-wide inflow requirement would be 55 percent of unimpaired flow during the wettest third of conditions, 45 percent of unimpaired flow during the intermediate third of hydrologic conditions, and 35 percent of unimpaired flow in the driest third of conditions, based on specified thresholds (rounded as appropriate) for the last 30 years of the four river index.

Additional off-ramps to the unimpaired flow requirements would apply in the tributary-specific water supply adjustments based on the fraction of the maximum allowable storage capacity, which is defined as the allowable flood control storage level as specified by the U.S. Army Corps of Engineers (USACE) or other agency with jurisdiction over flood control. If the storage drops below the specified fraction of maximum allowable storage capacity, the flow requirement would be reduced to 35 percent of unimpaired flow or off-ramped accordingly.

The numeric inflow requirements for the Sacramento/Delta tributaries would primarily be implemented through bypass flow requirements that limit diversions to ensure that the applicable flow requirements remain instream. In order to implement the numeric inflow requirements in accordance with water right priorities, demands for water that exceed the available supplies while

[3] New water supply projects are defined as 1) water rights obtained after December 31, 2025, including any permits issued after that date pursuant to applications filed by the State under Water Code section 10500, and 2) water right change petitions that would increase diversions from the Delta watershed and decrease Delta outflows compared to conditions existing as of December 31, 2025.

[4] The four river index refers to the sum of the unimpaired runoff 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.

preserving the instream flows at each compliance location and the amounts needed to serve senior water right demands would be subject to curtailment in order of water right priority unless an exception to curtailment applies. As discussed below in Section 13.3.5, *Implementation Methodology*, an implementation methodology will be developed to determine when water is not available under specific water rights. The required percentage of unimpaired flow would not apply to an individual tributary during periods when flows from that tributary could cause or contribute to flooding or other related public safety concerns.

Initial compliance points where the numeric inflow requirements would apply include the confluence of Sacramento/Delta tributaries with the Sacramento River; at the confluence with the Legal Delta for the Cosumnes, Calaveras, and Mokelumne Rivers; on the mainstem of the Sacramento River at the confluence with the Delta; and at upstream locations on Sacramento/Delta tributaries at the confluence of every major fork, branch, and tributary of the tributaries subject to the inflow requirements unless determined through the implementation process that they are not needed or appropriate. Compliance points are the locations that will be used to define the percent of unimpaired flow, inform assessment of compliance with the instream flow requirement, and determine whether any refinements to implementation of the inflow requirements are needed, including refinements to the implementation methodology. Updates to these compliance locations may be approved as part of the process to develop and update the implementation methodology after opportunity for public review and comment or through the Bay-Delta Plan annual and periodic review processes.

The revised proposed Plan amendments would also continue to provide for adaptive implementation of the inflow requirements in coordination with implementation of the cold water habitat and inflow-based Delta outflow requirements, to optimize benefits to fish and wildlife while minimizing water supply impacts. Adaptive implementation includes the ability to manage the numeric flow requirements as a total volume of water on a water year basis to shape flows (e.g., providing pulse flows to cue migration) for the benefit of fish and wildlife. The total volume of water provided within a water year would be required to be no lower than the volume of water that would have resulted from meeting the applicable unimpaired flow percentage on a 7-day running average, including applicable water supply adjustments. Flows for flood control purposes, hydropower releases, or other uncontrolled flows in excess of the applicable unimpaired flow percentage on a 7-day running average that were not documented to provide for the purpose of protecting fish and wildlife and Delta outflow could not reduce overall required inflow levels. The shaping of flows would be required to specifically ensure that flows are maintained year-round to support temperature maintenance, passage, and rearing; avoid stranding and dewatering of salmonids; and provide appropriately timed contributions to Delta outflows to protect estuarine species.

In addition, the required percent of unimpaired flow could be adjusted within the range from 45 to 65 percent of unimpaired flow, inclusive. Adjustments to the required percent of unimpaired flow between 45 and 65 percent of unimpaired flow may incorporate applicable water supply adjustments, provided that flows during January through June are no lower than what would be provided by the inflow requirements with the water supply adjustments or 45 percent of unimpaired flow without water supply adjustments, whichever is lower. Flows may be lower in the range if lower flows provide for the reasonable protection of fish and wildlife or to help meet the cold water habitat objective or if local cooperative solutions demonstrate that they achieve the inflow and cold water habitat objective through a combination of flow and other measures that are comparable to default implementation of the numeric flow requirements. Flows may only be required to be higher in the range, including possible removal of water supply adjustments for

existing water rights, if flows in a tributary are already higher than the required numeric levels, or it is demonstrated that higher flows are needed to reasonably protect fish and wildlife.

13.3.3.3 Cold Water Habitat

The narrative cold water habitat objective would apply on all of the Sacramento/Delta tributaries subject to the inflow objective described above and would be implemented through the requirements described below in this section under the regulatory pathway and the VA pathway described in Section 13.3.4, *Voluntary Agreement Pathway*, as well as other complementary actions described in the revised program of implementation.

Under the regulatory pathway, the cold water habitat objective would be implemented through requirements for management of cold water storage and releases and/or alternative protection measures to ensure that fish below dams are kept in good condition consistent with Fish and Game Code section 5937 and the narrative objective. The cold water habitat implementation actions described in this section would be integrated with the inflow implementation actions described in Section 13.3.3.2, *Sacramento/Delta Tributary Inflows*, including the water supply adjustments and adaptive implementation actions described above. The cold water habitat requirements would apply to all water rights not listed in Appendix B.1 that affect temperature management. Reservoir owners/operators identified in the revised program of implementation would be required to undertake specific implementation actions.

The owners and operators of reservoirs identified in the revised proposed Plan amendments that are not part of the VA pathway would be required to develop long-term temperature management strategies identifying how rim reservoirs and associated facilities will be operated to meet the cold water habitat requirements, based on an assessment of the effectiveness of cold water habitat protection measures on their tributaries and needed improvements to those measures for the purpose of complying with the cold water habitat objective. The long-term temperature management strategies would be required to identify temperature targets and locations where those targets will be measured. The strategies would also be required to evaluate other available measures to improve temperature management, including passage, temperature control device measures, riparian habitat improvements, and other measures that would be implemented to contribute to meeting the narrative cold water habitat objective and a timeline for implementing those measures. In addition to the strategies, annual temperature management plans would be required to be developed each year, in coordination with the State Water Board and fisheries agencies, identifying how temperature protection and related operations for the protection of salmonids and other native species would be achieved each year.

The long-term temperature management strategies would be required to identify proposed end-of-September reservoir carryover storage requirements. Owners and operators of rim reservoirs not covered by the VA pathway would be required to propose a carryover storage target within the range identified in the revised proposed Plan amendments for Executive Director approval. The established range is intended to provide for a cold water supply in the fall and into the subsequent water year while also maintaining supplies for other beneficial uses and human health and safety. Reservoir operators may also propose an alternative carryover storage requirement outside of the range for consideration by the State Water Board if they provide sufficient documentation and evidence that their proposed carryover storage requirement will provide adequate protection of cold water habitat, and other critical purposes, including human health and safety supplies. In the event that water right holders do not develop proposed carryover storage levels, the State Water

Board would undertake a public process to develop those requirements. The annual temperature management plans would include, at a minimum, a description of how the end-of-September carryover storage levels, or alternate approved measures, would be implemented in combination with the inflow requirements.

The Executive Director of the State Water Board could require long-term temperature management strategies and annual temperature management plans on additional Sacramento/Delta tributaries or stream segments as part of the periodic review process based on information indicating that water diversion and use practices are causing elevated water temperatures that negatively affect the aquatic ecosystem.

13.3.3.4 Local Cooperative Solutions

In Chapter 5, two implementation pathways are described: "default implementation" or "voluntary implementation plans." The revised proposed Plan amendments revise the terminology from "voluntary implementation plans" to "local cooperative solutions." This helps distinguish them from the proposed "voluntary agreement pathway" (or VA pathway described below in Section 13.3.4).

Water right holders could propose local cooperative solutions to comply with the applicable Sacramento/Delta inflow and cold water habitat requirements. Local cooperative solutions could utilize the adaptive implementation provisions, including shaping of flows and operating lower in the required inflow range by implementing those flows in combination with other complementary ecosystem protection measures and cold water habitat protection measures, including habitat restoration, passage, improvements in cold water management structures, or other measures that provide comparable benefits as would be expected absent the local cooperative solution.

Water right holders may propose local cooperative solutions for individual tributaries, two or more tributaries, or for regions, including the Delta. If a local cooperative solution is developed for two or more tributaries, the tributaries could work together to meet the combined numeric inflow requirements provided that the narrative inflow and cold water habitat objectives are met on each individual tributary. Specific quantitative accounting, including modeling and monitoring data as appropriate, would be required to show that the combined inflows are at least equal to what would have been provided by individual tributary implementation.

Prior to submittal of any proposed local cooperative solution to the State Water Board, the proponents would be required to consult with California Department of Fish and Wildlife (CDFW), appropriate California Native American Tribes, the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and other appropriate entities. The State Water Board would provide for a minimum 30-day public comment period for local cooperative solutions under consideration. Upon discontinuation of the WSAs, local cooperative solutions that achieve at least 55 percent of unimpaired flow on a water year basis could be approved by the Executive Director. Upon discontinuation of WSAs, local cooperative solutions that achieve at least 45 but less than 55 percent of unimpaired flow on a water year basis would require approval by the State Water Board. If WSAs are applicable, local cooperative solutions that propose changes to the WSAs would be required to achieve flows that are no lower than the water year volume that would be provided by the WSAs, and these local cooperative solutions would require approval by the State Water Board through a public process. In evaluating any local cooperative solution, the State Water Board would make an independent finding that the local cooperative solution is enforceable and is expected to provide comparable protection than default implementation for achieving the water quality objectives.

13.3.3.5 Delta Outflow

The proposed Delta outflow objectives, working with the inflow objective, are intended to provide a comprehensive integrated flow regime that protects fish and wildlife from natal streams out to the ocean. The narrative outflow objective would apply throughout the watershed and would be implemented through compliance with the existing Delta outflow objectives and implementation actions described above to meet the proposed narrative inflow and cold water habitat objectives, and implementation of the proposed inflow-based outflow objective described in this section.

The inflow-based Delta outflow objective would be implemented by requiring that required inflows be provided as outflows, including required inflows from the Sacramento/Delta tributaries including equivalent accretions from the Sacramento River Valley Floor and Delta and required inflows from the San Joaquin River and its tributaries. The required Delta outflow would be calculated by adding up the applicable required inflows from the Sacramento/Delta tributaries, including an equivalent amount of Sacramento River Valley Floor and Delta accretions, and required lower San Joaquin River flows making appropriate adjustments for natural losses. These flows are in addition to any approved HRL flow contributions to Delta outflows described below in Section 13.3.4, *Voluntary Agreement Pathway*. Water users downstream of the tributaries, except for *de minimis* water users, also would bear responsibility for achieving the inflow-based Delta outflow objective through limits on their diversions, including Project diversions and other in-Delta diversions. Implementation would be met in order of water right priority, unless exceptions apply, using the implementation methodology as described in Section 13.3.5, *Implementation Methodology*.

The State Water Board could consider possible exemptions to meeting the inflow-based Delta outflow requirements for water rights in which the diversion and use of water is limited to irrigation of lands below sea level in the Legal Delta. Initial monitoring of water use suggests that the net consumptive use of irrigated agriculture on subsided islands below sea level in the Delta may be equivalent to the amount of water that would be used by the vegetation that would grow absent irrigation and land management. However, because of the limited data set available for analysis, there is uncertainty in this conclusion. Therefore, the State Water Board, in coordination with other appropriate agencies and entities, would conduct additional analyses regarding water use on irrigated lands below sea level in the Delta and undertake a public process to evaluate the effectiveness of curtailments of agricultural diversions below sea level. Based on those analyses, the State Water Board could consider exemptions during implementation or periodic reviews to the inflow-based Delta outflow requirements for water rights for which diversions and use are limited to irrigation of lands below sea level in the Legal Delta. Any water rights in the Delta that are not subject to an exemption would be subject to applicable curtailments pursuant to the implementation methodology for the Bay-Delta Plan, including to achieve the inflow-based Delta outflow objective.

13.3.4 Voluntary Agreement Pathway

13.3.4.1 Description of the Voluntary Agreement Pathway

The VA pathway is an alternate implementation pathway for meeting the proposed objectives for Sacramento/Delta inflow and cold water habitat, inflow-based Delta outflow, and native fish viability and the existing objective for salmon protection (see Section 13.3.2) for the HRL water rights identified in Appendix B.1. The VA pathway would allow the HRL participants to meet the flow, habitat, and other required HRL commitments as described further below and in the revised proposed Plan amendments in lieu of meeting the regulatory pathway provisions for a period of 8

years with the possibility of extension to 15 years. Implementation of the VA pathway for HRL water rights would commence no later than October 1, 2027. Modifications to this schedule of up to three months could be approved by the Executive Director for good cause shown. The revised proposed Plan amendments incorporate HRL flow and habitat commitments and were informed by the various documents produced by HRL participants. However, none of these documents are incorporated into the revised draft Bay-Delta Plan due to the inclusion of other information in HRL documents not relevant or appropriate for inclusion in the Plan. The HRL participants also developed draft enforcement agreement proposals. While the possibility that HRL water rights would be required to move to the regulatory pathway if the HRL commitments are not met is, in and of itself, an enforcement mechanism, Section 4.4.9, *Implementation of Healthy Rivers and Landscapes Commitments Under the Voluntary Agreement (VA) Pathway*, of the revised proposed Plan amendments states that the State Water Board may also issue Government Code section 11415.60 decisions to enforce HRL commitments in accordance with the provisions contained in the Bay-Delta Plan. However, if it is determined that any Government Code section 11415.60 decision is needed, streamlined agreements would be developed that are acceptable to the State Water Board that focus on actions needed to ensure enforcement of the HRL commitments as described in the Bay-Delta Plan and remove other provisions not directly related to enforcement of those provisions.

The VA pathway described in the revised proposed Plan amendments is largely the same as the proposed VAs described in Chapter 9 with some modifications, including updates to the water quality objectives the VA pathway would implement; the addition of new HRL commitments on the Bear River, Yuba River, Auburn Ravine, and Putah Creek; provisions for protection of the VA pathway base flows; flow and habitat accounting; changes to the description of HRL flow and habitat commitments based on accounting provisions; and incorporation of provisions for VA pathway supplemental science and monitoring, reporting, and governance.

The VA pathway includes differing amounts of flow commitments, depending on water year type, and non-flow habitat restoration actions targeted at improving spawning and rearing capacity for juvenile salmonids, estuarine species, and other native fish and wildlife, on a portion of the Sacramento/Delta tributaries. The VA pathway includes governance and supplemental science and monitoring to direct flows and habitat restoration, conduct assessments, and develop strategic plans and annual reports. Since release of the 2023 draft Staff Report, the HRL participants provided new and updated documents that have informed development of the VA pathway, including term sheets for three additional HRL proposals on the Bear River, Auburn Ravine, Yuba River, and Putah Creek, which are described below.

The current flow and non-flow commitments are identified in Table 13.3-1. The VA pathway includes flow commitments on portions of the Sacramento River, Feather River, Bear River, Auburn Ravine, Yuba River, American River, Putah Creek, Mokelumne River, commitments for Delta outflows from Friant area contractors, commitments through foregone exports in the Delta, and water purchases. The VA pathway also includes non-flow commitments, including habitat restoration for spawning, instream rearing, and floodplain habitat.

Table 13.3-1. VA Flow and Non-Flow Commitments

	Additive Delta Inflows And Outflows (TAF) Above Base Conditions By Water Year Type					Restoration (Acres)		
Location	C	D	BN	AN	W	Spawning	Instream Rearing	Floodplain
Sacramento		100	100	100		113.5	137.5	20,000
American[1]	30	40	10	10		25	75	
Yuba[1]		50	50	50			50	100
Feather		60	60	60		15	5.25	1,655
Auburn Ravine (NID) C1 [1,2]		0-3.6	0-3.6	0-3.6				
Bear (NID) C2 [2]		5.6	5.6	5.6				
Yuba (NID) C3 [2]		5.6	5.6	5.6				
Bear (SSWD) C1 [3]		0-4.4	0-4.4	0-4.4				
Bear (SSWD) C2 [3]		0-4.4	0-4.4	0-4.4				
Putah[1]	7	6	6	6		1.4		
Putah (YCFCWCD)[1]		5	5	5				
Mokelumne[1]		5	5	7			1	25
Delta forgone exports		125	125	175				5,227.5[4]
Friant (by San Joaquin River Restoration Program Water Year Type)[1]		50	50	50				
PWA Fixed Price Purchases	3	63.5	84.5	99.5	27			
PWA Market Price Purchases		50	61	85				
Permanent State Water Purchases	65	108	9	52	123			

Blank cells indicate no proposed commitments in that category. Water year types are based on Sacramento Valley Index unless otherwise noted. C = Critical, D = Dry, BN = Below Normal, AN = Above Normal, W = Wet, NID = Nevada Irrigation District, SSWD = South Sutter Water District, TAF = thousand acre-feet, YCFCWCD = Yolo County Flood Control and Water Conservation District, PWA = public water agency, C1 = component 1, C2 = component 2, C3 = component 3.

[1] These flow volumes are provided either partially or fully through reservoir reoperations, through redirected water from another tributary, or in the case of Friant through limitations on future abilities to recapture flows and are up to amounts that are not expected to match these volumes in all years. Some or all of these flow commitments may not be accounted for as contributing to additive Delta outflows above base conditions as specified below and in Appendix B.1. Appendix B.1 includes more information about the specific commitments.

[2] Upon issuance of a new FERC license for the Yuba-Bear Hydroelectric Project, components 1 and 2 water will cease and component 3 will begin.

[3] Upon issuance of a new FERC license for Camp Far West Powerhouse, component 1 will cease and component 2 will begin. Additional Bear River inflow may be provided in any water year type for component 2, but any additional flows over the 4.4 TAF in dry, below normal, and above normal years will not be additive Delta outflow.

[4] Includes tidal wetland habitat.

The HRL water rights identified in Appendix B.1 of the revised proposed Plan amendments would contribute to meeting the water quality objectives described in Section 13.3.2 through the HRL flow and non-flow commitments described below. Water rights that are not part of the VA pathway would be subject to the Sacramento/Delta inflow and cold water habitat provisions and inflow-

based Delta outflow provisions described above in Section 13.3.3, unless an exception applies. Water rights identified in Appendix B.1 may also be subject to these provisions upon discontinuation or termination of the VA pathway for some or all rights. Minor modifications to the water rights listed in Appendix B.1, including inclusion of existing water rights less than or equal to 100 acre-feet on a specific HRL water right list, could be approved by the Executive Director after a minimum 45-day public comment period if they fall within the scope of the analyses supporting inclusion of the VA pathway for HRL water rights in the revised proposed Plan amendments. Substantive modifications, including inclusion of water rights larger than 100 acre-feet that were not previously identified, inclusion of new water supply projects, or inclusion of water rights on new tributaries, to the water right list in Appendix B.1 could be considered for approval by the Board as part of the annual or periodic review process, along with any necessary supporting environmental and scientific documentation and any other documentation determined to be needed by the Executive Director. Any proposals to add new HRL water rights or new water supply projects pursuant to the processes described above would be required to coordinate with the existing HRL participants in advance of submittal. The HRL participants could also request removal of HRL water rights from Appendix B.1, which could be approved by the Executive Director after a minimum 45-day public comment period. Upon removal of any HRL water rights, the regulatory pathway would apply to those water rights.

13.3.4.2 Protection of Base Flows and LTO Base Flow Balancing Provision

The HRL flows are intended to be additive to required flows under State Water Board Water Right Decision 1641 (D-1641) and resulting flows under the 2024 BiOps/Record of Decision (ROD), including flows required under the regulatory pathway and from the 2018 Update to the Bay-Delta Plan, and non-regulatory flows that were analyzed as part of the Scientific Basis Report Supplement and this Staff Report. The conditions to which HRL flows are added is referred to as the base (or reference conditions in Appendix B.1 to the Plan). While the implementation methodology will provide for the protection of the specific HRL flows that are provided that contribute to Delta outflows consistent with water right priorities and flows provided under the regulatory pathway, it will not provide for protecting other flows in the system that are not provided under the regulatory pathway, not provided under a water rights that is dedicated to meeting the HRL flow commitments, or not an approved instream flow dedication pursuant to Water Code section 1707. Because the base includes substantial flows that are outside of those that would be protected by the implementation methodology, additional mechanisms are needed to protect from diversion the base upon which the HRL flows are intended to be additive. As described in this Staff Report, in all but drier conditions, D-1641 Delta outflow requirements are significantly less than current Delta outflow conditions. Further, the 2024 BiOps/ROD do not include Delta outflow requirements, with the exception of some fall Delta outflows, which have not been implemented recently. In addition, D-1641 Delta outflow and the BiOp/ROD requirements do not apply to other water users outside of the SWP and CVP. Accordingly, it is possible that the HRL flow base would be reduced over time affecting the expected benefits of the HRLs without provisions to avoid those effects.

Modular Alternative 6a, Protection of Voluntary Agreement Flows, was developed to potentially address this issue. Staff Report Section 7.2, *Description of Alternatives*, includes a description of Modular Alternative 6a. While Alternative 6a was not carried forward specifically, to fulfill the intent of Modular Alternative 6a, a provision is included in the revised proposed Plan amendments for protection of the VA Pathway flow base applicable to new water supply projects. To help ensure that water quality conditions, including existing flows, together with other measures in the watershed, continue to support and maintain natural production of viable native fish populations, in future

water right actions the revised proposed Plan amendments state that the State Water Board would consider imposing requirements, based on the record established during the administrative proceeding, including any hearing, to ensure that the use of water is consistent with and supports the salmon protection, fish viability, inflow, inflow-based Delta outflow, and interior Delta flow objectives. Increased diversions from new water supply projects that are subject to the regulatory pathway inflow and inflow-based Delta outflow requirements would not be included in determination of the base flows to which the HRL flow commitments are required to be additive.

The revised proposed Plan amendments also include a new LTO base flow balancing provision to require there be a commensurate increase in HRL flow commitments to replenish substantial reductions in Delta outflow from base conditions to which HRL flows were assumed to be additive in the scientific and environmental analyses supporting approval of the VA pathway due to substantive changes in water project operations or other operational changes. The affected HRL participants would submit an interim plan for Executive Director approval that documents the change in Delta outflow and the commensurate increase in Delta outflow that would be provided. If the timing or magnitude of the commensurate increase in Delta outflow differs from what would have been provided absent the change, the affected HRL participant is required to submit scientific and technical information demonstrating that the proposed outflows along with other measures are anticipated to provide ecological benefits comparable to what would have occurred absent the change in operations.

13.3.4.3 HRL Flow Commitments

HRL flow commitments are specified for different water sources based on water year type. In order to utilize the VA pathway, these flows would be required to be provided consistent with the accounting procedures in the revised proposed Plan amendments. HRL flow commitments would be in addition to flows resulting from the responsibilities of non-HRL water rights pursuant to the Bay-Delta Plan, including the Lower San Joaquin River flow requirements; and other instream flow dedications, including Water Code section 1707 instream flow dedications to the extent applicable. The VA pathway does not include proposed Tuolumne River HRL commitments that are being considered through a separate process. However, this Staff Report does evaluate the possible contribution of Tuolumne River HRL flows to Delta outflows under the VA pathway, as well as the Lower San Joaquin River flow objectives adopted in 2018.

All HRL flows, except where otherwise stated below, would be additive Delta outflow to be provided above base Delta outflows. In order to protect HRL flows dedicated to instream use, HRL flow commitments, including water purchases, would be required to be available under a valid water right, at the water right's priority at the time flows are provided, and could not be provided from a water right that is duplicative of another right still being used for consumptive purposes. HRL flow commitments would be required to be provided consistent with water right priorities, within the scope of the dedicated water right, and otherwise in accordance with law. HRL participants would be required to provide a list of the specific water rights for each HRL water source, including water rights proposed for purchases and any accompanying substantiating information requested by the Executive Director, that could be dedicated instream within 6 months of adoption of the Plan amendments. To modify the list, HRL participants could submit proposed modifications 6 months before the planned use of any new water rights. The State Water Board would notify the public, provide a 30-day comment period for the list of water rights, and conduct an initial verification of water rights proposed to be dedicated. The Executive Director would notify HRL participants and

the public if any inconsistencies were identified that would need to be resolved for a water right to be included on the list of rights that could be dedicated instream.

Each year, HRL participants would be required to identify the specific water rights under which HRL flow commitments would be provided at least 90 days in advance of the planned use. The State Water Board would notify the public and provide a 30-day comment period for comments on whether dedication instream would injure other legal users of water, unreasonably affect fish and wildlife or other instream uses, or increase the amount of water that would have otherwise been used under that right. The Executive Director would provide notification to HRL participants and the public if any inconsistencies are identified that must be resolved in order for a specific water right to be dedicated instream.

Implementation of HRL flow commitments would be subject to a default schedule and flexibility brackets for each water source and water year type. The default schedule defines the proportion of the annual HRL flow commitments to be provided in each month on a default basis. Each HRL flow commitment could also be shaped for the benefit of native fish and wildlife within defined flexibility brackets (provided in the revised proposed Plan amendments) such that the average schedule of each HRL flow commitment over the 8-year term of the VA pathway is consistent with the default schedule for January through June. The HRL participants would determine the proposed schedule for release of HRL flow commitments on a tributary and water source basis each year in consultation with the State Water Board. Any proposal to release HRL flows outside the flexibility brackets or that would result in less HRL flows during January through June than the default schedule, regardless of flexibility brackets, would be subject to approval by the Executive Director. The HRL flow commitments would be required to be implemented in a manner consistent with water right priorities, avoiding impacts to native aquatic species, consistent with the Sustainable Groundwater Management Act (SGMA) to avoid redirected impacts from groundwater substitution, and to improve temperatures to the extent possible and avoid redirected impacts on water temperatures.

Sacramento River

The Sacramento River HRL participants would provide 100 thousand acre-feet (TAF)[5] of additional Sacramento River inflow and associated Delta outflows above base conditions in dry, below normal, and above normal years through groundwater substitution and land fallowing. No more than 20 TAF of water each year could be provided through groundwater substitution sources and could only be provided in a manner that does not have redirected impacts on fish and wildlife and consistent with the SGMA. Any proposal to maintain Sacramento River flow volumes in storage for cold water purposes could only occur in dry years and would require approval by the Executive Director of the State Water Board with support from NMFS and CDFW. Any portion of the flow contribution stored for cold water purposes and released in a subsequent year would be subject to the same provisions as would apply absent shifting the flows to another year, including approved accounting procedures, and would be required to result in additional Delta outflow at a time with benefits to native fish.

[5] Appendix 1 to the MOU identified 2 TAF of flow commitments in critical years and 102 in dry years. However, subsequent HRL proposal documents have removed this 2 TAF from critical and dry years since no HRL participant has committed to providing those flows.

American River

The American River HRL participants would provide 30, 40, 10, and 10 TAF of additive inflow and associated Delta outflows above base conditions in critical, dry, below normal, and above normal years, respectively, through groundwater substitution and reservoir reoperation. Flows should be targeted in the first three dry or critical years and in the first three above normal or below normal years during the eight-year term of the VA pathway. A portion of American River HRL flows could be provided through groundwater substitution and could only be provided in a manner that does not have redirected impacts on fish and wildlife and consistent with SGMA.

Yuba River

The Yuba River HRL participants would provide up to 50 TAF of additive inflow and associated Delta outflows above base conditions in above normal, below normal, and dry years. The MOU identified 60 TAF for the Yuba River, but the Yuba River HRL participants have committed to 50 TAF. The HRL participants propose that the remaining 10 TAF is provided by the recently submitted HRL commitments on the Bear River, Auburn Ravine, and Yuba River from NID and SSWD. The flow commitments would be provided through reservoir reoperations.

Bear River, Yuba River, and Auburn Ravine (Nevada Irrigation District)

NID would provide the HRL flow commitments for components 1 and 2 prior to issuance of a new Federal Energy Regulatory Commission (FERC) license and component 3 following issuance of a new FERC license. Component 1 is a commitment to redirect up to 3.6 TAF of Bear River flow to be additive to Auburn Ravine flows above base conditions in dry, below normal, and above normal years. Component 1 would not be additive to Delta outflow. Component 2 is a commitment of 5.6 TAF of additive Bear River inflow and associated Delta outflows above approved base conditions in dry, below normal, and above normal years, provided through reservoir reoperations. Component 3 is a commitment of 5.6 TAF of additive Yuba River inflow and associated Delta outflows above approved base conditions in dry, below normal, and above normal years, provided through reduced diversions on the Yuba River.

Bear River (South Sutter Water District)

SSWD would provide the HRL flow commitments for component 1 prior to issuance of a new FERC license and component 2 following issuance of a new FERC license through reservoir reoperations. Both components include commitments to provide up to 4.4 TAF of additive Bear River inflow and associated Delta outflows above base conditions in dry, below normal, and above normal years. Component 2 also includes flows in wet and critical years that are not additive to Delta outflows and higher flows in dry, below normal, and above normal years that are not additive to Delta outflows.

Feather River

The Feather River HRL participants would provide 60 TAF of additive inflow and associated Delta outflows above base conditions in above normal, below normal, and dry years. A portion of the Feather River HRL flow commitments could be provided through groundwater substitution and could only be provided in a manner that does not have redirected impacts on fish and wildlife and consistent with SGMA. The flow commitments would be provided through groundwater substitution, land fallowing, and reservoir reoperations.

Putah Creek

The Putah Creek HRL participants would provide 7, 6, 6, and 6 TAF of additive lower Putah Creek inflow above base conditions in critical, dry, below normal, and above normal years, respectively. The flow commitments would be provided through reservoir reoperations without refill limitations and would not be accounted for as contributing to increases in Delta outflows.

Putah Creek (Yolo County Flood Control and Water Conservation District)

The Putah Creek (Yolo County Flood Control and Water Conservation District [YCFCWCD]) HRL participants would provide 5 TAF of additive lower Putah Creek inflow above base conditions in dry, below normal, and above normal years. The Putah Creek (YCFCWCD) HRL flows would not be accounted for as contributing to increases in Delta outflows.

If YCFCWCD can demonstrate no significant adverse water quality effects to Putah Creek based on the approved monitoring described below and as determined by the State Water Board Executive Director in coordination with Central Valley Regional Water Quality Control Board (Central Valley Water Board) staff, the Putah Creek (YCFCWCD) HRL flow commitment may involve routing surface water from Cache Creek to lower Putah Creek and/or conducting groundwater recharge and later utilizing a portion of the banked groundwater from its recharge efforts to provide enhanced environmental flow contributions to lower Putah Creek. If the aforementioned criteria are not met, or if required water right and other permits are not obtained to divert from Cache Creek, YCFCWCD will provide the remainder of a year's flow commitment via purchases or exchanges that will result in additive flows to lower Putah Creek.

Prior to releasing any Cache Creek surface water or banked groundwater into Putah Creek, YCFCWCD would be required to develop, in consultation with State Water Board and Central Valley Water Board staff, a monitoring plan to inform whether releases would result in adverse water quality effects in Putah Creek. The monitoring plan would be subject to approval by the Executive Director of the State Water Board, including any conditions of approval. Once approved, YCFCWCD will be required to conduct monitoring in accordance with that approved plan. The monitoring would be required to include provisions to evaluate effects related to boron, nitrates, harmful algal blooms (HABs), and mercury and include monitoring of Cache Creek water quality and banked groundwater quality prior to diversion into Putah Creek, and Putah Creek water quality before releases of Cache Creek water or banked groundwater into Putah Creek. If the monitoring shows no expected significant adverse effects to Putah Creek water quality, YCFCWCD will be required to continue monitoring Putah Creek during and after releasing Cache Creek water or banked groundwater into Putah Creek. If monitoring information indicates possible significant adverse effects to Putah Creek water quality, YCFCWCD will notify the State Water Board and Central Valley Water Board immediately and cease releasing water into Putah Creek until the State Water Board Executive Director in coordination with Central Valley Water Board staff determine that significant adverse effects to water quality in Putah Creek are no longer expected. To the extent that this HRL commitment results in additional groundwater recharge than would occur absent the HRL commitment, YCFCWCD will be required to monitor Cache Creek surface water prior to recharge for boron, nitrates, HABs, and mercury, at minimum and, if monitoring information indicates possible significant adverse effects to groundwater quality, cease recharging groundwater until the State Water Board Executive Director in coordination with Central Valley Water Board staff determine that significant adverse effects to groundwater quality are no longer expected.

Mokelumne River

The Mokelumne River HRL participants would operate to provide instream flows above the 1998 Joint Settlement Agreement (JSA) minimum instream flow requirement by 10, 20, and 45 TAF per year for dry, below normal, and normal and above JSA water year types, respectively, except in years when the March 1st median forecast of end-of-September total combined Pardee and Camanche storage is less than 350,000 AF when these increased flows do not apply. Mokelumne River HRL participants indicate based on their modeling that they expect these changes to result in long-term average increases to Delta inflow and associated Delta outflows above base conditions in critically dry, dry and below normal Sacramento Valley Index years. However, these contributions would not be accounted for as Delta outflows. Instead, Mokelumne River HRL participants would provide financial contributions to fund 1 and 2 TAF of contributions to Delta outflows in below normal and above normal Sacramento Valley Index years, respectively, through market-price water purchases under the public water agency (PWA) water purchase program described below. The flow commitments would be provided through reservoir reoperations without refill limitations.

Friant Contributions to Delta Outflows

To implement the Friant HRL commitments, San Joaquin River Restoration Program (SJRRP) flows of up to 50 TAF would be provided in dry, normal-dry, and normal-wet years, as determined by SJRRP water year types, in order to contribute to Delta outflows above base conditions. If 50 TAF of contributions to Delta outflow would not be provided absent limitations on recapture of SJRRP flows, recapture of SJRRP flows would be reduced by up to 50 percent as needed to contribute toward the flow commitment of 50 TAF of Delta outflow.

SWP and CVP Export Provisions

To utilize the VA pathway, the HRL participants responsible for providing SWP and CVP export contributions, including DWR and Reclamation, would reduce exports compared to what would have occurred under base conditions by 125 TAF in both dry and below normal water year types, and 175 TAF in above normal water year types, in order to provide additive Delta outflow above base conditions. All diverters in the Delta watershed, including the SWP and CVP would also be required to bypass other HRL flow commitments to achieve the additive HRL Delta outflow commitments above base conditions, as well as other flows provided by non-HRL water rights, that are above base conditions, to meet Bay-Delta Plan regulatory requirements and other instream flow dedications as specified in accounting provisions included in Appendix B.1 and approved as part of the implementation methodology and associated regulation for the current update to the Bay-Delta Plan.

If there are circumstances outside of the HRL participant control under which the full quantity of HRL committed export reductions could not be provided while meeting minimum human health and safety needs for exports, HRL participants could submit a request for approval by the Executive Director to provide the shortage in export reductions in a future year. Any portion of the flow contribution shifted to a subsequent year for human health and safety needs would be subject to the same provisions as would apply absent shifting the flows to another year, and must result in additional Delta outflow at a time with benefits to fishes. Any such request must be supported by substantiation of the health and safety need, a proposal for how the flow shortage would be provided and accounted for in a future year, and other relevant information, including any additional information requested by the Executive Director.

Water Purchases

HRL participants would provide the following additive Delta outflows above base conditions:

1. PWA water purchases consisting of:
    a. Fixed price purchases of 3 TAF in critical, 63.5 TAF in dry, 84.5 TAF in below normal, 99.5 TAF in above normal, and 27 TAF in wet water year types.
    b. Market price purchases of 50 TAF in dry, 61 TAF in below normal, and 85 TAF in above normal water year types (inclusive of 1 and 2 TAF Mokelumne River HRL participant contributions).
2. Permanent state water purchases of 65 TAF in critical, 108 TAF in dry, 9 TAF in below normal, 52 TAF in above normal, and 123 TAF in wet water year types.

HRL participants are in the process of identifying purchases to fulfill this flow commitment. As information becomes available, Appendix B.1 would be updated. HRL participants would provide specific flow accounting information including the water rights associated with the purchases, including the quantities to be provided by land fallowing, groundwater substitution, and export reductions, consistent with the timeframes and criteria in section 4.4.9.2 of the revised proposed Plan amendments. Any permanent state water purchases not in place prior to each year's commitment would be backfilled with additional market price purchases.

New Water Projects Water Purchases

The MOU identifies flow volumes to be provided from "New Water Projects (Before Year 8)" including Chino Basin, Kern Fan, and Willow Springs Conjunctive Use. These projects have been removed from the revised proposed Plan amendments based on input from HRL participants. These projects could possibly be integrated into the VA pathway in the future as appropriate.

13.3.4.4 Flow Accounting

Flow accounting procedures are included in Appendix B.1 of the revised proposed Plan amendments. The procedures are intended to demonstrate that the HRL flows are provided in addition to base flows, including flows required by D-1641, other regulatory requirements, and other non-regulatory flows that would be present absent the HRL flows. The flow accounting procedures are intended to ensure that HRL commitments are provided consistent with water right priorities and are provided in addition to flows needed to meet senior water right demands. The flow accounting procedures are also intended to ensure that the HRL flows are provided in addition to flows resulting from the responsibilities of non-HRL water right holders pursuant to the Bay-Delta Plan, including the Lower San Joaquin River flow requirements and other instream flow dedications, including Water Code section 1707 instream flow dedications. Flow accounting is included in Appendix B.1 to demonstrate that HRL flows are overall or seasonally new additive water over this base flow by demonstrating that the water came from any of the following sources: (1) a new source of water that is replacing the source to be left instream (e.g., groundwater substitution); (2) an overall reduction in consumptive water use relative to base conditions in order to provide this source instream (e.g., land fallowing, an overall reduction in exports that would have occurred relative to base conditions); or (3) in the case of reservoir reoperations or Friant contributions that may not be fully additive to base conditions, that the operations are consistent with the expectations for additive inflows and outflows, where applicable, as described in Appendix

B.1 of the revised proposed Plan amendments. Flow accounting procedures may be refined by the Executive Director as part of the annual and periodic review processes in order to determine compliance with the HRL flow commitments. Interested parties would have the opportunity to petition the State Water Board for reconsideration of Executive Director refinements to accounting procedures.

13.3.4.5 HRL Non-Flow Habitat Restoration Commitments

Table 13.3-2 identifies the minimum additive contributions to physical habitat restoration, in acres and by general location, that would be required to be completed by HRL participants within the initial 8-year term of the VA pathway. HRL habitat restoration includes activities to increase the area of spawning habitat, instream rearing habitat, and floodplain habitat for the benefit of native fish and other aquatic species. The "Sutter Bypass, Butte Sink, and Colusa Basin" habitat category has been renamed "Valley Floor" habitat and expanded to include floodplain rearing habitat in the Yolo Bypass, Tisdale Bypass, Sacramento River, and the Delta. TheseTable 13.3-2.

New incremental implementation requirements would apply to HRL habitat restoration projects, as provided below. For good cause shown, the Executive Director could approve extensions to these timelines.

1. Within one year of adoption of the Plan amendments, the HRL participants must submit an initial habitat implementation schedule to the State Water Board and provide annual updates thereafter. Changes to implementation schedules and individual projects should be reflected in annual reports.
2. By the end of year two of the VA pathway, a preliminary list of HRL habitat restoration projects and the expected outcome of the habitat accounting protocol must be identified.
3. By the end of year four of the VA pathway, 50 percent of the cumulative habitat commitments must have completed construction and accounting must be completed or largely completed for that quantity of habitat. In addition, the projected implementation schedule and expected outcome of habitat accounting must demonstrate that the full habitat commitment will be completed by the end of year eight of the VA pathway.
4. By the end of year six of the VA pathway, 75 percent of the cumulative habitat commitments must have completed construction and accounting must be completed or largely completed for that quantity of habitat, or otherwise demonstrate an ability to achieve the full habitat commitment by the end of year eight, satisfactory to the Executive Director.

The VA pathway would require the HRL habitat restoration projects to include provisions for incorporating input from California Native American Tribes and other interested parties during the development, implementation, and assessment of non-flow habitat restoration measures, including input from tribes on Traditional Ecological Knowledge (TEK) and other relevant information.

Table 13.3-2. HRL Habitat Restoration Commitments

Tributary or Water Source	Habitat Restoration Commitment
Sacramento River	113.5 acres of spawning habitat and 137.5 acres of instream rearing habitat
Valley Floor	20,000 acres of floodplain rearing habitat in flood bypasses (Yolo Bypass, Tisdale Bypass, Sutter Bypass, Butte Sink, and Colusa Basin), the Sacramento River, and the Delta (preferably located outside of the flood bypasses)
American River	25 acres of spawning habitat and 75 acres of instream rearing habitat
Yuba River	50 acres of instream rearing habitat and 100 acres of floodplain rearing habitat
Auburn Ravine	Installation of additional fish screens on private diversions in lower Auburn Ravine
Feather River	15 acres of spawning habitat, 5.25 acres of instream rearing habitat, and 1,655 acres of floodplain rearing habitat
Putah Creek	1.4 acres of spawning habitat
Mokelumne River	1 acre of instream rearing habitat and 25 acres of floodplain rearing habitat
North Delta Arc and Suisun Marsh	5,227.5 acres of tidal wetland and associated floodplain habitat

In addition, the HRL participants could conduct fish food production pilot actions if it can be demonstrated that contaminant concentrations would not exceed benchmarks for aquatic life and that the action would not increase aqueous or bioaccumulated methylmercury, subject to Executive Director approval in consultation with the Central Valley Regional Board. Any such pilot actions would be subject to evaluations of effectiveness during the first periodic review process under the VA pathway, and could continue if it were demonstrated that the source waters were not exceeding aquatic life benchmarks for contaminants and pesticides, that the actions had not resulted in a measurable increased concentration in aqueous or bioaccumulated methylmercury, and that the action was resulting in significant benefits for native fishes. All fish food production actions would be required to be conducted pursuant to and consistent with a valid water right.

13.3.4.6 Non-Flow Habitat Restoration Accounting

The HRL non-flow habitat restoration commitments are required to be additive to existing physical habitat conditions and regulatory requirements existing as of December 2018 as determined through the non-flow habitat accounting protocols included in Appendix B.2 of the revised proposed Plan amendments. The HRL non-flow habitat restoration actions are required to be completed within the initial 8-year term of the VA pathway. Accounting for HRL non-flow habitat restoration would be required to account for the following three steps:

First, projects completed by HRL participants would be required to fulfill all of the following conditions in order to count toward the HRL commitments under the VA pathway:

1. The project must create new suitable habitat or restore existing habitat with limited suitability in a manner that provides significant additional benefits for the target species and life stages;
2. The project must not be used to fulfill any regulatory requirements that existed as of December 2018 or earlier; and

3. Project construction must be started after December 2018 and completed by the end of year 8 of the VA pathway.

Second, the number of acres of qualifying projects that meet all applicable design criteria must be determined. Tributary spawning, instream rearing, and tributary floodplain rearing habitat restoration projects (including tributary floodplain projects intended to be counted toward the valley floor floodplain habitat commitment) would be subject to the design criteria specified in the revised proposed Plan amendments. HRL participants could request project-specific modifications to these design criteria, subject to approval by the Executive Director and CDFW. Bypass floodplain and tidal wetland habitat projects do not have pre-defined criteria and instead HRL participants would be required to submit proposed design criteria for approval by the Executive Director and CDFW.

Design criteria for tributary habitat projects include different sets of criteria for spawning, instream rearing, and floodplain rearing habitat projects. These criteria include depth, velocity, substrate (for spawning), cover (for rearing), and inundation (for floodplain rearing). The basis for the design criteria is described in the final Scientific Basis Report Supplement (Appendix G2, *Final Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan*) but is also described briefly here. Depth and velocity criteria were based on field surveys associating depth and velocity with fish observations and were defined by the depth and velocity ranges identified by the Conservation Planning Foundation for Restoring Chinook Salmon and *O. mykiss* in the Stanislaus River (Anchor QEA, LLC 2019). The criterion for suitable spawning substrate was based on Gard (2006), Riebe et al. (2014) and Merz et al. (2018). The cover criterion is based on prior research indicating that cover is important for rearing habitat suitability and is often the most limiting factor when applied alongside velocity and depth (San Joaquin River Restoration Program 2012). Available literature indicates that habitat for rearing Chinook salmon contains suitable cover if cover features constitute at least 20 percent (Raleigh et al. 1986) or at least 75 percent (Whipple et al. 2019) of the habitat area, or if suitable cover features are present within 1 meter of any point in the stream area (San Joaquin River Restoration Program 2012). The cover criterion requires at least 15 percent of the habitat area constitute suitable cover features and an additional 5 percent of the habitat area is required to constitute either cobble, a 2-foot buffer applied to cover features, or additional suitable cover features. Only a small portion of the cover requirement is allowed to be provided by cobble or buffer due to limited cover provided by those features and uncertainty regarding the effectiveness of those features as cover for salmonid rearing. The inundation criterion is based on the meaningful floodplain event criteria in the final Scientific Basis Report Supplement, which found that floodplain rearing benefits are maximized by at least two 21-day inundation events during the rearing period, occurring in 2 out of every 3 years.

Third, for tributary spawning, instream rearing, and floodplain rearing, habitat verification would occur to confirm that the acreage of habitat meeting design criteria across a range of flows conforms with or provides equivalent benefits to the flow-habitat relationships representing the incremental addition of VA habitat over existing conditions provided by HRL participants for assessment of the benefits of the VA pathway (i.e., those used in the final Scientific Basis Report Supplement). This verification would be provided to the Executive Director of the State Water Board and CDFW for approval. This verification would not be required for tributary floodplain restoration projects intended to be counted toward the valley floor floodplain habitat commitment. Instead, the number of acres meeting applicable design criteria could be counted toward the valley floor floodplain habitat commitment.

13.3.4.7 Supplemental Science and Monitoring

HRL participants would be required to conduct supplemental science and monitoring in addition to general monitoring processes and activities described below in Section 13.3.9.1, *Bay-Delta Monitoring and Evaluation Program*. The HRL participants would be required to develop hypotheses, metrics, targets, and associated monitoring to inform assessment of compliance and effectiveness of the VA pathway. The hypotheses, metrics, targets, and monitoring would be provided to the Executive Director for approval and may be updated through the annual or periodic review process after public review and comment. The HRL monitoring as approved by the Executive Director would be required to begin within the first year of implementation of the VA pathway. The HRL supplemental science and monitoring would be incorporated within the Bay-Delta Monitoring and Evaluation Program (BDMEP) defined below and would be required to adhere to the requirements in the BDMEP, including for review and revision of monitoring and special studies, data management and quality, and reporting. In conducting supplemental monitoring, HRL participants should coordinate with any topically and geographically related monitoring surveys, including the Delta and San Francisco Bay Regional Monitoring Programs. In addition, the HRL participants would be required to provide support for implementation of the Delta Cyanobacterial Harmful Algal Blooms (CHABs) Monitoring Strategy.

The HRL participants would also be required to conduct habitat suitability assessments and habitat utilization and biological effectiveness assessments The habitat suitability assessments would evaluate the suitability over time of non-flow habitat restoration projects and their conformance to applicable design criteria and other variables with an influence on habitat suitability, such as dissolved oxygen and temperature. The habitat utilization and biological effectiveness assessments would evaluate whether each project is effective in achieving biological outcomes and the applicable narrative objectives, based primarily on empirical data and observations obtained through monitoring. These assessments would evaluate whether and the extent to which constructed non-flow habitat restoration sites are being used by target native species populations and life stages. Habitat suitability and utilization and biological effectiveness assessments would be conducted annually for the term of the VA pathway.

13.3.4.8 Annual Reports, Periodic Reports, and Ecological Outcomes Analysis Report

The HRL participants would submit annual reports, periodic reports, and an ecological outcomes analysis report to the State Water Board. These reports would include all associated accounting and ecological monitoring data. In addition, HRL participants would be required to participate in annual public meetings before the State Water Board consistent with the annual and periodic review processes described below in Section 13.3.9.5, *Annual and Periodic Review*, including possible needed revisions to science and monitoring activities. California Native American Tribes and the public would have the opportunity to provide input on HRL science and monitoring activities during annual reviews.

Annual reports would include information on HRL actions, including HRL flow and non-flow measures that were taken in the previous year, an implementation schedule for HRL non-flow habitat restoration projects, a summary of scientific findings, a summary of tribal outreach and engagement, a summary of expected HRL activities for the next water year, an analysis demonstrating that implementation of the HRL commitments did not result in redirected impacts to native fish and wildlife resources in the Trinity River watershed, and an assessment of water

temperature management in each HRL tributary including any planned improvements in future years.

Periodic reports would be submitted every 3 years and would include all items required for annual reports over the prior 3 years, and an analysis of progress to date on contributing toward the applicable narrative objectives, including progress related to HRL hypotheses, metrics, and targets informed by required monitoring.

The ecological outcomes analysis report would be provided after year 6 of implementation of the VA pathway. The ecological outcomes analysis report would include a synthesis of scientific data and information generated by the VA pathway with documentation of the hypotheses tested, and associated monitoring, evaluation, and results. The ecological outcomes report would be required to evaluate the scientific basis and rationale for continuing the VA pathway as is, or continuing the VA pathway with modifications, beyond year 8 if HRL participants intend to seek an extension of the VA pathway beyond the initial 8-year term, as well as possible termination of the VA pathway for HRL water rights. The report would be required to contain methods and presentation of the results equivalent to those in the Scientific Basis Report Supplement for the initial VA pathway in order to evaluate whether the expected benefits occurred. The State Water Board would request a Delta Independent Science Board review of the ecological outcomes report to receive input and recommendations on the scientific rationale for continuing or modifying the VA pathway.

13.3.4.9 HRL Governance

State Water Board staff would provide advice and oversight on compliance and participate in decision-making affecting HRL Governance as described in the revised proposed Plan amendments. HRL participants would also be required to engage with California Native American Tribes and consider their input in decision-making affecting HRL Governance, including but not limited to tribal participation in the HRL science committee. HRL participants would be required to develop a tribal engagement plan in coordination with tribes, describing specific tribal engagement opportunities related to HRL milestones that would require approval by the Executive Director of the State Water Board prior to year 1 of the initial 8-year term of the VA pathway. The tribal engagement plan would be required to include the designation of a tribal coordinator responsible for engaging with tribes and liaising between the HRL participants and the State Water Board on tribal matters relevant to the VA pathway.

13.3.4.10 Continuation, Modification, or Termination of the VA Pathway

The VA pathway would remain in effect for a term of 8 years after the effective date, unless the VA pathway is terminated before 8 years or extended to as long as 15 years as discussed below. The State Water Board could also require modifications to the VA pathway as discussed below. Prior to a decision to extend, modify, or terminate the VA pathway, State Water Board staff would produce a draft recommendation that would undergo public comment and Delta Independent Science Board review and input before consideration by the State Water Board at a public Board meeting. The following default and annual and periodic review processes apply to extension, modification, or termination of the VA pathway.

Under the default process, the HRL participants could submit a request to the State Water Board at year 6 of VA pathway implementation to extend the VA pathway beyond the initial 8-year term. The State Water Board would then initiate a process to evaluate the VA pathway for consideration of

extension, including possible modifications. The State Water Board would solicit public comments and hold a public workshop to discuss the possible extension and modification of the VA pathway, including information regarding the effectiveness of the VA pathway at achieving the applicable narrative objectives. Following the public workshop, the State Water Board would act on the request for VA pathway extension or modification to determine whether to extend the VAs after year 8. The State Water Board would consider the green, yellow, and red light criteria to determine the continuation of the VA pathway (green light), modification of the VA pathway (yellow light), or termination of the VA pathway (red light).

If the draft recommendation is to terminate the VA pathway, the State Water Board staff would include an addendum to the Scientific Basis Report Supplement that synthesizes the then-current scientific information concerning flows for the protection of fish and wildlife beneficial uses. The addendum would be publicly circulated for comment with the draft recommendation for continuation, modification, or termination of the VA pathway and provided to the Delta Independent Science Board for review and input. The State Water Board would consider that addendum as part of its Board meeting on the staff recommendation for continuation, modification, or termination of the VA pathway. If the State Water Board concludes that it is appropriate to terminate the VA pathway under the red light scenario discussed below, it would also decide whether any modifications to the regulatory pathway are necessary in recognition of updated scientific information in the addendum or other legal or policy reasons and take one of the following actions:

1. If the State Water Board determines modifications to the regulatory pathway are necessary, it would immediately commence an update to the Bay-Delta Plan or its implementing regulation to incorporate the necessary changes.
2. If the State Water Board determines modifications to the regulatory pathway are not necessary, it would provide a new determination, that is judicially reviewable under Code of Civil Procedure section 1085, that the regulatory pathway is legally and scientifically appropriate under the provisions of Water Code section 13241.

A green light determination could occur if the State Water Board concludes that the VA pathway provided flow and non-flow commitments, including in a manner substantially consistent with Board-approved accounting protocols, and the monitoring, science, reporting, and other requirements of the Bay-Delta Plan have been fulfilled. The State Water Board would also be required to determine that the VA pathway is substantially achieving the HRL metrics and targets, including biological effectiveness, habitat suitability, and habitat utilization criteria; and that the ecological outcomes analysis and other relevant information support the conclusion that continuing the VA pathway would contribute the HRL participants' responsibility toward attainment of the narrative fish viability and salmon protection objectives by 2050.

A yellow light determination could occur if the State Water Board concludes that the VA pathway provided flow and non-flow commitments, including in a manner substantially consistent with Board-approved accounting protocols, and the monitoring, science, reporting, and other requirements of the Bay-Delta Plan have been fulfilled. The State Water Board would also be required to determine that the VA pathway is meeting a significant number of HRL metrics and targets, including biological effectiveness, habitat suitability, and habitat utilization criteria; and that the ecological outcomes analysis and other relevant information support the conclusion that continuing the VA pathway, with modifications, would contribute the HRL participants' responsibility toward attainment of the narrative fish viability and salmon protection objectives by 2050.

The red light determination could occur if the State Water Board concludes that the VA pathway is not achieving the conditions above for the green or yellow light determinations. Under a red light determination, the State Water Board may determine that the regulatory pathway provisions, including the Sacramento/Delta inflow and cold water habitat and inflow-based outflow provisions, would apply to the HRL water rights. The State Water Board could also determine that modifications to the regulatory provisions are needed and pursue appropriate processes to update the Bay-Delta Plan.

In addition to determining whether the VA pathway should continue after year 8, the VA pathway could be modified or terminated as part of the State Water Board's annual or periodic review processes prior to or after the end of the 8-year term. Specifically, the VA pathway may be modified or terminated if the HRL participants fail to or are unable to implement HRL commitments including failure to implement the HRL flow, habitat, funding, monitoring, science, or other provisions consistent with the program of implementation or withdrawal of a party or parties from the VA pathway that materially affects the ability of any remaining HRL participants to fulfill their HRL commitments included in the program of implementation. The State Water Board would conduct a public workshop and solicit public comments and could allow additional time for the HRL participants to come into compliance before considering modification or termination of the VA pathway. The State Water Board may modify or terminate the VA pathway for compliance issues without a Bay-Delta Plan amendment.

In addition, as part of the periodic review processes, the State Water Board could consider modifying or terminating the VA pathway before year 8 based on significant evidence that continuing implementation of the VA pathway will not provide reasonable protection of beneficial uses or will jeopardize the continued survival of native fishes. State Water Board staff would prepare an assessment that would undergo public comment and Delta Independent Science Board review and input before consideration by the State Water Board at a public Board meeting. If the State Water Board determines that significant evidence supports the conclusion that continuing implementation of the VA pathway will not provide reasonable protection of beneficial uses or will jeopardize the continued survival of native fishes, the State Water Board could modify or terminate the Bay-Delta Plan's VA pathway through a Bay-Delta Plan amendment.

13.3.5 Implementation Methodology

The State Water Board will implement the flow components of the Sacramento/Delta updates to the Bay-Delta Plan through water right or water quality actions, as necessary, including and primarily through water right curtailments based on water right priorities subject to possible modifications (e.g., drought, public health and safety, public trust obligations). The State Water Board would curtail water rights when it is determined that:

1. Water is not available at water right priorities regardless of instream flow requirements. These curtailments would apply to all water rights, including for HRL water rights that are part of the VA pathway, unless an approved exception to curtailment applies.
2. Water is not available based on water right priorities due to responsibility for meeting the tributary inflow and the inflow-based Delta outflow requirements. These curtailments would apply unless a water right is covered under the VA pathway or an exception to curtailment applies.

To inform the above curtailments, the State Water Board would develop an implementation methodology to determine when water is not available at water right holders' priorities of right, including operational rules for reservoir management and integration of adaptive implementation provisions. The Executive Director could approve exceptions to curtailments for certain wildlife refuge supplies. In addition, the State Water Board would develop appropriate provisions to address human health and safety needs and other possible reasons for short-term and long-term exceptions to curtailments associated with implementation of the Bay-Delta Plan for specific purposes.

This methodology would be based on the Water Unavailability Methodology for the Delta Watershed, which was developed and used to implement emergency drought curtailment regulations in water years 2021 to 2023. The methodology will incorporate water right demands for water within the Sacramento and San Joaquin watersheds and unimpaired flow data in order to determine when water is not available for diversion under specific water right priorities. The methodology would be developed through a public process before use in implementation of the Bay-Delta Plan and would be subject to refinement over time through a public process.

13.3.6 Interior Delta Flows

Operation of the SWP and CVP pumping facilities and other water diversion projects in the Delta can affect salmonids, pelagic fishes, and other species through alteration of channel flow, which can lead to adverse transport flows, changes in water quality, changes to Delta habitat, and entrainment of fish and other aquatic organisms, depending on the specific diversion facility design and operational criteria. The revised proposed Plan amendments include a new narrative interior Delta flow objective and minor revisions to the existing numeric interior Delta flow objectives for operation of the Delta Cross Channel. The implementation provisions described below apply to the water rights for the SWP and CVP regardless of whether these rights are subject to the VA or regulatory pathway. The narrative objective is expected to be met through compliance by the SWP and CVP with the numeric interior Delta flow objectives in the Plan and implementation measures required pursuant to State and federal Endangered Species Act requirements for the operations of the CVP and SWP export facilities. As appropriate, during the annual or periodic review of the Bay-Delta Plan and its implementation, the State Water Board would evaluate the effectiveness of the interior Delta flow objectives and implementation actions and any needed changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including to provide for consistent operations of the CVP and SWP export facilities for the reasonable protection of fish and wildlife.

The Delta Cross Channel Gates closure objective is implemented through water right requirements of the CVP and the NMFS BiOp for CVP operations. The December 2025 draft Plan proposed to add specific provisions from the NMFS BiOp to the Bay-Delta Plan, but those are no longer proposed to be added. However, other minor updates to the implementation provisions have been made to clarify the language and update decision-making processes.

13.3.7 Designation of Tribal Tradition and Culture (CUL) and Incorporation of Tribal and Subsistence Fishing Beneficial Uses

In 2017, in collaboration with California Native American Tribes and the public, the State Water Board established and defined two beneficial uses unique to California Native American Tribes and a

third beneficial use unique to people and communities who engage in subsistence fishing, which are CUL, Tribal Subsistence Fishing (T-SUB), and Subsistence Fishing (SUB). Together, these beneficial uses are generally referred to as TBUs. The CUL beneficial use is defined as uses of water that support the cultural, spiritual, ceremonial, or traditional rights or lifeways of California Native American Tribes, including but not limited to, navigation, ceremonies, or fishing, gathering, or consumption of natural aquatic resources, including fish, shellfish, vegetation, and materials. It is expressly designed to encompass the great variety of California Native American cultural, ceremonial, and traditional uses of waters within the State. While not designed to directly protect fish populations and aquatic life, the consumption of fish, as well as tribal cultural ceremonies and spiritual lifeways, depend on healthy fish populations.

The revised proposed Plan amendments designate CUL specifically due to the cultural and spiritual importance of native fish and wildlife that migrate throughout the watershed, particularly salmon, to tribes. The reasonable protection of CUL as it relates to the tribes' cultural ceremonies and spiritual lifeways to salmon overlaps with the reasonable protection of the aquatic life beneficial uses identified in the Bay-Delta Plan or designated in the applicable Regional Water Boards' water quality control plans, including EST, COLD, WARM, MIGR, SPWN, WILD, and RARE (also referred to as fish and wildlife beneficial uses). Although the CUL beneficial use does not itself authorize implementation actions aimed at protecting fish populations, there is a practical overlap: implementation actions taken to protect aquatic life beneficial uses related to flow, water project operations, and physical habitat restoration, also support the healthy fish populations on which tribal cultural uses depend. Other tribal uses and activities encompassed within the CUL use may be directly supported by flow actions, including for example, navigation, gathering and consumption of natural resources, and immersion ceremonies.

The designation of CUL within the Bay-Delta watershed is based on substantial evidence provided to the State Water Board through tribal outreach and engagement efforts. Tribal representatives shared through written and verbal testimony the significance of salmon within tribal culture, including in creation stories, as a centerpiece of traditional ceremonies and feasts (such as traditional salmon bakes), and the general correlation of Native American life ways with the timing and locations of northern California salmon runs. The State Water Board recognizes the centrality that vital fish populations have for cultural, spiritual, ceremonial, and traditional rights and lifeways of tribes in the Bay-Delta watershed. Salmonids utilize the watershed both temporally and spatially at various life stages, and the tribes' cultural and spiritual use is centered on the connectivity between themselves and their ancestors with these species and the ecosystem that supports them.

Throughout the scoping period, tribal representatives shared the prominent role salmon hold within tribal culture. Through the submission of comments and input delivered at State Water Board workshops, hearings, and other meetings, tribal representatives have offered numerous examples of tribal uses of water within the watershed and the significance salmon and water, including a healthy ecosystem that supports salmon populations, have to tribal culture. The significance of salmon was conveyed through the sharing of relationships between Native American life ways, salmon, and the streams and watersheds that support them. This connection is passed down through generations as Traditional Ecological Knowledge (TEK), further discussed in Chapter 11, *Tribal Engagement, Traditional Ecological Knowledge and Tribal Beneficial Uses*.

T-SUB and SUB are not designated by the revised proposed Plan amendments for any waterbodies in the Bay-Delta watershed. However, while T-SUB and SUB relate to the risks to human health from consumption of noncommercial fish or shellfish at higher rates and were not developed to in and of

themselves protect aquatic life, a thriving fish population, especially salmon which are a key sensitive species in the Bay-Delta Plan, could support fishing at higher consumptive rates; therefore, flow actions for the reasonable protection of fish and wildlife are related to the T-SUB and SUB beneficial uses on the same waters. Implementation measures for the reasonable protection of fish and wildlife also will inure to the benefit of subsistence fishing by tribes and non-tribal communities. Individual stream segments could also be designated for T-SUB and SUB beneficial uses as appropriate by the regional water boards.

13.3.8 General Provisions

13.3.8.1 Trinity River Provisions to Avoid Redirected Impacts

The revised proposed Plan amendments include provisions to ensure no redirected impacts from implementation of the revised proposed Plan amendments on the Trinity River. Reclamation currently operates the CVP Trinity River Division, comprised of Trinity Dam, Lewiston Dam, and the Clear Creek Tunnel, which transports water from Lewiston Dam into Whiskeytown Lake on Clear Creek. As the operator of the CVP Trinity River Division, Reclamation would be required to ensure that implementation of the Bay-Delta Plan, including the VA pathway, does not result in redirected impacts to native fish and wildlife resources in the Trinity River watershed, including temperature and instream flow impacts. Reclamation would be required to report at least annually to confirm there are no redirected impacts to the Trinity River from implementation of the current updates to the Bay-Delta Plan. As part of the annual and periodic review processes, and more often if needed, the State Water Board would evaluate whether any additional actions are needed to address any redirected impacts to the Trinity River or to ensure that beneficial uses are protected on the Trinity River, in consultation with the North Coast Regional Water Quality Control Board.

13.3.8.2 Habitat Restoration and Other Complementary Ecosystem Measures

The State Water Board's Bay-Delta planning and implementation efforts are part of a multi-faceted approach to address protection of fish and wildlife in the Bay-Delta and reconcile an altered ecosystem. The State Water Board has responsibility and authority for addressing flow and other water quality impairments, but ecosystem recovery in the Delta depends on more than adequate flows. It also requires implementation of complementary measures, including habitat restoration, fisheries management, control of waste discharges and invasive species, and other efforts by other agencies and entities in the watershed that are responsible for these actions. These actions are discussed in more detail in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta* and the revised proposed Plan amendments.

13.3.9 Monitoring and Evaluation

13.3.9.1 Bay-Delta Monitoring and Evaluation Program (BDMEP)

The proposed changes to the Bay-Delta Plan represent a significant shift in the geographic scope and methods by which the State Water Board historically implemented the Bay-Delta Plan that will require additional supporting monitoring, reporting, assessment, accounting, and adaptive management at the watershed scale, including the Bay, Delta, and tributaries. A comprehensive monitoring, evaluation, reporting, and special studies program is needed for the Bay-Delta

watershed to assess compliance with water quality objectives, investigate the technical factors involved in water quality control, inform implementation of the Bay-Delta Plan (including adaptive management), and inform possible future changes to the Plan. Further discussion of the existing monitoring for the Bay-Delta Plan and watershed and the need for a comprehensive monitoring program can be found in Chapter 5.

The State Water Board would require monitoring, evaluation, reporting, and special studies through water right and water quality actions. Pursuant to its authorities, including but not limited to Water Code sections 1051, 13165, and 13267, monitoring, evaluation, reporting, and special studies (collectively referred to as monitoring activities) would address both the individual and cumulative impacts of diversions and discharges on beneficial uses of water including fish and wildlife, recreation, tribal, municipal, industrial, and agricultural uses.

To accomplish these purposes, the State Water Board would establish the Bay-Delta Monitoring and Evaluation Program (BDMEP), comprising the monitoring activities needed to implement the Bay-Delta Plan. The BDMEP would be an appendix (Appendix A) to the Bay-Delta Plan that could be regularly updated without Plan amendments, as appropriate, including through the annual and periodic review processes. Development and implementation of the BDMEP would be done incrementally. As a starting point, the initial BDMEP (included in Appendix A of the revised proposed Plan amendments) includes the proposed monitoring and reporting requirements pursuant to conditions in the water rights for the operations of the SWP and CVP, including the addition of specific requirements for monitoring pursuant to general water right conditions; monitoring and reporting identified in the 2018 Bay-Delta Plan; and additional monitoring needed to address HABs (described below under Section 13.3.9.2, *Harmful Algal Blooms*). The BDMEP would also further define the processes that will be used for modifying monitoring activities and include data quality requirements to produce accessible, high-quality, reliable data.

The initial BDMEP would incorporate HRL supplemental monitoring and science activities, which would be the collective responsibility of HRL participants. HRL supplemental monitoring and science activities would be required to adhere to the requirements in the BDMEP, including for review and revision of monitoring and special studies, data management and quality, and reporting.

The initial BDMEP would be further developed to include monitoring, special study, and reporting activities needed to implement the current amendments to the Bay-Delta Plan, including needed monitoring, special study, and reporting that should be conducted by other water right holders in addition to DWR and Reclamation and in tributary watersheds in addition to the Bay-Delta estuary. This comprehensive BDMEP would be developed by State Water Board staff in coordination with partner agencies, California Native American Tribes, and other interested participants.

The State Water Board would work with California Native American Tribes to incorporate TEK in the BDMEP to the extent practicable. Partner monitoring with California Native American Tribes could help fulfill monitoring requirements and fill geographic gaps (e.g., on tributaries) or gaps in monitoring elements. Any component of monitoring and assessment incorporating TEK would follow the Collective benefit, Authority to control, Responsibility, Ethics Principles for Indigenous Data Governance (CARE principles). The CARE principles help ensure that Indigenous People receive the collective benefit of their own data and retain authority to control their data, as well as helping guarantee that data holders engage respectfully so that the use of Indigenous data helps strengthen tribal communities. Indigenous Peoples' ethics would inform the use of Indigenous data.

Special studies and monitoring for southern Delta salinity and the San Joaquin River monitoring and evaluation program have been incorporated into the BDMEP and relocated within the BDMEP section of the revised proposed Plan amendments without substantive edits from the original text approved in the 2018 update to the Bay-Delta Plan. However, one edit was made to the San Joaquin River monitoring and evaluation program that changes the due date for the Annual Report from December 31 to May 31 to be consistent with other reporting dates in the BDMEP.

13.3.9.2 Harmful Algal Blooms

The revised proposed Plan amendments include general monitoring provisions related to HABs and provisions that would apply under the VA pathway. As part of the HRL supplemental science and monitoring activities, HRL participants would be required to support the Delta Stewardship Council's Delta Cyanobacterial HABs (CHABs) Monitoring Strategy through implementation of a coordinated, Delta-wide HAB monitoring program and associated special studies to ensure necessary data collection for understanding HAB drivers and effects, developing mechanistic and predictive models, and identifying possible management and mitigation measures to control HABs in the Delta. The HRL monitoring plan developed for these purposes must also include provisions for monitoring for HABs on the HRL tributaries during the bloom season from May through October, or at the earliest detection of a bloom and continuing until blooms are no longer detected, following the tiered monitoring approach further described in Table A-3 of Appendix A to the revised proposed Plan amendments. During drought years, monitoring must extend through November.

The initial BDMEP (detailed in Section 13.3.9.1, *Bay-Delta Monitoring and Evaluation Program (BDMEP*)) incorporates the HRL supplemental monitoring and science activities for HABs described above and new monitoring and measurement requirements for HABs applicable to the SWP and CVP that are added to the "Water Quality Compliance and Baseline Monitoring" table, including HAB visual indices and cyanobacterial toxins. These requirements are added pursuant to the requirements of condition 10 of State Water Board Water Right Decision 1485 (D-1485) requiring intensive phytoplankton studies and developing and improving water quality predictive tools with an emphasis on the understanding of flow, salinity, and phytoplankton relationships. These requirements also contribute to fulfilling condition 11 of D-1641 requiring water quality and ecological monitoring. These requirements include seven new monitoring locations at HAB "hotspots", where HABs regularly occur in the Delta, including HAB monitoring in the south Delta, as well as additional HAB monitoring at existing locations in the Delta following the tiered monitoring approach described in Table A-3 of Appendix A of the revised proposed Plan amendments. A monitoring workplan describing the detailed protocols for HAB monitoring would be required to be submitted for approval to the State Water Board Executive Director within 1 year of approval of the current Plan amendments by California Office of Administrative Law (OAL).

In addition, the initial BDMEP includes special studies relating to HABs to inform the development of mechanistic and predictive modeling of HABs and to test the efficacy of HAB management and mitigation measures. A special study investigating the exposure of native estuarine fish species to cyanobacterial toxins will also be required to be completed within 5 years of approval of the current Plan amendments by OAL. This special study would include a literature review and/or a synthesis of existing data to evaluate how HABs have affected native fish species in the Delta. The review/ synthesis will identify gaps in monitoring information that would be needed to further evaluate effects on native fish species. The proposed monitoring workplan for the special study will be submitted for review and comment by CDFW prior to submittal to the State Water Board Executive

Director for approval, including any necessary conditions, prior to commencing work on the special study.

The initial HAB special study requirements under the BDMEP will be further developed into a more comprehensive monitoring program. The State Water Board has committed to working with the regional water boards and other appropriate entities to develop and implement a long-term, Delta-wide HAB monitoring program, as recommended by the Delta CHAB Monitoring Strategy (Preece et al. 2024). Monitoring activities for HABs would include a combination of remote-sensing with high resolution satellite imagery and field-based surveys using continuous and discrete monitoring methods at known HAB "hotspots" and other regions of the Delta. The monitoring program would include monitoring during the bloom season from May to October, or at the earliest detection of a bloom and continuing until blooms are no longer detected, following the tiered approach for HAB monitoring further described in Table A-3 of Appendix A to the revised proposed Plan amendments. During drought years, monitoring will extend through November. Tiered monitoring includes discrete physical/chemical monitoring, sampling for phytoplankton communities and benthic algal mats, including cyanobacterial and other planktonic and benthic species known to produce toxins, algal pigment analysis, HAB visual indices, and monitoring for concentrations of cyanobacterial toxins when HABs are forming. The tiered monitoring for HABs is comprised of three tiers (routine monitoring, enhanced monitoring, and enhanced laboratory analysis) and is intended to reduce resources needed for monitoring by requiring enhanced monitoring only during active HAB events.

Monitoring requirements for HABs under the BDMEP were informed by the Delta CHAB monitoring designs report prepared by the U.S. Geological Survey (Bouma-Gregson et al. 2025). The report recommends possible monitoring designs that could be implemented as part of a coordinated Delta-wide CHAB monitoring program, consistent with recommendations from the Delta CHAB Monitoring Strategy (Preece et al. 2024).

As part of the revised proposed Plan amendments, the State Water Board will take actions to implement the California Water Boards' Framework and Strategy for Freshwater Harmful Algal Bloom Monitoring (FHAB Strategy) within the Bay-Delta watershed. This is in addition to coordinating with regional water boards, other agencies, California Native American Tribes, and other interested parties including environmental justice communities to help implement the Delta CHAB Monitoring Strategy to improve HAB science, research, and monitoring, develop HAB models, and identify management and mitigation measures for HABs in the Delta. This information will be used during the periodic review process to determine whether changes are needed to the Bay-Delta Plan or its implementation to address HABs.

13.3.9.3 Biological Goals

Biological goals would be used to inform the continued update and implementation of the Bay-Delta Plan, including adaptive implementation and evaluation of the effectiveness of Bay-Delta Plan and its implementation; inform updates and implementation of the BDMEP, and future changes to the Bay-Delta Plan and its implementation. The biological goals would include tributary goals that contribute to meeting the overall goals for each population, including the narrative salmon protection objective, and goals for the Delta. The biological goals would be consistent with the best available scientific information, including information regarding viable populations, recovery plans for listed species, and other appropriate information. Biological goals for the Sacramento/Delta would use scientific information to establish a numeric value or range of values for biological goals, would be expressed in terms that are SMART (specific, measurable, achievable, relevant, and time-

bound), and for anadromous salmonids would be based on viable salmonid population (VSP) parameters including abundance, life history and genetic diversity, productivity, and spatial structure. Biological goals do not change or amend the Bay-Delta Plan, they provide indicators of overall progress against which to measure the success of various implementation measures. The Lower San Joaquin River biological goals would be integrated with the provisions for the Sacramento/Delta biological goals without substantive edits from the original text approved in the 2018 update to the Bay-Delta Plan.

13.3.9.4 Tribal Engagement and Traditional Ecological Knowledge

The State Water Board would develop and regularly update a tribal engagement plan in coordination with California Native American Tribes for consultation, outreach, and engagement to incorporate tribal knowledge and perspectives into its Bay-Delta Plan update, and implementation efforts. The State Water Board would also hold tribal listening sessions with interested California Native American Tribes at least once per year in conjunction with annual and periodic reviews to hear feedback from tribes on the Bay-Delta Plan, its implementation, and any needed updates. The State Water Board would form, in conjunction with tribes, a Bay-Delta Tribal Advisory Group to provide input to the State Water Board on Bay-Delta Plan update and implementation issues and related matters. The composition, structure, and meeting frequency would be determined by members.

The State Water Board will consider and incorporate TEK, tribal feedback, and perspectives shared by California Native American Tribes to inform the State Water Board's efforts to update and implement the Bay-Delta Plan. TEK will be considered in a full and complementary way alongside non-Indigenous scientific approaches. As the State Water Board develops specific policies and guidelines regarding incorporation of TEK, those policies and guidelines will be adhered to. In addition, the State Water Board's consideration and incorporation of TEK and tribal feedback and perspectives will follow CARE principles. To ensure adherence to the CARE principles, the State Water Board will request tribal review by the Bay-Delta Tribal Advisory Group of any Bay-Delta Plan related documents incorporating TEK and will revise documentation of TEK based on that feedback.

The State Water Board would continue working to improve its tribal engagement processes using existing resources and will devote additional resources toward this process as they become available. The State Water Board would continue to offer California Native American Tribes the opportunity to engage in formal Government-to-Government Consultation on Board actions, policies, and processes that may affect tribes and would continue to engage with tribes outside of formal consultation.

13.3.9.5 Annual and Periodic Review

The Bay-Delta Plan and its implementation measures would undergo annual and periodic reviews to assess and report on progress on implementation of the Bay-Delta Plan and any needed changes to the Plan or its implementation to provide for the reasonable protection of beneficial uses.

The State Water Board would hold annual public meetings to discuss progress on implementing the Bay-Delta Plan by the State Water Board and other entities with responsibility for implementation actions. During annual reviews, the State Water Board could act on various approvals or adjustments provided for in the program of implementation and would receive updates and public

input and could provide direction on any delegated approvals or adjustments provided in the program of implementation.

For periodic reviews, the State Water Board would conduct a hearing consistent with applicable legal requirements every 3 years to discuss progress to date on implementation of the Bay-Delta Plan, effectiveness at providing for the reasonable protection of beneficial uses, and possible needed changes to the Bay-Delta Plan and its implementation, including the opportunity for public input.

In addition to allowing for public input on priority issues during periodic review, the State Water Board would identify priority issues for discussion as part of each periodic review. Key topics for periodic review include:

- Efforts by the State Water Board and other entities to implement the Bay-Delta Plan;
- The effectiveness of the water quality objectives and implementation measures at protecting beneficial uses of water;
- Possible needed changes to the objectives or implementation measures to provide for the reasonable protection of beneficial uses;
- Progress on achieving biological goals once developed and other fish and wildlife conditions;
- Monitoring and special study activities and HRL supplemental science and monitoring, including hypotheses, metrics, targets, and monitoring, and any needed changes; and
- Climate change effects and any needed adjustments to the Bay-Delta Plan or its implementation.

The State Water Board would also consider other topics for prioritized discussion during periodic review that may involve actions within the Bay-Delta Plan and its implementation and actions outside of those processes. The following list of actions was identified based on the latest update to the Bay-Delta Plan and could be modified in the future:

- Possible methods to reduce the incidence of temporary urgency change petitions related to Bay-Delta Plan requirements;
- Possible changes to interior Delta flow implementation measures that may be needed to provide for reasonable protection of fish and wildlife beneficial uses;
- Possible changes to WSAs that may be needed to provide for the reasonable protection of fish and wildlife beneficial uses;
- Consideration of water supply adjustments for new water supply projects;
- Consideration of possible future HRL proposals;
- A possible high flow offramp for the regulatory pathway inflow and outflow requirements while providing for the reasonable protection of fish and wildlife;
- Actions by the Water Boards or other agencies to protect beneficial uses on the Trinity River, including any needed measures to address any redirected impacts from implementation of the Bay-Delta Plan;

- Actions by the Water Boards or other agencies to protect beneficial uses on the upper San Joaquin River, including any needed measures to address any redirected impacts from implementation of the Bay-Delta Plan; and
- Any other issues identified by the State Water Board.

Topics will be prioritized and addressed through successive annual and periodic reviews. These lists of periodic review topics could be modified within or outside of the Plan without a basin plan amendment. Staff will identify any recommendations for any proposed amendments to the Bay-Delta Plan or its implementation that may be needed and prepare a report describing proposed changes. The report would undergo public review and comment, and associated procedures, including any environmental documentation needed, as appropriate, and be presented to the State Water Board for consideration. Individual periodic review cycles could extend longer than 3 years and updates to the Bay-Delta Plan and its implementation would be carried out continually as needed.

13.4 Changes in Hydrology and Water Supply

13.4.1 Introduction

This section describes the Sacramento Water Allocation Model (SacWAM) (version 2025.08.28) modeled changes in hydrology and water supply that could occur as a result of the revised proposed Plan amendments. The potential changes in hydrology and water supply are described for the regions subject to new flow requirements (the Sacramento River watershed, Delta eastside tributaries, and Delta [Sacramento/Delta]), and regions that receive Sacramento/Delta water supplies that may be reduced as a result of the revised proposed Plan amendments (the San Francisco Bay Area [Bay Area], San Joaquin Valley, Central Coast, and Southern California). Model results are presented for changes in streamflows, reservoir levels, and Sacramento/Delta water supply.

SacWAM results are presented in this section for:

1. The starting point for the regulatory pathway for existing water rights of 55% of unimpaired flow (UF) with watershed-wide water supply adjustments and tributary-specific water supply adjustments that apply to the Mokelumne and Calaveras Rivers and Putah Creek; refinements to reservoir carryover storage provisions under the proposed cold water habitat provisions of the Plan; and changes to constraints on exports from the Delta. The scenario reflecting these changes is referred to as 55% UF with water supply adjustments (or 55 w/WSAs scenario);
2. The VA pathway that is very similar to the Healthy Rivers and Landscapes (HRL) commitments evaluated in Chapter 9, *Proposed Voluntary Agreements*, referred to as the VA scenario; and
3. Two additional scenarios intended to capture potential outcomes that could occur as a result of the 2025 Record of Decision (ROD) and 2025 Incidental Take Permit (ITP) (collectively, 2025 ROD/ITP) in combination with the 55 w/WSAs scenario and VA scenario, referred to as the 55 w/WSAs + 2025 ROD/ITP scenario and the VA + 2025 ROD/ITP scenario.

The regulatory pathway and VA pathway are described in more detail in Section 13.3, *Revised Proposed Plan Amendments*, and in Section 13.4.2, *Modeling Approach*.

Postprocessing of SacWAM results was also conducted for certain analyses where appropriate as described further below.

13.4.2 Modeling Approach

This section describes the modeling approach for simulating baseline and the 55 w/WSAs and VA scenarios. Detailed descriptions of the model assumptions for each tributary, Central Valley Project (CVP) and State Water Project (SWP) operations, and Delta operations for each scenario, can be found in Appendix H1a, *Sacramento Water Allocation Model Methods*, and references therein.

Appendix H1a, *Sacramento Water Allocation Model Methods*, was produced to support Chapter 13, *Revised Proposed Plan Amendments,* of the 2025 partially recirculated draft Staff Report, and retains numerous references to the December 2025 revised draft Plan. Because the modeling of the starting point for the regulatory pathway and the VA pathway remains consistent with the version provided in the 2025 partially recirculated draft Staff Report, Appendix H1a has not been updated to replace

references to the December 2025 revised draft Plan with references to the final draft Plan. However, Appendix H1a has been updated to include new Appendices H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments,* and H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments,* as discussed below.

13.4.2.1 Sacramento Water Allocation Model (SacWAM) General Updates

Since the release of SacWAM version 2023.06.12 to support the 2023 draft Staff Report and prior to the release of the 2025 partially recirculated draft Staff Report, minor refinements were made to SacWAM as part of SacWAM version 2025.08.28 to incorporate input from stakeholders during the public comment process and other refinements. Model changes include extension of the period of simulation through 2021 and changes to modeling assumptions for CVP contractor priorities as well as minor changes to assumptions for operations of Contra Costa Water District (CCWD), Oroville Reservoir, Folsom Reservoir, and Delta depletions. Additionally, the new 55 w/WSAs scenario was developed to represent the starting point for the regulatory pathway. See Appendix H1a, *Sacramento Water Allocation Model Methods*, for a detailed explanation of these model changes.

SacWAM version 2025.08.28 was used to simulate the potential effects of the starting point for the regulatory pathway (55 w/WSAs scenario) and the VA pathway (VA scenario). These results are summarized throughout this section and are provided in detail in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*. To enable comparison of the 55 w/WSAs scenario to the flow scenarios analyzed in Chapter 6, *Changes in Hydrology and Water Supply,* and Chapter 7, *Environmental Analysis*, SacWAM version 2025.08.28 was also used to simulate the potential effects of the 35, 45, 55, and 65 scenarios. These results are presented in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*.

Results for baseline and the 35, 45, 55, and 65 scenarios generated using SacWAM version 2025.08.28 (presented in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*) differ slightly from results previously generated using SacWAM version 2023.06.12 (presented in Chapter 6, *Changes in Hydrology and Water Supply,* and Appendix A1, *Sacramento Water Allocation Model Methods and Results*). As a result of model refinements between the 2023.06.12 and 2025.08.28 versions of SacWAM that affect both the modeled baseline and flow scenarios, it is not appropriate to directly compare results from different versions of SacWAM. However, the relative differences between the modeled flow scenarios and baseline (changes compared to baseline) are similar between the 2023.06.12 and 2025.08.28 versions of SacWAM for most summaries of results.

Although results for baseline and the flow scenarios (35, 45, 55, and 65 scenarios) produced using SacWAM version 2023.06.12 and SacWAM version 2025.08.28 are generally very similar, certain refinements have resulted in larger changes for certain reservoirs, tributary flows, and water supplies. As discussed in Appendix H1a, *Sacramento Water Allocation Model Methods*, CVP south-of-Delta (SOD) demand priorities were adjusted to separate delivery priorities between contract types and to more accurately represent the way that the U.S. Bureau of Reclamation (Reclamation) allocates water between contract types SOD. Additionally, north-of-Delta (NOD) and SOD refuge priorities were increased relative to other senior demands to reflect provisions of the December 2025 revised draft Bay-Delta Plan intended to prioritize refuge water supplies. The refinements to agricultural demand priorities have little effect on regionally aggregated changes to agricultural water supplies in the 35, 45, 55, or 65 scenarios. In contrast, the changes to refuge demand priorities

have a substantial effect on the modeled changes to refuge supplies in the 35, 45, 55, and 65 scenarios. As modeled in SacWAM version 2023.06.12 and reflected in Chapter 6, *Changes in Hydrology and Water Supply,* and Appendix A1, *Sacramento Water Allocation Model Methods and Results,* of the 2023 draft Staff Report, each of these scenarios showed substantial reductions to refuge supplies in the Sacramento River watershed, with smaller reductions in the San Joaquin Valley. For example, the modeling results discussed in Chapter 6 indicate that across all water year types the average annual reduction in Sacramento/Delta supply to wildlife refuges would be 43 thousand acre-feet (TAF) to the Sacramento River watershed (Chapter 6, Table 6.4-7) and 4 TAF to the San Joaquin Valley (Table 6.4-23) for the 55 scenario. In the modeling results produced using SacWAM version 2025.08.28, the estimated reductions in refuge water supplies are substantially less than identified in Chapter 6 as a result of the prioritization of refuge supplies, particularly for the Sacramento River watershed. The average annual reduction in refuge water supplies would be 2 TAF to the Sacramento River watershed and 0 TAF to the San Joaquin Valley (see Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*, for modeling results produced using SacWAM version 2025.08.28).

The SacWAM modeling also includes refinements that add constraints on diversions from Mill, Deer, and Antelope Creeks. SacWAM demand site A_05_NA draws water from Mill Creek, Deer Creek, Antelope Creek, the Sacramento River, and groundwater; constraints on the transmission links from each of the surface water sources were added to better reflect land use associated with each tributary. These changes result in generally lower and less variable baseline flows during the irrigation season in Deer and Mill Creeks, with higher and more variable baseline flows in Antelope Creek during the same period, when comparing results generated with SacWAM version 2025.08.28 to those from SacWAM version 2023.06.12. Additionally, results from the revised model show greater reductions in agricultural water supply to water budget area 5 (see results for agricultural water supplies to water budget area 5 in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenario,* and Appendix A1, *Sacramento Water Allocation Model Methods and Results*), though the changes are not large enough to affect the conclusions of any impact analysis presented in the Staff Report.

Several other refinements also affect the model results for baseline and the flow scenarios, including refinements to operations of several reservoirs. The expressions for top-of-conservation (TOC) for Folsom and Oroville Reservoirs were updated based on updates made to CalSim 3 which provide a better representation of current operations of these reservoirs. For Folsom Lake, these changes reflect physical improvements to the flood spillway, and result in increased end of April storage levels in wetter years. Reservoir operations for Lake Berryessa were refined in two ways. First, expressions were added to SacWAM to limit the maximum required release from Lake Berryessa to reflect infrastructure limitations. Second, the maximum Solano Project allocation was increased to 100 percent under the 55 scenario to correct an error in SacWAM version 2023.06.12 that was specific to that scenario. Overall, these changes in reservoir operations result in increased end of April and end of September storage levels under the 45 and 65 scenarios and decreased end of April and end of September storage levels under the 55 scenario.

Additional changes to SacWAM described in Appendix H1a, *Sacramento Water Allocation Model Methods*, do not result in specific directional changes in model results. Cumulatively, the full set of model updates result in smaller differences between the two sets of flow scenarios (35, 45, 55, and 65 scenarios) for some locations and water year types, including changes to modeled Delta inflow and outflow, regulated tributary streamflows, SOD exports, and storage levels in other reservoirs.

Since the release of the 2025 partially recirculated draft Staff Report, additional minor refinements were made to SacWAM as part of SacWAM version 2026.05.29 used to model the 55 w/WSAs + 2025 ROD/ITP scenario and the VA + 2025 ROD/ITP scenario. These updates generally result in a very limited scope of changes to model results, with potentially larger effects in specific locations during specific months of the simulation. The general updates applicable to all scenarios include the following: utilizing an updated version of the WEAP software platform, correcting the Trinity River water year type for 2017 through 2021, and refining the representation of the Lodi Decree instream flow requirement. Limited additional updates were applied to the VA scenario, including refinement of modeling assumptions for the Mokelumne VA. For previously modeled scenarios including baseline, VA scenario, and 55 w/WSAs scenario, these updates produce only minor changes in results and support the same conclusions presented below in Sections 13.4.3, *Changes in Hydrology*, and 13.4.4, *Changes in Surface Water Supply*, with limited exceptions. The updates made to SacWAM as part of SacWAM version 2026.05.29 are described in detail in Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*. Results for the 55 w/WSAs + 2025 ROD/ITP scenario and the VA + 2025 ROD/ITP scenario are presented in Section 13.4.6, *Sensitivity Analysis for 2025 Record of Decision and 2025 Incidental Take Permit*, Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments,* and Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*.

13.4.2.2 Baseline Condition

The baseline is the primary point of comparison for evaluating the environmental impacts of the alternatives evaluated in the Staff Report. Section 6.2.1, *Baseline Assumptions*, provides a detailed description of the approach used to simulate baseline conditions in SacWAM. The baseline regulatory assumptions in SacWAM have not changed and remain the same between the analyses presented in the 2023 draft Staff Report and those presented in Chapter 13, *Revised Proposed Plan Amendments*. As described in Section 6.2.1, the process for the Sacramento/Delta updates to the Bay-Delta Plan has been ongoing since 2012. Since the planning process for the Sacramento/Delta updates started, there have been changes to regulations that affect reservoir operations, streamflow requirements, and Delta operations. Updates to the Long-Term Operation of the Central Valley Project and State Water Project (LTO) and Biological Opinions (BiOps) and issuance of Incidental Take Permits (ITPs) have changed the requirements for the operation of the SWP and CVP. As of the release of the 2023 draft Staff Report, actual changes to operations of the CVP and SWP had not significantly changed under most circumstances. Generally, the project baseline includes regulatory requirements as they were implemented in recent years prior to the release of the 2023 draft Staff Report (and continuing until the end of 2024 when significant changes to LTO operations were implemented) to represent existing conditions during the development of the revised proposed Plan amendments; these regulatory assumptions are listed in Table 6.2-1 in Chapter 6, *Changes in Hydrology and Water Supply*.

As described in Chapter 6, *Changes in Hydrology and Water Supply*, the 2019 BiOps and 2020 LTO Record of Decision (ROD) (Reclamation 2020) proposed the removal of the inflow to export ratio (I:E) limits that were included in the 2009 National Marine Fisheries Service (NMFS) BiOp limiting exports by the CVP and SWP as a function of San Joaquin River flows. A similar export limit to increase spring Delta outflows was applied to the SWP operations in the 2020 California Department of Fish and Wildlife (CDFW) ITP. The 2020 CDFW ITP requirement limited SWP exports according to the SWP's share of the San Joaquin I:E requirement as previously defined in the NMFS

2009 BiOp, with some additional offramps that allow for somewhat greater exports in wet years. While the I:E requirements applied to the CVP were proposed to be removed in the 2019 BiOps and 2020 LTO ROD, due to court orders and other actions associated with litigation on the 2019 BiOps and 2020 LTO ROD, this component had not been implemented as of the release of the 2023 draft Staff Report, and the CVP had effectively been operating to the 2020 CDFW ITP I:E (spring Delta outflow) requirement applied to the SWP, which resulted in San Joaquin I:E constraints on CVP exports generally limiting I:E to between 1:1 in drier conditions up to 4:1 in wetter conditions for all of April and May similar to constraints that had been in place since 2009.

In late 2024, LTO operations were further updated by Reclamation and associated updated BiOps and an updated ROD (Reclamation 2024) were issued that did not include the San Joaquin I:E restrictions on CVP exports during the spring. With the 2024 CVP LTO updates, the court order that previously prevented Reclamation from implementing the I:E changes was no longer in effect and for the first time since 2009, the more stringent I:E provisions were not in effect for the CVP in 2025. The 2024 CDFW ITP for operations of the SWP retains the 2020 CDFW ITP I:E (spring Delta outflow) requirements for the SWP's proportional share of combined CVP and SWP exports until such time as the HRL flow and habitat commitments are implemented when those requirements are then eliminated in favor of the HRL export reductions.

Because the CVP had effectively been operating to the 2020 CDFW ITP spring Delta outflow requirement applied to the SWP until 2025, the SacWAM baseline incorporates the San Joaquin I:E limit as formulated in the 2020 CDFW ITP but applied to both SWP and CVP exports since these conditions are closest to recent operations and are largely consistent with conditions that existed at the time the Notice of Preparation was issued for this project. Removing the San Joaquin I:E limitations on CVP exports would substantially increase CVP exports in April and May, with a concurrent decrease in Delta outflow and increase in net negative (reverse) Old and Middle River (OMR) flows.

13.4.2.3 Regulatory Pathway

The general approach to using SacWAM described in Section 6.2.2, *Unimpaired Flow Scenario Assumptions*, was applied to assess the effects of the starting point for the regulatory pathway (55 w/WSAs scenario). While the approach to using SacWAM to assess expected changes in hydrology and water supply associated with the 55 w/WSAs scenario is generally the same as that described for the flow scenarios in Chapter 6, *Changes in Hydrology and Water Supply*, the 55 w/WSAs scenario includes new water supply adjustments that lower flow requirements under all but wetter conditions and includes changes to export constraints based on San Joaquin River Flows (San Joaquin inflow to export ratio or I:E) requirements for the CVP, as described below. More details are provided in Appendix H1a, *Sacramento Water Allocation Model Methods.*

Watershed-Wide Water Supply Adjustments

The watershed-wide water supply adjustments apply based on the cumulative sum of the prior 12 months of the Sacramento Valley Four River Index (four river index)[1] during October through May. The requirement for May applies for June through September. Under the watershed-wide water

[1] The four river index refers to the sum of the unimpaired runoff 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.

supply adjustments, 55% of unimpaired flow is required in the wettest one-third of years, 45 percent of unimpaired flow in the middle one-third of years, and 35 percent of unimpaired flow in the driest one-third of years. Thresholds of the four-river index that would trigger the watershed-wide water supply adjustments were calculated as the 0.67 and 0.33 quantiles of historical values of the 12-month four river index from water years 1992 through 2021, rounded to the nearest 0.1 million acre-feet (MAF). The years 1992 through 2021 were used to represent current climate and hydrological conditions, based on the contemporary reference period used by the California Department of Water Resources (DWR) to calculate adjusted historical hydrology for CalSim 3 (Schwarz et al. 2025).

During October through May, when the 12-month four river index is below 20.2 MAF, the flow requirement is reduced to 45 percent of unimpaired flow watershed-wide and when the 12-month four river index is below 13.2 MAF, the flow requirement is reduced to 35 percent of unimpaired flow watershed-wide. The requirement for May applies for June through September. Water supply adjustments are applied to all unimpaired flow requirement compliance locations throughout the Sacramento/Delta which are listed in Table A1-2 of Appendix A1, *Sacramento Water Allocation Model Methods and Results*.

Tributary-Specific Water Supply Adjustments

In addition to watershed-wide water supply adjustments described above, additional tributary-specific water supply adjustments apply for specified rainfall dominated and municipal supply dominated tributaries, including the Mokelumne River, Calaveras River, and Putah Creek. The tributary-specific water supply adjustments allow for the requirements to be further reduced, and at times provide for no new inflow requirements under the revised proposed Plan amendments (this does not affect other regulatory requirements, including existing Decision 1641 requirements). The tributary-specific water supply adjustments were developed to apply in conjunction with the watershed-wide water supply adjustments to further reduce impacts to municipal water supplies and reservoir carryover storage levels in these three watersheds that are highly impaired and are also either municipal water supply dominated or are flashy rainfall dominated systems that cause significant challenges managing carryover storage, or both.

These tributary-specific water supply adjustments are based on local storage conditions as defined in the table below which reduce or remove the flow requirements during low storage conditions. If the previous month's storage is below the fraction of TOC listed in the final draft Bay-Delta Plan, the applicable flow requirement is the lower of the flow requirement listed or the watershed-wide water supply adjustment described above.

Table 13.4-1. Tributary-Specific Water Supply Adjustments

Tributary	Reservoir	Fraction of Top of Conservation	Required Percent of Unimpaired Flow
Mokelumne River	Camanche Reservoir	<0.72	35%
		<0.53	0%
Putah Creek	Lake Berryessa	<0.9	35%
		<0.57	0%
Calaveras River	New Hogan Reservoir	<0.72	35%
		<0.42	0%

When the unimpaired flow requirement for an individual tributary is reduced, the reduction in required flow is translated to all unimpaired flow requirements within the watershed and is translated to downstream flow requirements as well. For example, if the storage is low in Camanche Reservoir in one month, then all unimpaired flow requirements are reduced on the Mokelumne River the following month. Additionally, the inflow-based Delta outflow requirement is reduced by the volume reduced at the mouth of the tributary. This ensures that when the required flow is reduced on one tributary, it does not need to be made up from another tributary. Table H1a-9 of Appendix H1a, *Sacramento Water Allocation Model Methods*, shows how flow requirement reductions are translated within each watershed and downstream.

Export Constraints Based on San Joaquin River Flows Requirement for the CVP

The export constraints assumptions of the 55 w/WSAs scenario for the regulatory pathway starting point reflect the current regulatory provisions for the CVP under the 2024 LTO ROD and associated Biological Opinions, and the interior Delta flows provisions of the revised proposed Plan amendments that do not impose more stringent I:E constraints from the 2020 CDFW ITP as originally identified in the proposed Project identified in the 2023 draft Staff Report (consistent with Alternative 4a -Exclusion of Interior Delta Flow and Fall Delta Outflow Related Amendments; see Section 13.3.2.4, *Interior Delta Flows*). Accordingly, the 55 w/WSAs scenario does not include San Joaquin I:E constraints on CVP exports from April through May beyond those included in State Water Board Decision 1641 (D-1641). As discussed in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, the current Bay-Delta Plan and D-1641 do not include any required limitation on OMR flows but do include limitations on exports based on total Delta inflows referred to as the export to inflow ratio (E:I) and based on San Joaquin I:E. The current Bay-Delta Plan and D-1641 generally require that exports be no greater than 100% of the flow of the San Joaquin River at Vernalis (1:1 San Joaquin River inflows to exports) from April 15 to May 15, or 1,500 cubic feet per second (cfs), whichever is greater. The Bay-Delta Plan and D-1641 I:E requirements are less stringent than the CDFW 2020 ITP spring Delta outflow requirement, which incorporated I:E requirements from the 2009 NMFS BiOp generally limiting I:E to between 1:1 in drier conditions up to 4:1 in wetter conditions for all of April and May, but only applied to the SWP. As discussed above, the baseline includes the 2020 CDFW ITP I:E limits applied to both the SWP and CVP. While the revised proposed Plan amendments do not include any additional I:E requirements for either the CVP or the SWP beyond D-1641 requirements (consistent with Alternative 4a), the 2024 CDFW ITP continues to include these requirements for operation of the SWP, consistent with the 2020 CDFW ITP, and only identifies that the requirements would be removed with implementation of the HRL export reductions. Therefore, the I:E requirement is still assumed to apply to the SWP in the 55 w/WSAs scenario. However, given that it is possible that under a regulatory pathway these requirements would be removed from the SWP as well, a sensitivity analysis is included in Appendix H1a5, *Sacramento Water Allocation Model Results for Export Constraint Sensitivity Analysis*.

Under the 55 w/WSAs scenario, removing the restrictions on CVP exports based on San Joaquin River flows results in decreased (more negative) OMR flows and increased CVP exports in April and May, consistent with what was analyzed in the 2023 draft Staff Report Section 7.24.5.1, *Exclusion of Interior Delta Flow and Fall Delta Outflow Related Amendments Alternative (Alternative 4a)*. This contrasts with how interior Delta flows are modeled under baseline conditions and the unimpaired flow scenarios, which account for restrictions on SWP and CVP exports as a function of the San Joaquin I:E as formulated in the 2020 CDFW ITP but applied to both SWP and CVP exports.

13.4.2.4 Voluntary Agreement Pathway

As discussed in Section 13.3, *Revised Proposed Plan Amendments*, the VA pathway is an implementation pathway for HRL water rights and commitments based on Chapter 9, *Proposed Voluntary Agreements,* and in Section 7.2, *Description of Alternatives*, as Alternative 6, with some modifications, including updates to the water quality objectives the VA pathway would implement; the addition of new HRL commitments on the Bear River, Yuba River, Auburn Ravine, and Putah Creek; provisions for protection of base flows intended to achieve the purpose of Alternative 6a; flow and habitat accounting; changes to the description of HRL flow and habitat commitments based on accounting provisions; and incorporation of provisions for HRL supplemental science and monitoring, reporting, and governance. The VA pathway is included in the revised proposed Plan amendments as an alternative implementation pathway for the new proposed objectives for Sacramento/Delta inflow and cold water habitat, inflow-based Delta outflow, and native fish viability and the existing objective for salmon protection through the flow, habitat, and other required HRL commitments. The VA pathway would apply to the water rights that are part of approved HRLs, during the term of the VA pathway. Since the release of SacWAM version 2023.06.12 to support the 2023 draft Staff Report, minor refinements were made to SacWAM as part of version 2025.08.28 to support the 2025 partially recirculated draft Staff Report to incorporate input from stakeholders during the public comment process and other refinements that affect the modeling of the VA pathway (referred to as the VA scenario in Chapter 9).

The HRL flow commitments are intended to be additive to flows required by D-1641 and flows resulting from implementation of the 2024 LTO ROD and 2024 BiOps where applicable,[2] other regulatory requirements, and other non-regulatory flows that would be present absent HRL flow commitments as analyzed in the Scientific Basis Report Supplement supporting the VA pathway and the Staff Report. This condition is referred to as the "base" in the main body of the Plan and the "reference conditions" in Appendix B.1. The HRL Memorandum of Understanding (MOU) originally identified that flows would be additive to flow required by D-1641 and flows resulting from implementation of the 2019 BiOps. Since that time the HRL participants have requested that the 2019 BiOps be modified to reflect the 2024 LTO updates, which are largely consistent with the 2019 LTO and BiOps (DWR has prepared a memo [DWR 2025] summarizing the differences [see Appendix H1a, Section H1a.3.2, *Sensitivity to LTO of the CVP and SWP*]). Following the HRL participants' request to change the VA pathway base flow conditions from the 2019 BiOps to reflect the 2024 LTO updates to the ROD and BiOps, Reclamation adopted a new LTO ROD in December 2025 that relied on the 2024 BiOps but made further changes that would affect the base/reference conditions.

The HRL flows were assumed to be additive to the flows analyzed in the 2026 Staff Report and 2023 Final Draft Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements. To make clear that the base for the VA pathway flows does not include the 2025 ROD changes, the revised proposed Plan amendments, including Appendix B.1, specify that the base/reference conditions for the VA pathway flows are flows resulting from implementation of the 2024 ROD and BiOps (2024 ROD/BiOps) where applicable. Any references to the 2024 BiOps as part of the base/reference conditions in this Staff Report is intended to reflect the 2024 ROD.

[2] Because the HRL proposal includes tributaries and water right holders that are not associated with the CVP and SWP, the statement "where applicable" is included.

The final draft Bay-Delta Plan was also updated to clarify that the base/reference conditions is not intended to include increased diversions from new water supply projects, including water right applications and change petitions approved after 2025, that are not part of the VA pathway but instead subject to the inflow and inflow-based Delta outflow requirements in Sections 4.4.2.2 and 4.4.2.6 of the Plan.

The 2024 ROD/BiOps condition is different than the Staff Report baseline in that the 2024 ROD/BiOps condition is the theoretical assumed starting point for accounting purposes upon which HRL flow contributions would be added, rather than a reflection of current or prior existing conditions or baseline. The baseline is the primary point of comparison for evaluating the environmental impacts of the alternatives evaluated in the Staff Report. The major difference between the baseline and 2024 ROD/BiOps condition relative to exports and Delta outflows is the applicability of I:E constraints that apply during April and May. The I:E export limits have the effect of restricting exports and increasing Delta outflow during April and May. In the 2024 ROD/BiOps condition, exports are higher on average in January through June than the project baseline, and Delta outflow is lower on average in these months, because the 2024 ROD/BiOps does not include the I:E requirements from the 2020 CDFW ITP or 2009 BiOps applied to either the CVP or the SWP (see above section on *Export Constraints Based on San Joaquin River Flows Requirement for the CVP*). Therefore, the VA pathway assumes that the I:E requirements do not apply to the CVP or SWP. Instead, the VA pathway includes export reductions that are considered HRL flow commitments that would account for a portion of the effects of I:E constraints on interior Delta flows and Delta outflow.

While the 2024 LTO ROD and 2020 LTO ROD are the same with respect to both not including I:E requirements, the 2024 LTO ROD does include other relatively minor differences in cold water pool management on the Sacramento River, minimum instream flows on Clear Creek, American River water temperature management strategies, and OMR management. The 2024 LTO ROD also included provisions to implement HRL export reductions for two years prior to approval of HRL commitments by the Board ("Early Implementation").[3] The 2024 LTO ROD also includes provisions to implement the HRL commitments after approval by the Board. If the HRL commitments are not approved, then Reclamation would conduct operations consistent with 2024 LTO ROD, which does not include a spring outflow or I:E action absent adoption of the VA pathway. The differences between the 2020 LTO ROD and the 2024 LTO ROD are generally minor, and they would not substantially affect the incremental analysis of the modeling and therefore are not reflected in any of the SacWAM modeling scenarios evaluated in this Chapter 13 (see Appendix H1a, Section H1a.3.2, *Sensitivity to LTO of the CVP and SWP*, for additional discussion of differences in modeling assumptions and results between the 2020 LTO ROD and the 2024 LTO ROD).

Consistent with Section 9.5.2, *VA Modeling Approach*, the general approach to modeling the effects of the VA pathway on hydrology and water supply is first to simulate the 2019 BiOps condition and then build the VA scenario from the 2019 BiOps condition.

As discussed in Section 13.3.4.3, *HRL Flow Commitments*, the VA pathway includes flow contributions that would be provided through water purchase programs. The sources for the Public Water Agency (PWA) Fixed Price Water Purchase Program are identified and as such are explicitly modeled in SacWAM. However, the unspecified water purchases (PWA Market Price Water Purchase

[3] Subsequent to the signing of the 2024 LTO ROD, Reclamation proposed to remove Early Implementation of the HRL Delta export reduction in its Action 5 Operations Plan for the LTO of the CVP and SWP (Reclamation 2025). Reclamation did not carry out the Early Implementation action during water year 2025.

Program and permanent state water purchases) would be from unspecified willing sellers, which could include inflow sources within the Sacramento/Delta watershed or reductions in exports, both of which could result in additional Delta outflows. Because the sources of the unspecified water purchases are not fully known at this time, they are not included in the SacWAM modeling of the VA scenario. Similarly, the effects of the Friant HRL commitments are not explicitly modeled in SacWAM. However, the effects of unspecified water purchases are accounted for through postprocessing of SacWAM results and are evaluated where appropriate in Section 13.4.4, *Changes in Surface Water Supply.* The effects of the Friant HRL commitments and unspecified water purchases are also included in the Delta outflow results presented in Section 13.4.3, *Changes in Hydrology*, through postprocessing of SacWAM results.

The MOU proposing HRL commitments also includes Tuolumne River HRL commitments. The SacWAM modeling and postprocessing of model output of the VA scenario does not incorporate possible contributions from the Tuolumne River because approval of the Tuolumne River HRL proposal is being considered through a separate process due to the geographic scope of that proposal being outside of the Sacramento/Delta update to the Bay-Delta Plan. However, because that proposal if approved would contribute to Delta outflows under the HRL, Section 13.4.2.6, *Lower San Joaquin River Watershed Contributions to Delta Outflow*, provides additional discussion on possible conditions with and without additions to Delta outflow from the Tuolumne River HRL commitments. In addition, the Lower San Joaquin River flow objectives adopted in 2018 are also evaluated in Section 13.4.2.6 since those flows would also contribute to Delta outflows upon implementation (if the Tuolumne River HRL proposal is approved, the Tuolumne River HRL flow and habitat commitments would be implemented in lieu of the 2018 Lower San Joaquin River flow requirements on that tributary).

In August 2025, the Board received additional HRL proposals from Nevada Irrigation District (NID) and South Sutter Water District (SSWD) specific to the Bear River, Yuba River, and Auburn Ravine. NID would provide the HRL flow commitments for components 1 and 2 prior to issuance of a new Federal Energy Regulatory Commission (FERC) license and component 3 following issuance of a new FERC license. Component 1 is a commitment to redirect up to 3.6 TAF of Bear River flow to be additive to Auburn Ravine flow above approved base conditions in dry, below normal, and above normal years. Component 1 would not be additive to Delta outflow. Component 2 is a commitment of 5.6 TAF of additive Bear River inflow and associated Delta outflows above approved base conditions in dry, below normal, and above normal years, provided through reservoir reoperations. Component 3 is a commitment of 5.6 TAF of additive Yuba River inflow and associated Delta outflows above approved base conditions in dry, below normal, and above normal years, provided through reduced diversions on the Yuba River.

The SSWD proposal contains two components. SSWD would provide the HRL flow commitments for component 1 prior to issuance of a new FERC license and component 2 following issuance of a new FERC license through reservoir reoperations. Both components include commitments to provide up to 4.4 TAF of additive Bear River inflow and associated Delta outflows above approved base conditions in dry, below normal, and above normal years. Component 2 also includes flows in wet and critical years that are not additive to Delta outflows and higher flows in dry, below normal, and above normal years that are not additive to Delta outflows.

These additional HRL flow contributions were not modeled in SacWAM because the specific conditions under which the HRL flow contributions would be provided are variable based on specific circumstances, including future consultation with CDFW and others, or not fully known at

this time. Specifically, it is unclear when new FERC licenses will be issued and what the specific conditions will be of the new FERC licenses that affect the implementation of these flow contributions. However, these HRL flow contributions would be expected to result in some additional Delta inflow and Delta outflow as discussed above.

As described in Section 13.2, *Planning Process*, after release of the 2023 draft Staff Report, a proposal for HRL commitments by the Yolo County Flood Control and Water Conservation District (YCFCWCD) was submitted to the State Water Board. The HRL commitment involves YCFCWCD providing 5 TAF of flows from either Putah Creek sources or surface water flows from Cache Creek to lower Putah Creek, either directly or via groundwater recharge and banking. These flows are not proposed to be accounted for as additive to Delta outflows. Providing these flow commitments from Cache Creek is dependent on YCFCWCD HRL participants obtaining a new water right permit to divert water from Cache Creek. The State Water Board has not made any decision on approving a water right application that would provide for the diversion of water from Cache Creek for use in Putah Creek which would be considered as part of a separate State Water Board decision-making process from the Sacramento/Delta update to the Bay-Delta Plan and would include a separate environmental review process. These flows are not included in the SacWAM modeling because the sources of the flow contributions that would be provided to Putah Creek are not fully known at this time and these flows are not proposed to be accounted for as additive to Delta outflows.

As discussed in Section 13.3.4, *Voluntary Agreement Pathway*, the VA pathway would apply to the water rights that are part of approved HRLs (i.e., the specific water rights identified in Appendix B.1 of the revised proposed Plan amendments), during the term of the VA pathway. Under the VA pathway, water rights that are not part of the approved VA pathway would be subject to the regulatory pathway. The SacWAM modeling of the VA scenario is focused on the HRL flow commitments and does not explicitly model the provision of additional flows from water right holders on the regulatory pathway that are not part of the VA pathway. The water rights identified in Appendix B.1 constitute the majority of the water diverted and used within the Sacramento/Delta watershed. While some additional flows would be expected under the VA pathway from water rights not included in Appendix B.1 that are on the regulatory pathway the resulting flows and effects would fall between the results of the VA pathway and the regulatory pathway and would be much closer to the VA pathway results.

13.4.2.5 Export Constraint Sensitivity Analysis

The baseline, flow scenarios, 55 w/WSAs scenario, and VA scenario as modeled in SacWAM include differing assumptions regarding the applicability of the more stringent (beyond D-1641 requirements) I:E constraints for CVP and SWP exports. As discussed above, the SacWAM baseline and flow scenarios apply the I:E limits as formulated in the CDFW 2020 ITP to both SWP and CVP exports since these conditions are closest to recent operations through 2024 and are largely consistent with conditions that existed at the time the Notice of Preparation was issued for this project. To reflect changes to regulatory conditions that started in 2025, the 55 w/WSAs scenario reflects removal of the I:E constraints on CVP exports but not on SWP exports, consistent with the 2024 LTO ROD and BiOps and 2024 CDFW ITP. The HRL commitments do not include the more stringent I:E constraints for either the CVP or the SWP consistent with the HRL MOU and the 2024 LTO ROD and BiOps and 2024 CDFW ITP but do include export reductions that would account for a portion of the effects of the more stringent I:E constraints.

A sensitivity analysis was performed to quantify the impacts of removal of the CVP San Joaquin I:E constraints for the flow scenarios. SacWAM version 2025.08.28 was run for the 35, 45, 55, and 65 scenarios with the I:E requirements removed for the CVP. This sensitivity analysis facilitates direct comparisons of model results between the baseline, flow scenarios, and 55 w/WSAs scenario, which, as described above, have different assumptions regarding the applicability of I:E requirements to the CVP. Results of this sensitivity analysis are presented in Appendix H1a4, *Sacramento Water Allocation Model Results for CVP Export Constraint Sensitivity Analysis*.

To evaluate the possibility that a future version of the CDFW ITP replaces the spring Delta outflow requirement (in the form of the more stringent I:E limits) with the additional spring outflows that are expected under the regulatory pathway of the revised proposed Plan amendments, an additional sensitivity analysis was performed that removes the I:E constraints for both the CVP and SWP. SacWAM version 2025.08.28 was run to simulate effects of the 35, 45, 55, 65, and 55 w/WSAs scenarios with the I:E requirements removed for both the CVP and SWP. Detailed results for the sensitivity analysis are provided in Appendix H1a5, *Sacramento Water Allocation Model Results for Export Constraint Sensitivity Analysis*.

Generally, removal of the more stringent I:E constraints for both the CVP and SWP substantially increases exports in April and May, resulting in decreased Delta outflow and increasingly negative OMR flows. The effects on OMR flows and Delta outflow are greater in wetter year types, with more pronounced decreases occurring under the Low Flow Alternative and 55 w/WSAs scenario than under the 55 or 65 scenarios. The largest changes relative to baseline in Delta outflow and interior Delta flows occur in above and below normal year types.

The impacts of the flow scenarios on water supply are generally reduced with the more stringent I:E limits removed. There are smaller decreases in total water supply, Southern California urban water supply, and San Joaquin agricultural supply in the scenarios with the I:E removed. The effects of removing the I:E on changes in water supply are more pronounced in wetter year types and under the Low Flow Alternative and 55 w/WSAs scenario compared with drier conditions and the 55 and 65 scenarios, respectively (See Appendix H1a5, *Sacramento Water Allocation Model Results for Export Constraint Sensitivity Analysis*).

13.4.2.6 Lower San Joaquin River Watershed Contributions to Delta Outflow

The HRL MOU includes proposed Tuolumne River flow and habitat commitments. In addition, in 2018 the State Water Board approved updates to the Bay-Delta Plan's Lower San Joaquin River (LSJR) flow objectives and program of implementation (as well as southern Delta salinity updates) which included preparation of environmental documentation. The Board is in the process of implementing those updates through a regulation. Following adoption of such a regulation, the 2018 LSJR flow objectives will be in effect unless HRL proposals are approved on one or more of the LSJR tributaries. The Board is moving forward with a process to consider updates to the Bay-Delta Plan's LSJR flow objectives that were approved in 2018 to consider the Tuolumne River HRL proposal through a separate process, including separate environmental review. On April 11, 2023, the State Water Board issued a Notice of Preparation for a staff report/substitute environmental document to enable consideration of the Tuolumne River HRL proposal. On October 13, 2025, the State Water Board released a draft Scientific Basis Report Supplement for consideration of potential updates to the Bay-Delta Plan for the proposed Tuolumne River HRL proposal. The Board is conducting a separate review of the Tuolumne River HRL proposal because it would require changes to the

program of implementation for the LSJR flow objectives of the Bay-Delta Plan adopted in 2018 and because the Tuolumne River HRL proposal involves changes in the San Joaquin River watershed that is a separate watershed from the Sacramento/Delta watershed.

The additional flows that would be contributed to Delta outflow from the Tuolumne River HRL commitments and implementation of the 2018 Bay-Delta Plan LSJR flow objectives are discussed further and summarized in Section 13.4.3.1, *Flows*, under Delta outflow results. Because the Tuolumne River HRL and implementation of the 2018 Bay-Delta Plan LSJR flow objectives are subject to separate State Water Board decision-making processes, their effects on Delta outflow are evaluated separately.

13.4.2.7 Interpretation of Model Results

The following sections present modeling results for changes in hydrology and water supply under the 55 w/WSAs scenario and the VA scenario compared to baseline conditions, using SacWAM version 2025.08.28. Model results are presented for changes in streamflows, reservoir levels, and Sacramento/Delta water supply. Modeled changes from baseline under the 55 w/WSAs scenario are compared qualitatively against modeled changes from baseline under the flow scenarios presented in Chapter 6, *Changes in Hydrology and Water Supply*, to provide context for interpreting the potential effects of the regulatory pathway. VA scenario results for changes in hydrology are included for tributaries with HRL commitments.

Model results discussed in the following sections differ from those provided in Chapter 6, *Changes in Hydrology and Water Supply*, and Chapter 9, *Proposed Voluntary Agreements,* both due to changes in how the regulatory and VA pathways are represented, as well as a result of refinements to SacWAM that are summarized above in Section 13.4.2.1, *Sacramento Water Allocation Model (SacWAM) General Updates*, and described in detail in Appendix H1a, *Sacramento Water Allocation Model Methods*. Overall, as a result of the water supply adjustments and additional adjustments to carryover storage reflected in the modeling of the 55 w/WSAs scenario analyzed in this chapter that were not reflected in the modeling of the flow scenarios analyzed in Chapters 6 and 7, the water supply reductions and associated environmental impacts are generally less under the 55 w/WSAs scenario compared to the 55 scenario analyzed in Chapters 6 and 7, as discussed further in Section 13.7, *Environmental Analysis*.

Because SacWAM simulates hypothetical conditions, SacWAM is not intended to be used in a real-time predictive manner. SacWAM results are intended to be used in a comparative manner, which allows for assessing the changes in system operations and resulting incremental effects between scenarios. Modeling results are presented throughout this section in graphical and tabular formats that facilitate comparison of the statistical properties of streamflow, reservoir storage, and water supply among modeling scenarios. The graphical results presented in this section include boxplots and exceedance curves. Section 6.1.1, *Presentation of Results*, provides overview information about boxplots and exceedance curves.

13.4.3 Changes in Hydrology

13.4.3.1 Flows

This section presents a summary of findings related to the SacWAM modeling results for streamflows. Detailed graphical and tabular summaries of results for all tributaries can be found in

Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*. Modeling results for tributary streamflows are generally presented as the tributary outflow, or flow at the mouth of the given tributary. These tributary mouth locations were selected for analysis because streamflows at the mouth of a tributary represent the tributary watershed's total contribution to Delta inflows. Tributary streamflows for the Mokelumne River are presented for the Mokelumne River upstream of its confluence with Dry Creek and the Cosumnes River, and tributary streamflows for the Cosumnes River are presented for the Cosumnes River upstream of its confluence with Dry Creek. These Mokelumne and Cosumnes River locations represent the total contribution of these watersheds to Delta inflows. To assess the cumulative contributions of tributary streamflows on the Sacramento River, modeling results are assessed below Shasta Dam to represent contributions from the headwater tributaries and at Freeport to represent contributions from the lower Sacramento River tributaries.

Model results are presented throughout this section in graphical and tabular formats. Monthly streamflows are presented as boxplots, with months from October through September shown on the x-axis (horizontal axis) and modeled monthly streamflow in cfs shown on the y-axis (vertical axis). Multiple boxplots corresponding to individual modeled scenarios are shown side-by-side for each month. The sum total of January through June, July through December, and annual streamflows averaged by water year type and across all water years in TAF are provided in tables for each modeled scenario. SacWAM-modeled scenarios presented in this section include the existing condition scenario, or baseline (white box), 55 w/WSAs scenario (grey box), and VA scenario (grey box).

Results for the cumulative distribution of monthly flows for each tributary for baseline, the 55 w/WSAs scenario, and the VA scenario are presented in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments and* are also discussed below.

Sacramento River Region and Delta Eastside Tributaries

Overall, the SacWAM modeling results show distinct hydrologic patterns for unregulated tributaries and regulated tributaries. Findings for each are presented separately below. Monthly streamflow condition boxplots are shown below for Sacramento/Delta tributaries. Boxplots for each individual tributary are included in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*.

Regulated Tributary Streamflows

Regulated tributaries are tributaries that contain a major storage reservoir or other large-scale flow-regulating infrastructure. In the Sacramento River watershed and Delta eastside tributaries regions, the following tributaries to the Sacramento River and the Delta are considered regulated tributaries: American River, Bear River, Cache Creek, Calaveras River, Clear Creek, Feather River, Mokelumne River, Putah Creek, Sacramento River, Stony Creek, and Yuba River. Several of these tributaries are tributaries with HRL commitments, including the Sacramento River, Feather River, Yuba River, American River, Bear River, Mokelumne River, and Putah Creek. Several of these tributaries are part of the CVP and SWP. Other regulated tributaries have local water projects that provide hydropower generation, water supply within the basin, and flood control for downstream inhabitants. Additional information is provided in Section 6.3.1.1, *Sacramento River Region and Delta Eastside Tributaries*.

While each regulated tributary exhibits unique hydrology, water storage, demand, and operations, several patterns emerge for the 55 w/WSAs scenario and VA scenario. In the 55 w/WSAs scenario,

streamflows generally increase over baseline during late winter through spring months, decrease during late summer months, and remain relatively unchanged during early winter months. On an annual basis, streamflows generally increase over baseline under the 55 w/WSAs scenario. Streamflows for tributaries with HRL commitments under the VA scenario generally show similar patterns but exhibit smaller increases over baseline in the spring months and smaller decreases from baseline in the summer months compared to the 55 w/WSAs scenario. However, results for some regulated tributaries do not fully align with these general trends, as discussed further below. For example, under the 55 w/WSAs scenario, average flows on the Calaveras River would increase compared to baseline during both January through June and July through December.

The following sections describe the SacWAM streamflow results for each of the major regulated tributaries.

American River

Regulatory Pathway

Modeled mean monthly flows on the lower American River under the 55 w/WSAs scenario show increases from baseline in the months of January through June and decreases from baseline in the months of July through December, falling closer to modeled mean flows for the Low Flow Alternative than the 55 scenario in all months except for February when flows are closer to the 55 scenario (see Table A1-16 and Table A1-17 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). Under the 55 w/WSAs scenario, the largest increase in flow compared to baseline occurs in April, when the average monthly flow increases from 3,086 cfs to 3,715 cfs, and the largest decrease occurs in August, when the average monthly flow decreases from 2,758 cfs to 2,323 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower American River under the 55 w/WSAs scenario increase compared to baseline in all water year types except for above normal years, with the largest increase of 45 TAF/yr in below normal years. Results show that there are increases in average total January through June streamflows and decreases in average total July through December streamflows in all water year types. Under the 55 w/WSAs scenario, the largest increase in average total January through June streamflows compared to baseline occurs in below normal years (135 TAF) and the smallest increase occurs in critical years (64 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are most similar to the Low Flow Alternative in critical, dry, and below normal years, and the 55 scenario in above normal and wet years. Across all years, the increase in average total January through June streamflows under the 55 w/WSAs scenario compared to baseline is 94 TAF, falling between the increases observed under the Low Flow Alternative and 55 scenario. The largest decrease in average total July through December streamflows under the 55 w/WSAs scenario occurs in above normal years (127 TAF) and the smallest decrease occurs in critical years (37 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are most similar to the Low Flow Alternative in dry and below normal years, and the 55 scenario in critical, above normal, and wet years. Across all years, the decrease in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 79 TAF, falling between the decreases observed under the Low Flow Alternative and 55 scenario.

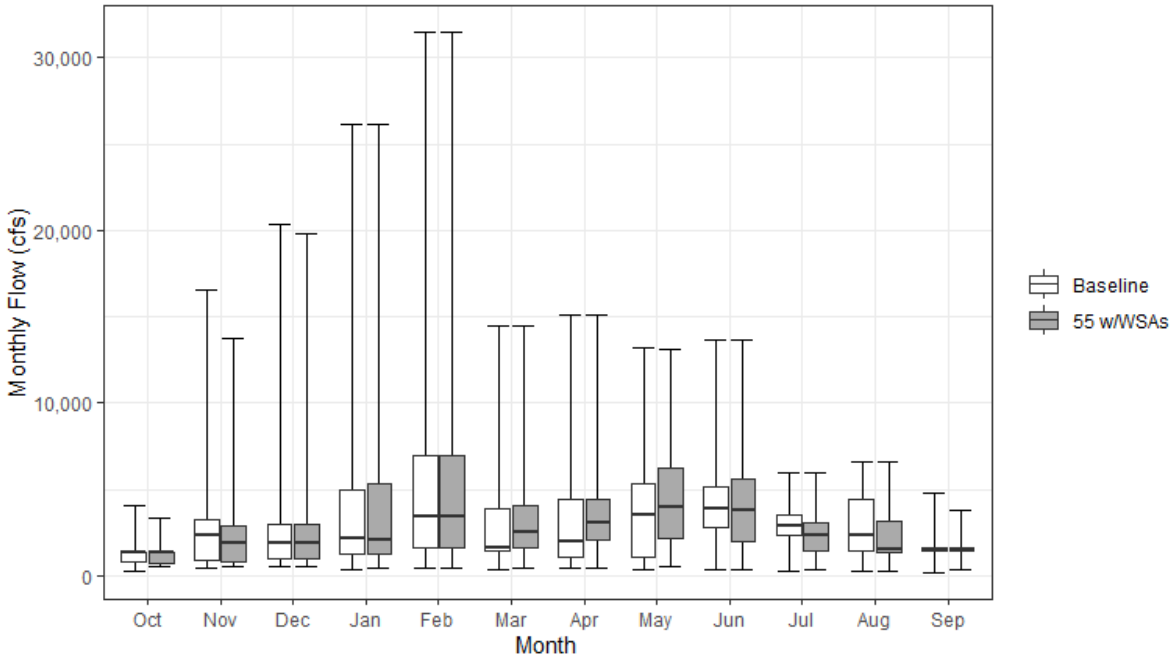


Figure 13.4-1. Monthly Streamflow for the American River above the Sacramento River under Baseline and 55 w/WSAs Scenarios

Table 13.4-2. Average Total January–June Flow for the American River above the Sacramento River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	415	64
D	701	103
BN	1,054	135
AN	1,620	114
W	2,572	69
All	1,401	94

Table 13.4-3. Average Total July–December Flow for the American River above the Sacramento River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	434	-37
D	671	-98
BN	810	-90
AN	992	-127
W	1,272	-62
All	881	-79

Table 13.4-4. Average Total Annual Flow for the American River above the Sacramento River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	849	27
D	1,372	5
BN	1,864	45
AN	2,612	-13
W	3,844	7
All	2,282	15

Voluntary Agreement Pathway

Modeled mean monthly flows on the lower American River under the VA scenario show increases from baseline in the months of November and January through June and decreases from baseline in the months of July through October and December. The largest increase in flow compared to baseline occurs in May, when the average monthly flow increases from 3,867 cfs to 4,088 cfs, and the largest decrease occurs in July, when the average monthly flow decreases from 2,833 cfs to 2,575 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower American River under the VA scenario increase compared to baseline in critical, dry, and above normal years and decrease compared to baseline in below normal and wet years, showing an increase across all water year types. Results show that there are increases in average total January through June streamflows and decreases in average total July through December streamflows under the VA scenario in all water year types. The largest increase in average total January through June streamflows compared to baseline occurs in dry years (75 TAF) and the smallest increase occurs in wet years (5 TAF). Across all water year types, the increase in average total January through June streamflows under the VA scenario compared to baseline is 33 TAF. The largest decrease in average total July through December streamflows compared to baseline occurs in dry years (50 TAF) and the smallest decrease occurs in critical years (5 TAF). Across all water year types, the decrease in average total July through December streamflows under the VA scenario compared to baseline is 22 TAF.

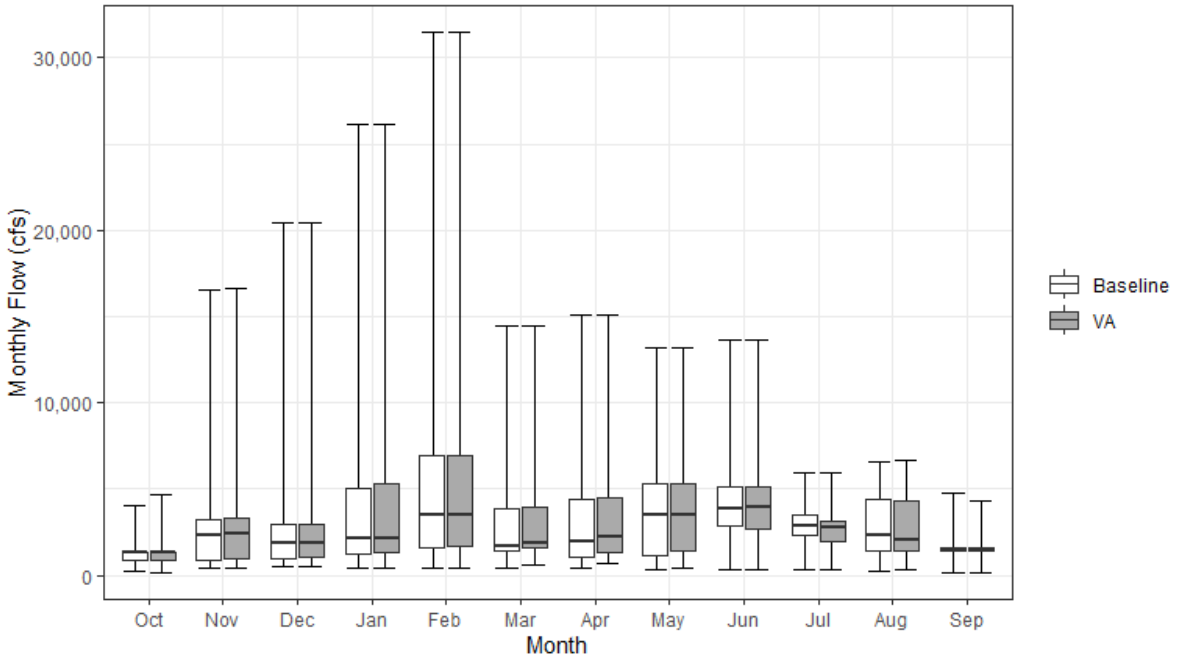


Figure 13.4-2. Monthly Streamflow for the American River above the Sacramento River under the Baseline and VA Scenarios

Table 13.4-5. Average Total January–June Flow for the American River above the Sacramento River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	415	39
D	701	75
BN	1,054	32
AN	1,620	19
W	2,572	5
All	1,401	33

Table 13.4-6. Average Total July–December Flow for the American River above the Sacramento River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	434	-5
D	671	-50
BN	810	-36
AN	992	-13
W	1,272	-7
All	881	-22

Table 13.4-7. Average Total Annual Flow for the American River above the Sacramento River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	849	34
D	1,372	25
BN	1,864	-4
AN	2,612	6
W	3,844	-2
All	2,282	11

Feather River

Regulatory Pathway

Modeled mean monthly flows on the lower Feather River under the 55 w/WSAs scenario show increases from baseline in the months of November through May, and decreases from baseline in the months of June through October, falling closest to modeled mean flows for the 55 scenario in October and closest to the Low Flow Alternative in all other months (see Table A1-52 and Table A1-53 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). Under the 55 w/WSAs scenario the largest increase in flow compared to baseline occurs in April, when the average monthly flow increases from 7,499 cfs to 9,616 cfs, and the largest decrease occurs in July, when the average monthly flow decreases from 7,821 cfs to 6,159 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower Feather River under the 55 w/WSAs scenario increase compared to baseline in below normal, above normal, and wet years, and decrease compared to baseline in critical and dry years, showing an increase across all water year types. Results show that there are increases in average total January through June streamflows in all water year types and decreases in average total July through December streamflows in all water year types except for wet years. Under the 55 w/WSAs scenario, the largest increase in average total January through June streamflows compared to baseline occurs in below normal years (515 TAF) and the smallest increase occurs in wet years (56 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are most similar to the Low Flow Alternative in critical, dry, below normal, and above normal years, and most similar to the 55 scenario in wet years. Across all water year types, the increase in average total January through June streamflows under the 55 w/WSAs compared to baseline is 239 TAF, similar to the Low Flow Alternative. Average total July through December streamflows under the 55 w/WSAs scenario increase in wet years (145 TAF) and decrease in all other years, with the largest decrease occurring in dry years (477 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are most similar to the Low Flow Alternative except in wet years when they fall closer to the 55 scenario. Across all water year types, the decrease in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 201 TAF, similar to the Low Flow Alternative.

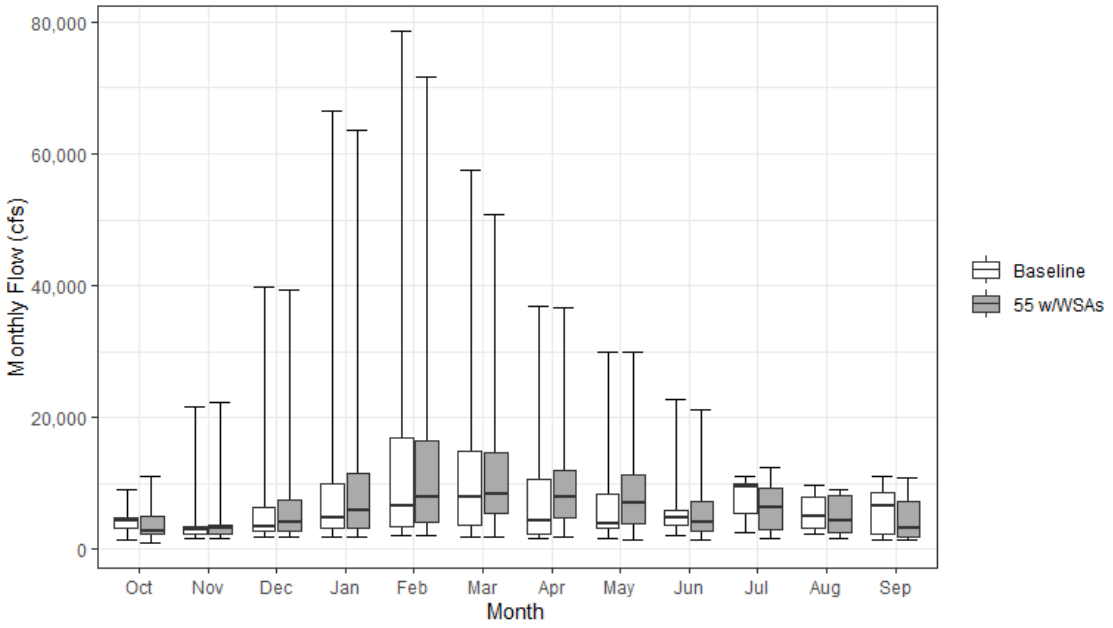


Figure 13.4-3. Monthly Streamflow for the Feather River above the Sacramento River under the Baseline and 55 w/WSAs Scenarios

Table 13.4-8. Average Total January–June Flow for the Feather River above the Sacramento River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	987	60
D	1,383	315
BN	2,098	515
AN	3,480	360
W	6,210	56
All	3,173	239

Table 13.4-9. Average Total July–December Flow for the Feather River above the Sacramento River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1,187	-247
D	1,716	-477
BN	2,165	-402
AN	2,328	-178
W	2,510	145
All	2,031	-201

Table 13.4-10. Average Total Annual Flow for the Feather River above the Sacramento River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	2,174	-187
D	3,099	-162
BN	4,263	113
AN	5,808	182
W	8,720	201
All	5,204	38

Voluntary Agreement Pathway

Modeled mean monthly flows on the lower Feather River under the VA scenario show increases from baseline in the months of November and March through May and decreases from baseline in the months of December through February and June through October. The largest increase in flow compared to baseline occurs in April, when the average monthly flow increases from 7,499 cfs to 8,140 cfs, and the largest decrease occurs in September, when the average monthly flow decreases from 5,959 cfs to 5,612 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower Feather River under the VA scenario increase compared to baseline in dry, below normal, and above normal years and decrease compared to baseline in critical and wet years, showing an increase across all water year types. Results show that there are increases in average total January through June streamflows and decreases in average total July through December streamflows under the VA scenario in all water year types. The largest increase in average total January through June streamflows compared to baseline occurs in below normal years (136 TAF) and the smallest increase occurs in critical years (7 TAF). Across all water year types, the increase in average total January through June streamflows under the VA scenario compared to baseline is 70 TAF. The largest decrease in average total July through December streamflows compared to baseline occurs in below normal years (94 TAF) and the smallest decrease occurs in dry years (7 TAF). Across all water year types, the decrease in average total July through December streamflows under the VA scenario compared to baseline is 38 TAF.

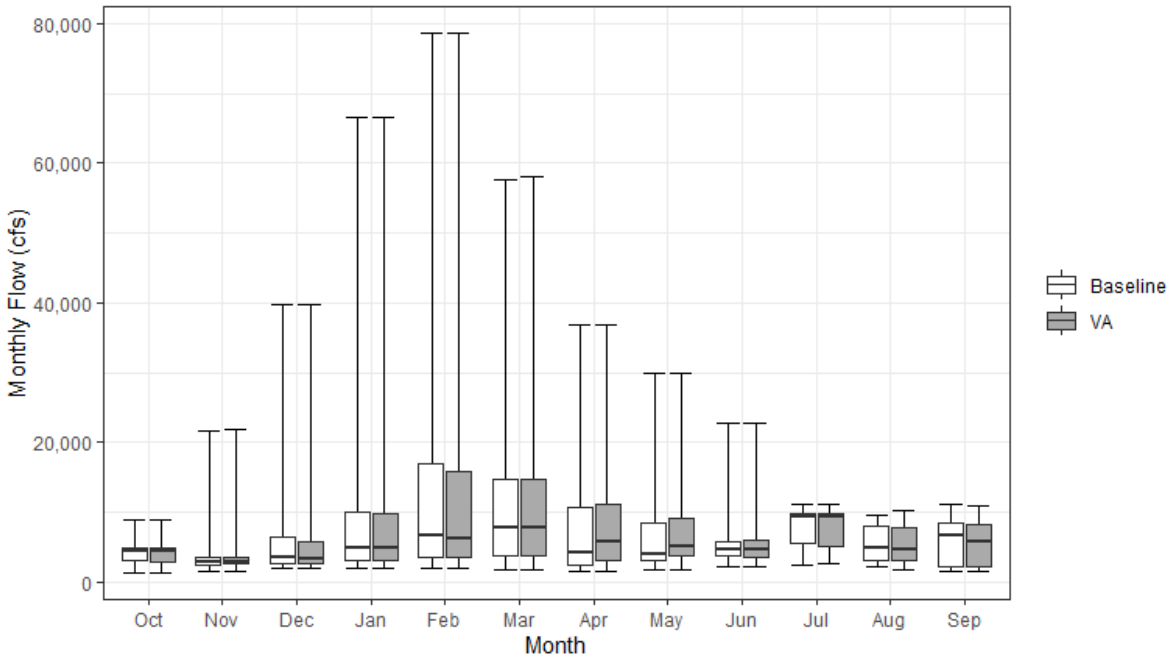


Figure 13.4-4. Monthly Streamflow for the Feather River above the Sacramento River under the Baseline and VA Scenarios

Table 13.4-11. Average Total January–June Flow for the Feather River above the Sacramento River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	987	7
D	1,383	116
BN	2,098	136
AN	3,480	103
W	6,210	15
All	3,173	70

Table 13.4-12. Average Total July–December Flow for the Feather River above the Sacramento River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	1,187	-32
D	1,716	-7
BN	2,165	-94
AN	2,328	-20
W	2,510	-35
All	2,031	-38

Table 13.4-13. Average Total Annual Flow for the Feather River above the Sacramento River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	2,174	-25
D	3,099	109
BN	4,263	42
AN	5,808	83
W	8,720	-20
All	5,204	32

Sacramento River

Regulatory Pathway

Modeled mean flows on the Sacramento River below Keswick Reservoir under the 55 w/WSAs scenario show increases from baseline in the months of March through May, September, and October, and decreases from baseline in the months of June through August and November through February, generally falling closest to modeled mean flows for the Low Flow Alternative in late winter and early summer, and closest to the 55 scenario in spring, summer, and fall. The largest increase in flow compared to baseline occurs in May, when the average monthly flow increases from 8,583 cfs to 9,278 cfs, and the largest decrease occurs in December, when the average monthly flow decreases from 7,639 cfs to 6,783 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the Sacramento River below Keswick Reservoir under the 55 w/WSAs scenario increase compared to baseline in dry, below normal, and above normal years, and decrease compared to baseline in critical and wet years, showing a decrease across all water year types. Results show that there are increases in average total January through June streamflows in all water year types except for critical years and decreases in average total July through December streamflows in all water year types. Under the 55 w/WSAs scenario, average total January through June streamflows decrease in critical years (317 TAF) and increase in all other water year types, with the largest increase compared to baseline occurring in above normal years (288 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are most similar to the Low Flow Alternative in critical years and the 55 scenario in all other water year types, though with a significantly smaller increase from baseline in dry years and a significantly larger increase from baseline in wetter years compared to the 55 scenario. Across all water year types, the increase in average total January through June streamflows under the 55 w/WSAs compared to baseline is 59 TAF, similar to the 55 scenario. Average total July through December streamflows under the 55 w/WSAs scenario decrease in all water year types, with the largest decrease occurring in wet years (217 TAF) and the smallest decrease occurring in dry years (14 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are generally most similar to the 55 scenario. Across all water year types, the decrease in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 130 TAF, similar to the 55 scenario.

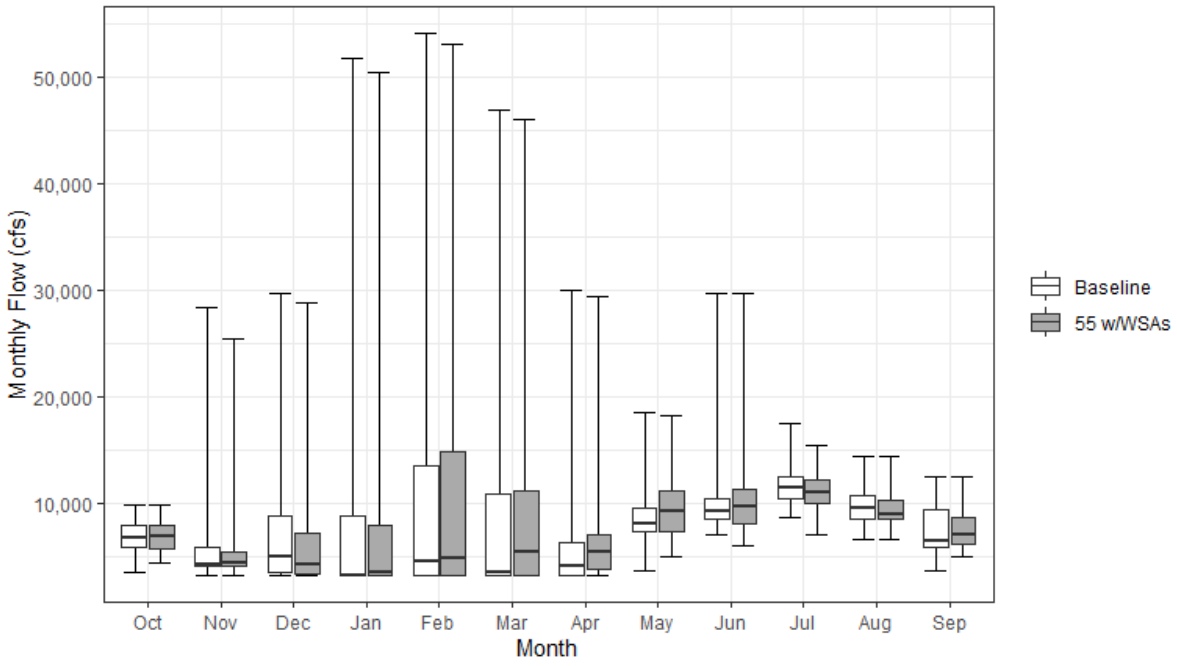


Figure 13.4-5. Monthly Streamflow for the Sacramento River below Keswick Reservoir under the Baseline and 55 w/WSAs Scenarios

Table 13.4-14. Average Total January–June Flow for the Sacramento River below Keswick by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1,984	-317
D	2,098	16
BN	2,357	243
AN	3,400	288
W	4,869	84
All	3,127	59

Table 13.4-15. Average Total July–December Flow for the Sacramento River below Keswick by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	2,458	-207
D	2,647	-14
BN	2,752	-27
AN	2,986	-187
W	3,603	-217
All	2,967	-130

Table 13.4-16. Average Total Annual Flow for the Sacramento River below Keswick by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	4,442	-524
D	4,745	2
BN	5,109	216
AN	6,386	101
W	8,472	-133
All	6,094	-71

Modeled mean monthly flows on the Sacramento River at Freeport under the 55 w/WSAs scenario show increases from baseline in the months of January through June, and decreases from baseline in the months of July through December, generally falling closest to modeled mean flows for the 55 scenario in fall months and closest to the Low Flow Alternative in the winter, spring, and summer months (see Table A1-76 and Table A1-77 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). The largest increase in flow compared to baseline occurs in April, when the average monthly flow increases from 22,016 cfs to 25,470 cfs, and the largest decrease occurs in July, when the average monthly flow decreases from 16,664 cfs to 14,437 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the Sacramento River at Freeport under the 55 w/WSAs scenario increase compared to baseline in below normal, above normal, and wet years and decrease compared to baseline in critical and dry years, showing an increase across all water year types. Results show that there are increases in average total January through June streamflows and decreases in average total July through December streamflows in all water year types. Under the 55 w/WSAs scenario, the largest increase in average total January through June streamflows compared to baseline occurs in below normal years (844 TAF) and the smallest increase occurs in critical years (82 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are most similar to the Low Flow Alternative in critical, dry, and below normal years, and the 55 scenario in above normal and wet years. Across all water year types, the increase in average total January through June streamflows under the 55 w/WSAs scenario compared to baseline is 536 TAF, falling closest to the increase observed under the Low Flow Alternative. The largest decrease in average total July through December streamflows under the 55 w/WSAs scenario occurs in dry years (618 TAF) and the smallest decrease occurs in wet years (82 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are most similar to the Low Flow Alternative in dry, below normal, and above normal years, and the 55 scenario in critical and wet years. Across all water year types, the decrease in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 374 TAF, falling between the decreases observed under the Low Flow Alternative and 55 scenario.

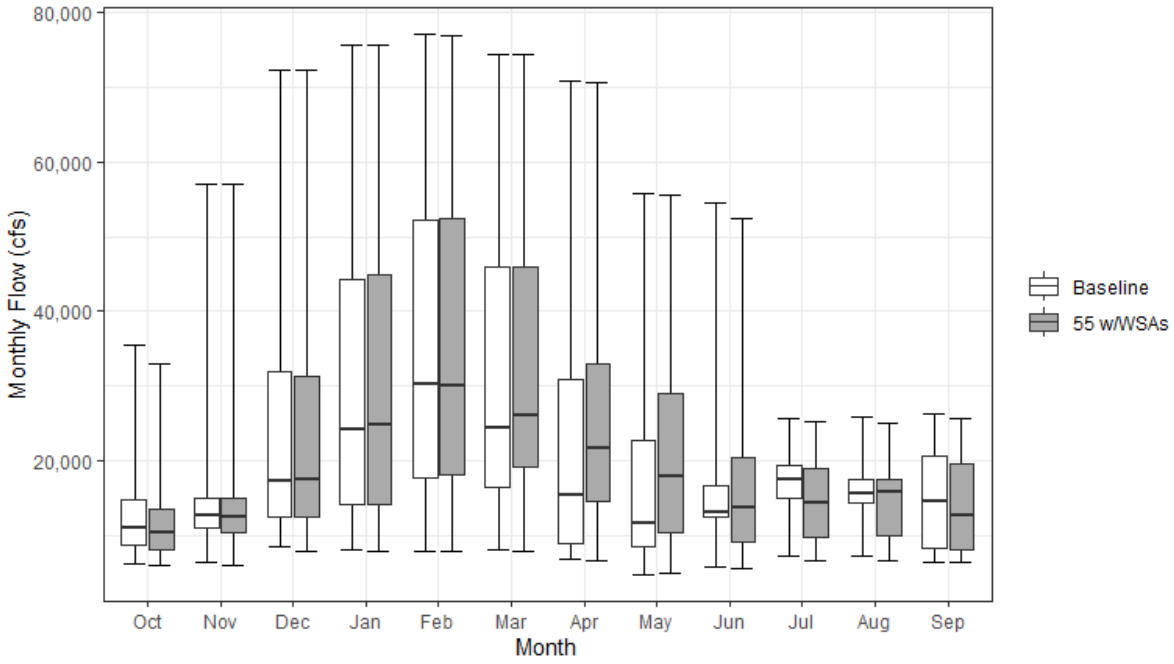


Figure 13.4-6. Monthly Streamflow for the Sacramento River at Freeport under the Baseline and 55 w/WSAs Scenarios

Table 13.4-17. Average Total January–June Flow for the Sacramento River at Freeport by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	4,001	82
D	5,402	509
BN	7,477	844
AN	11,191	816
W	14,733	489
All	9,103	536

Table 13.4-18. Average Total July–December Flow for the Sacramento River at Freeport by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	3,626	-302
D	4,991	-618
BN	5,604	-542
AN	6,674	-484
W	8,070	-82
All	6,025	-374

Table 13.4-19. Average Total Annual Flow for the Sacramento River at Freeport by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	7,627	-220
D	10,393	-109
BN	13,081	302
AN	17,865	332
W	22,803	407
All	15,128	162

Voluntary Agreement Pathway

Modeled mean monthly flows on the Sacramento River below Keswick Reservoir under the VA scenario show increases from baseline in the months of April, May, and August, and decreases from baseline in the months of June, July, and September through March. The largest increase in flow compared to baseline occurs in April, when the average monthly flow increases from 6,179 cfs to 6,786 cfs, and the largest decrease occurs in December, when the average monthly flow decreases from 7,639 cfs to 7,336 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the Sacramento River below Keswick Reservoir under the VA scenario decrease compared to baseline in all water year types except for dry years. Results show that there are increases in average total January through June streamflows in all water year types except for critical and wet years and decreases in average total July through December streamflows in all water year types except for dry years. Under the VA scenario, the largest increase in average total January through June streamflows occurs in dry years (111 TAF) and the largest decrease occurs in critical years (41 TAF). Across all water year types, average total January through June streamflows increase by 40 TAF compared to baseline. Average total July through December streamflows increase in dry years (28 TAF) under the VA scenario and decrease in all other water year types, with the largest decrease occurring in above normal years (104 TAF). Across all water year types, average total July through December streamflows decrease by 40 TAF compared to baseline.

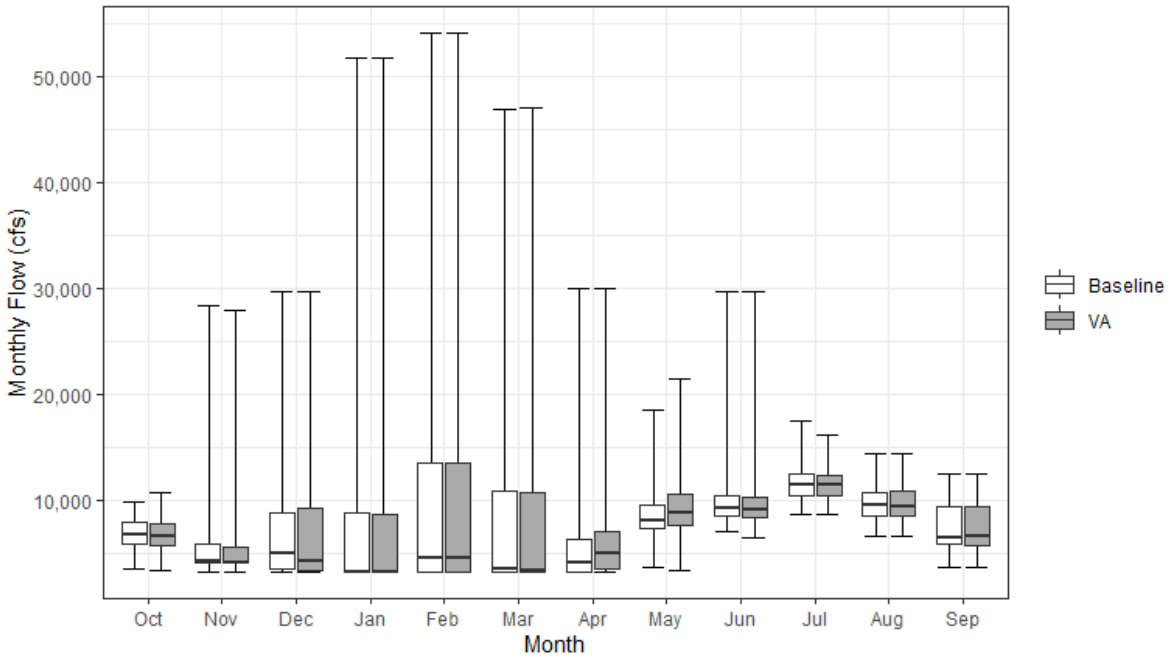


Figure 13.4-7. Monthly Streamflow for the Sacramento River below Keswick Reservoir under the Baseline and VA Scenarios

Table 13.4-20. Average Total January–June Flow for the Sacramento River below Keswick by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	1,984	-41
D	2,098	111
BN	2,357	77
AN	3,400	101
W	4,869	-16
All	3,127	40

Table 13.4-21. Average Total July–December Flow for the Sacramento River below Keswick by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	2,458	-33
D	2,647	28
BN	2,752	-85
AN	2,986	-104
W	3,603	-40
All	2,967	-40

Table 13.4-22. Average Total Annual Flow for the Sacramento River below Keswick by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	4,442	-74
D	4,745	139
BN	5,109	-8
AN	6,386	-3
W	8,472	-56
All	6,094	0

Modeled mean monthly flows on the Sacramento River at Freeport under the VA scenario show increases from baseline in the months of January through May and decreases from baseline in the months of June through December. The largest increase in flow compared to baseline occurs in May, when the average monthly flow increases from 17,828 cfs to 19,278 cfs, and the largest decrease occurs in July, when the average monthly flow decreases from 16,664 cfs to 16,280 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the Sacramento River at Freeport under the VA scenario decrease compared to baseline in critical and wet years and increase in all other water year types, showing an increase across all water year types. Results show that there are increases in average total January through June streamflows and decreases in average total July through December streamflows in all water year types. Under the VA scenario, the largest increase in average total January through June streamflows occurs in dry years (336 TAF) and the smallest increase occurs in wet years (21 TAF). Across all water year types, average total January through June streamflows increase by 174 TAF compared to baseline. The largest decrease in average total July through December streamflows under the VA scenario occurs in below normal years (175 TAF) and the smallest decrease occurs in dry years (1 TAF). Across all water year types, average total July through December streamflows decrease by 76 TAF under the VA scenario compared to baseline.

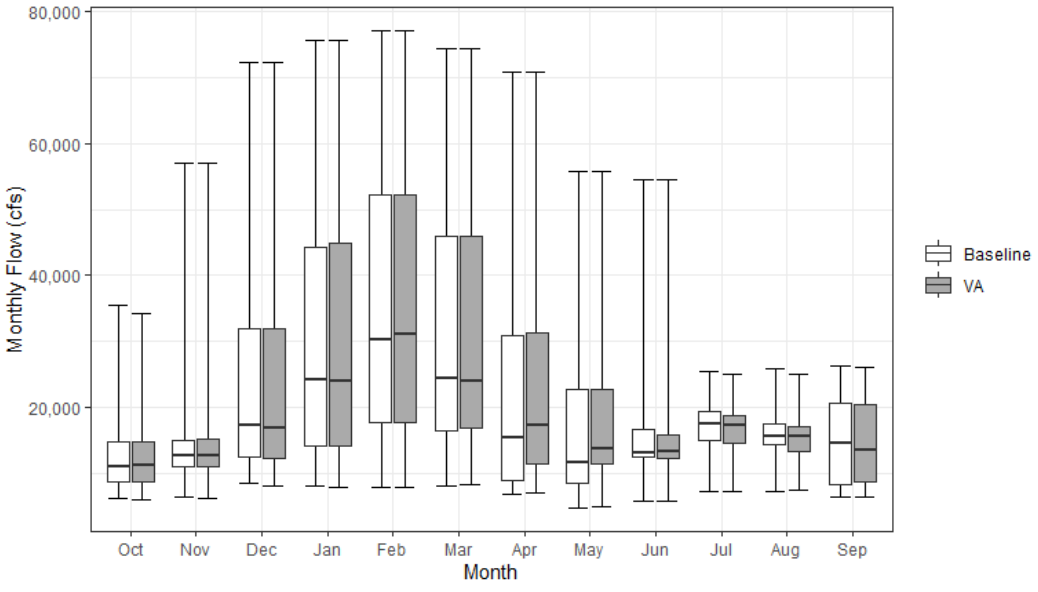


Figure 13.4-8. Monthly Streamflow for the Sacramento River at Freeport under the Baseline and VA Scenarios

Table 13.4-23. Average Total January–June Flow for the Sacramento River at Freeport by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	4,001	23
D	5,402	336
BN	7,477	302
AN	11,191	259
W	14,733	21
All	9,103	174

Table 13.4-24. Average Total July–December Flow for the Sacramento River at Freeport by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	3,626	-59
D	4,991	-1
BN	5,604	-175
AN	6,674	-87
W	8,070	-74
All	6,025	-76

Table 13.4-25. Average Total Annual Flow for the Sacramento River at Freeport by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	7,627	-36
D	10,393	335
BN	13,081	127
AN	17,865	172
W	22,803	-53
All	15,128	98

Yuba River

Regulatory Pathway

Modeled mean monthly flows on the lower Yuba River under the 55 w/WSAs scenario show increases from baseline in the months of February through May, October, and November, and decreases from baseline in the months of June through September, December, and January, falling closest to modeled mean flows for the 55 scenario in November and January and closest to the Low Flow Alternative in all other months (see Table A1-94 and Table A1-95 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). The largest increase in flow compared to baseline occurs in May, when the average monthly flow increases from 2,662 cfs to 3,158 cfs, and the largest decrease occurs in June, when the average monthly flow decreases from 2,108 cfs to 1,986 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower Yuba River under the 55 w/WSAs scenario increase compared to baseline in all water year types and across all water year types. Results show that there

are increases in average total January through June streamflows in all water year types and decreases in average total July through December streamflows in all water year types except for wet years when there is no change compared to baseline. Under the 55 w/WSAs scenario, the largest increase in average total January through June streamflows compared to baseline occurs in dry years (84 TAF) and the smallest increase occurs in wet years (29 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types. Across all water year types, the increase in average total January through June streamflows under the 55 w/WSAs scenario compared to baseline is 56 TAF. Changes in average total July through December streamflows under the 55 w/WSAs scenario range from a decrease of 12 TAF in below normal years to no perceptible change (0 TAF) compared to baseline in wet years. Average total July through December streamflows under the 55 w/WSAs scenario generally fall between baseline and the Low Flow Alternative. Across all water year types, the decrease in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 6 TAF, falling between baseline and the Low Flow Alternative.

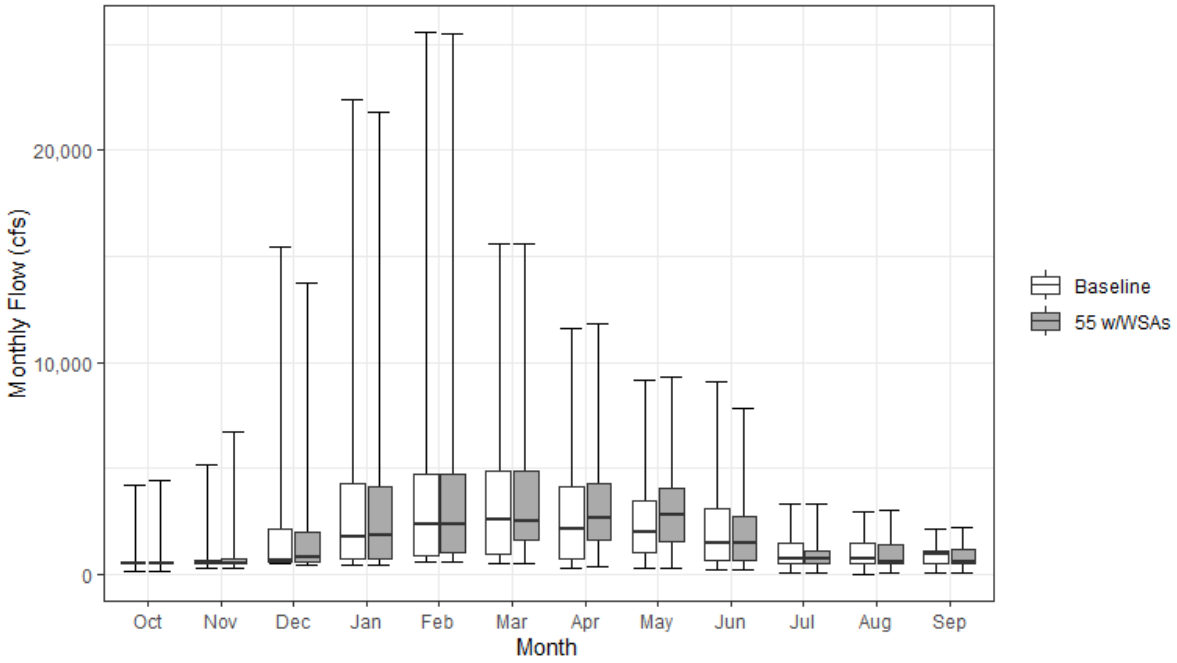


Figure 13.4-9. Monthly Streamflow for the Yuba River above the Feather River under Baseline and 55 w/WSAs

Table 13.4-26. Average Total January–June Flow for the Yuba River above the Feather River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	253	58
D	463	84
BN	804	63
AN	1,263	56
W	2,005	29
All	1,059	56

Table 13.4-27. Average Total July–December Flow for the Yuba River above the Feather River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	178	-4
D	244	-10
BN	295	-12
AN	403	-10
W	658	0
All	388	-6

Table 13.4-28. Average Total Annual Flow for the Yuba River above the Feather River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	431	54
D	707	74
BN	1,099	51
AN	1,666	46
W	2,663	29
All	1,447	50

Voluntary Agreement Pathway

Modeled mean monthly flows on the lower Yuba River under the VA scenario show increases from baseline in the months of April, May, August, and September, and decreases from baseline in the months of October through March, June, and July. The largest increase in flow compared to baseline occurs in April, when the average monthly flow increases from 2,677 cfs to 3,035 cfs, and the largest decreases occur in December, when the average monthly flow decreases from 2,001 cfs to 1,878 cfs and January, when the average monthly flow decreases from 3,180 cfs to 3,057 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower Yuba River under the VA scenario decrease compared to baseline in critical and wet years and increase in all other water year types, showing a slight increase across all water year types. Results show that there are increases in average total January through June streamflows in all water year types except for critical and wet years and decreases in average total July through December streamflows in all water year types except for dry years. Under the VA scenario, the largest increase in average total January through June streamflows occurs in above normal years (43 TAF) and the largest decrease occurs in wet years (12 TAF). Across all water year types, average total January through June streamflows increase by 11 TAF compared to baseline. Average total July through December streamflows are unchanged from baseline in dry years under the VA scenario and decrease in all other water year types, with the largest decrease occurring in wet years (20 TAF). Across all water year types, average total July through December streamflows decrease by 10 TAF compared to baseline.

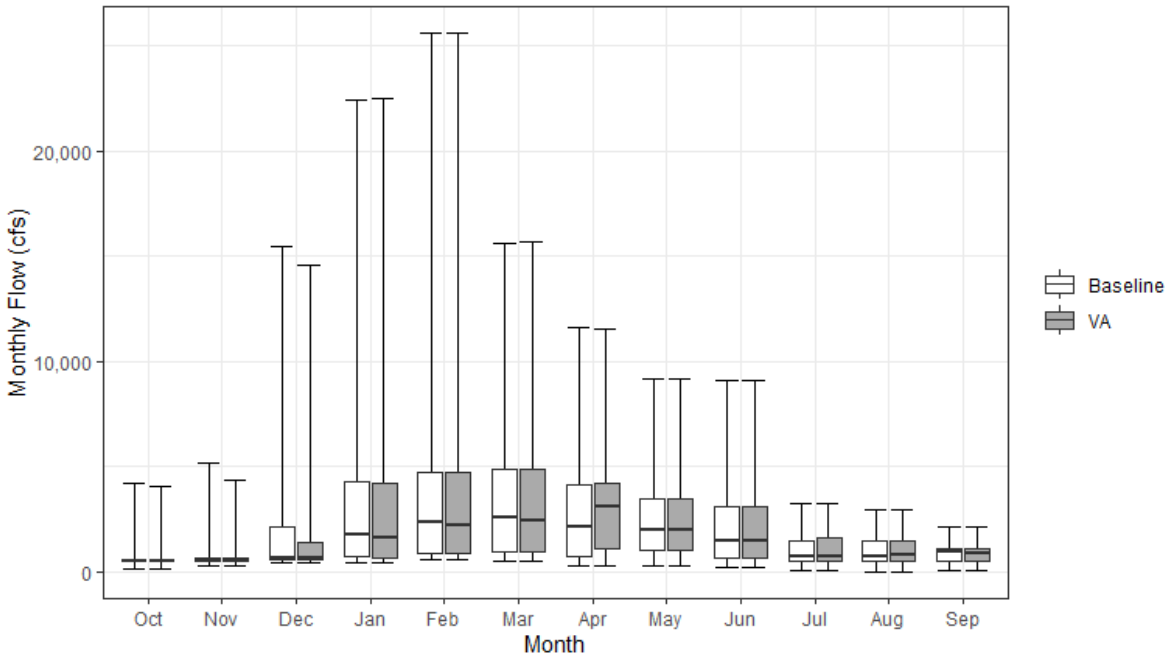


Figure 13.4-10. Monthly Streamflow for the Yuba River above the Feather River under the Baseline and VA Scenarios

Table 13.4-29. Average Total January–June Flow for the Yuba River above the Feather River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	253	-9
D	463	14
BN	804	37
AN	1,263	43
W	2,005	-12
All	1,059	11

Table 13.4-30. Average Total July–December Flow for the Yuba River above the Feather River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	178	-3
D	244	0
BN	295	-10
AN	403	-11
W	658	-20
All	388	-10

Table 13.4-31. Average Total Annual Flow for the Yuba River above the Feather River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	431	-12
D	707	14
BN	1,099	27
AN	1,666	32
W	2,663	-32
All	1,447	1

Bear River

Regulatory Pathway

Modeled mean monthly flows on the lower Bear River under the 55 w/WSAs scenario show increases from baseline in the months of June, July, October, and November, and decreases from baseline in the months of December through May, August, and September, generally falling closest to modeled mean flows for the Low Flow Alternative in late winter and early spring months and closest to the 55 scenario in other months (see Table A1-22 and Table A1-23 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). The largest increase in flow compared to baseline occurs in November, when the average monthly flow increases from 288 cfs to 332 cfs, and the largest decrease in flow occurs in January, when the average monthly flow decreases from 1,341 cfs to 1,299 cfs, and February, when the average monthly flow decreases from 1,715 cfs to 1,673 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower Bear River under the 55 w/WSAs scenario decrease compared to baseline in all water year types. Results show that there are decreases in average total January through June streamflows in all water year types and slight increases in average total July through December streamflows in all water year types except for above normal and wet years when there is no change compared to baseline. Under the 55 w/WSAs scenario, the largest decrease in average total January through June streamflows compared to baseline occurs in above normal years (20 TAF) and the smallest decrease occurs in critical years (2 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types. Across all water year types, the decrease in average total January through June streamflows under the 55 w/WSAs scenario compared to baseline is 10 TAF. The largest increase in average total July through December streamflows under the 55 w/WSAs scenario occurs in below normal years (3 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are most similar to the Low Flow Alternative except in above normal and below normal years when they are closer to the 55 scenario. Across all water year types, the increase in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 1 TAF, similar to the Low Flow Alternative.

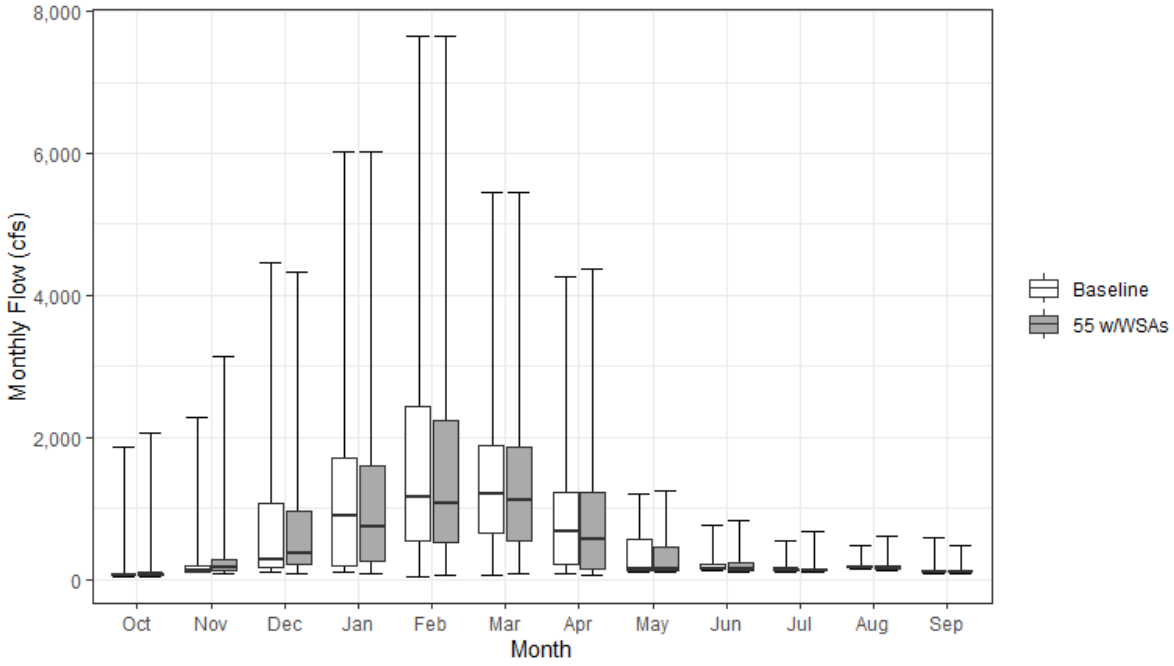


Figure 13.4-11. Monthly Streamflow for the Bear River above the Feather River under the Baseline and 55 w/WSAs Scenarios

Table 13.4-32. Average Total January–June Flow for the Bear River above the Feather River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	85	-2
D	168	-12
BN	282	-15
AN	466	-20
W	635	-7
All	354	-10

Table 13.4-33. Average Total July–December Flow for the Bear River above the Feather River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	54	1
D	68	2
BN	70	3
AN	106	0
W	184	0
All	106	1

Table 13.4-34. Average Total Annual Flow for the Bear River above the Feather River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	139	-1
D	236	-10
BN	352	-12
AN	572	-20
W	819	-7
All	460	-9

Voluntary Agreement Pathway

As discussed in more detail in Section 13.4.2, *Modeling Approach*, in August 2025, the Board received additional HRL proposals from NID and SSWD specific to the Bear River, Yuba River, and Auburn Ravine. These additional HRL flow contributions were not modeled in SacWAM because the specific conditions under which the HRL flow contributions would be provided are variable based on specific circumstances, including future consultation with CDFW and others, or not fully known at this time. Specifically, it is unclear when new FERC licenses will be issued and what the specific conditions will be of the new FERC licenses that affect the implementation of these flow contributions. However, these HRL flow contributions would be expected to result in some additional Delta inflow and Delta outflow as discussed above.

Mokelumne River

Regulatory Pathway

Modeled mean monthly flows on the lower Mokelumne River under the 55 w/WSAs scenario show increases from baseline in the months of March through June, and decreases from baseline in the months of July through February, generally falling closest to modeled mean flows for the Low Flow Alternative in the months of January through June and closest to the 55 scenario in the months of July through September (see Table A1-60 and Table A1-61 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). The largest increase in flow compared to baseline occurs in May, when the average monthly flow increases from 687 cfs to 1,275 cfs, and the largest decrease occurs in July, when the average monthly flow decreases from 450 cfs to 236 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower Mokelumne River under the 55 w/WSAs scenario increase compared to baseline in all water year types except for wet years. Results show that there are increases in average total January through June streamflows in all water year types and decreases in average total July through December streamflows in all water year types except for critical years when there is no change compared to baseline. Under the 55 w/WSAs scenario, the largest increase in average total January through June streamflows compared to baseline occurs in above normal years (97 TAF) and the smallest increase occurs in critical years (7 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types except in wet years. Across all water year types, the increase in average total January through June streamflows under the 55 w/WSAs scenario compared to baseline is 64 TAF. Changes in average total July through December streamflows under the 55 w/WSAs scenario range from a decrease of 69 TAF in above normal years

to no change (0 TAF) compared to baseline in critical years. Average total July through December streamflows under the 55 w/WSAs scenario are most similar to the Low Flow Alternative except in below normal and wet years when they are closer to the 55 scenario. Across all water year types, the decrease in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 41 TAF.

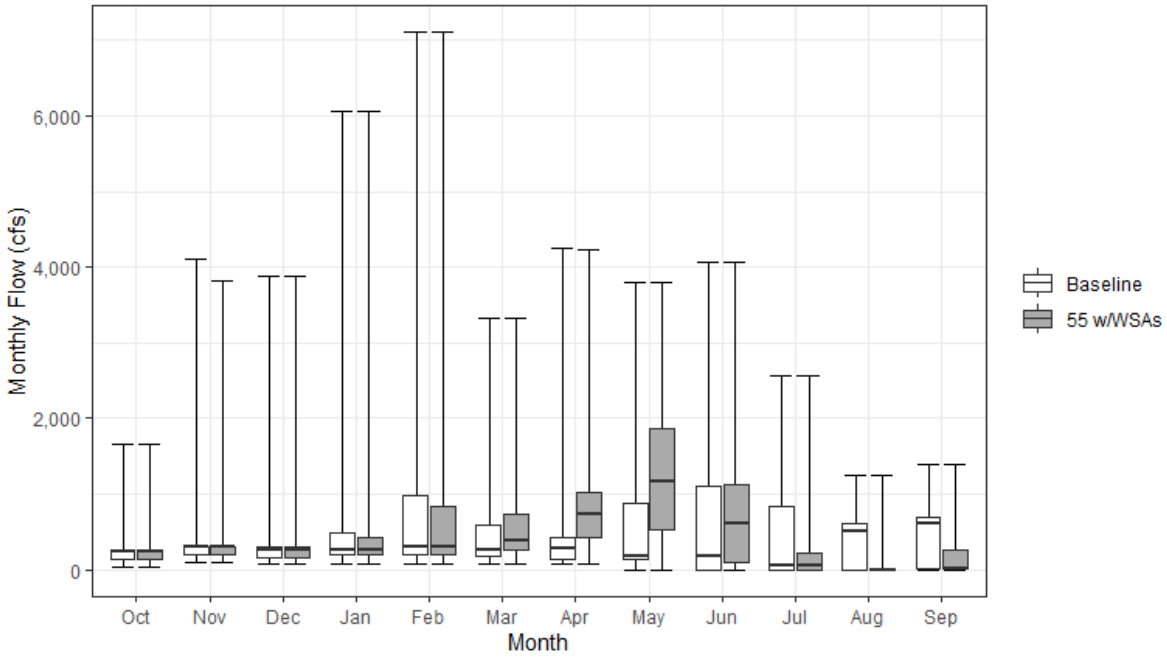


Figure 13.4-12. Monthly Streamflow for the Mokelumne River above the Confluence with the Cosumnes River under the Baseline and 55 w/WSAs Scenarios

Table 13.4-35. Average Total January–June Flow for the Mokelumne River above the Confluence with the Cosumnes River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	47	7
D	64	69
BN	119	96
AN	231	97
W	521	57
All	230	64

Table 13.4-36. Average Total July–December Flow for the Mokelumne River above the Confluence with the Cosumnes River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	37	0
D	53	-10
BN	113	-53
AN	180	-69
W	274	-68
All	144	-41

Table 13.4-37. Average Total Annual Flow for the Mokelumne River above the Confluence with the Cosumnes River by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	84	7
D	117	59
BN	232	43
AN	411	28
W	795	-11
All	374	23

Voluntary Agreement Pathway

Modeled mean monthly flows on the lower Mokelumne River under the VA scenario show small increases from baseline in the months of December, March, and April, and small decreases from baseline in the months of January, February, and May through November. The largest increase in flow compared to baseline occurs in April, when the average monthly flow increases from 529 cfs to 600 cfs, and the largest decrease occurs in May, when the average monthly flow decreases from 687 cfs to 654 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower Mokelumne River under the VA scenario decrease compared to baseline in below normal, above normal, and wet years, increase in dry years, and show no change in critical years. Results show that there are increases in average total January through June streamflows in all water year types except for critical years when there is no change compared to baseline and decreases in average total July through December streamflows in all water year types except for dry and critical years when there is no change compared to baseline. Under the VA scenario, average total January through June streamflows are unchanged from baseline in critical years and increase in all other water year types, with the largest increase occurring in dry and above normal years (3 TAF). Across all water year types, average total January through June streamflows increase by 2 TAF compared to baseline. Average total July through December streamflows are unchanged from baseline in dry and critical years under the VA scenario and decrease in all other water year types, with the largest decrease occurring in above normal years (5 TAF). Across all water year types, average total July through December streamflows decrease by 2 TAF compared to baseline.

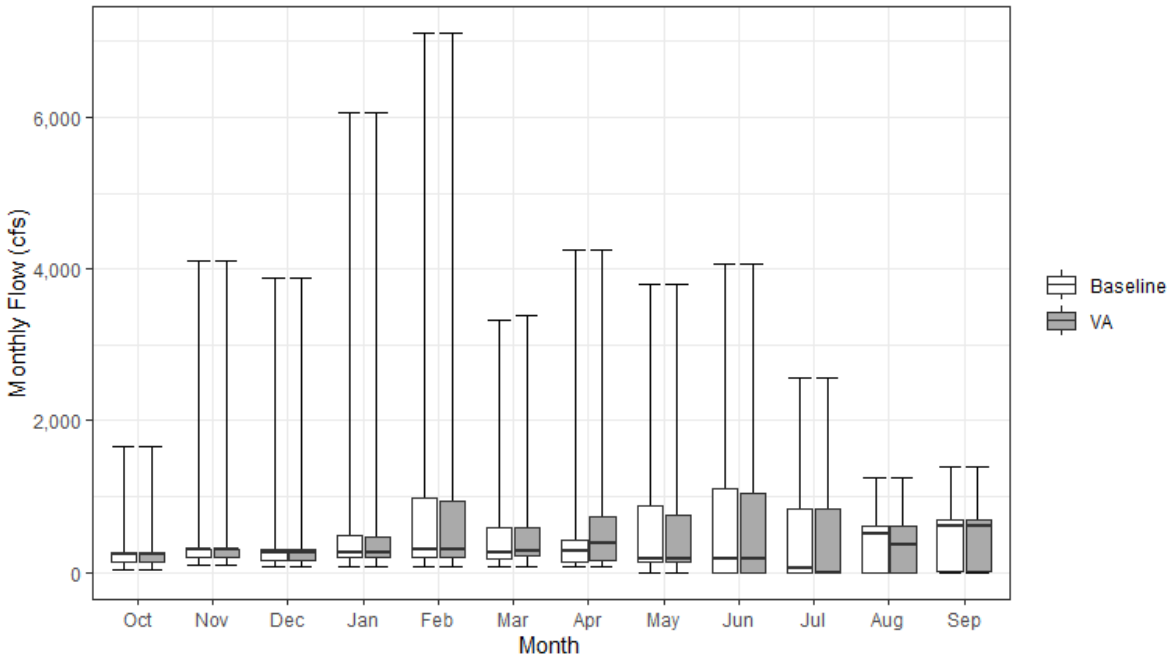


Figure 13.4-13. Monthly Streamflow for the Mokelumne River above the Confluence with the Cosumnes River under the Baseline and VA Scenarios

Table 13.4-38. Average Total January–June Flow for the Mokelumne River above the Confluence with the Cosumnes River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	47	0
D	64	3
BN	119	1
AN	231	3
W	521	1
All	230	2

Table 13.4-39. Average Total July–December Flow for the Mokelumne River above the Confluence with the Cosumnes River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	37	0
D	53	0
BN	113	-2
AN	180	-5
W	274	-2
All	144	-2

Table 13.4-40. Average Total Annual Flow for the Mokelumne River above the Confluence with the Cosumnes River by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	84	0
D	117	3
BN	232	-1
AN	411	-2
W	795	-1
All	374	0

Calaveras River

Regulatory Pathway

Modeled mean monthly flows on the lower Calaveras River under the 55 w/WSAs scenario show increases from baseline in the months of December through September and no change from baseline in the months of October and November, falling closer to modeled mean flows for the Low Flow Alternative than the 55 scenario in all months (see Table A1-36 and Table A1-37 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). The largest increase in flow compared to baseline occurs in April when the average monthly flow increases from 31 cfs to 94 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on the lower Calaveras River under the 55 w/WSAs scenario increase compared to baseline in all water year types. This pattern is driven by increases in average total January through June and July through December streamflows in all water year types. Under the 55 w/WSAs scenario, the largest increase in average total January through June streamflows compared to baseline occurs in above normal years (20 TAF) and the smallest increase occurs in critical years (6 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types. Across all water year types, the increase in average total January through June streamflows under the 55 w/WSAs scenario compared to baseline is 15 TAF. Similar to the pattern observed in average total January through June streamflows, the largest increase in average total July through December streamflows under the 55 w/WSAs scenario occurs in above normal years (4 TAF) and the smallest increase occurs in critical years (1 TAF) and dry years (1 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types. Across all water year types, the increase in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 2 TAF.

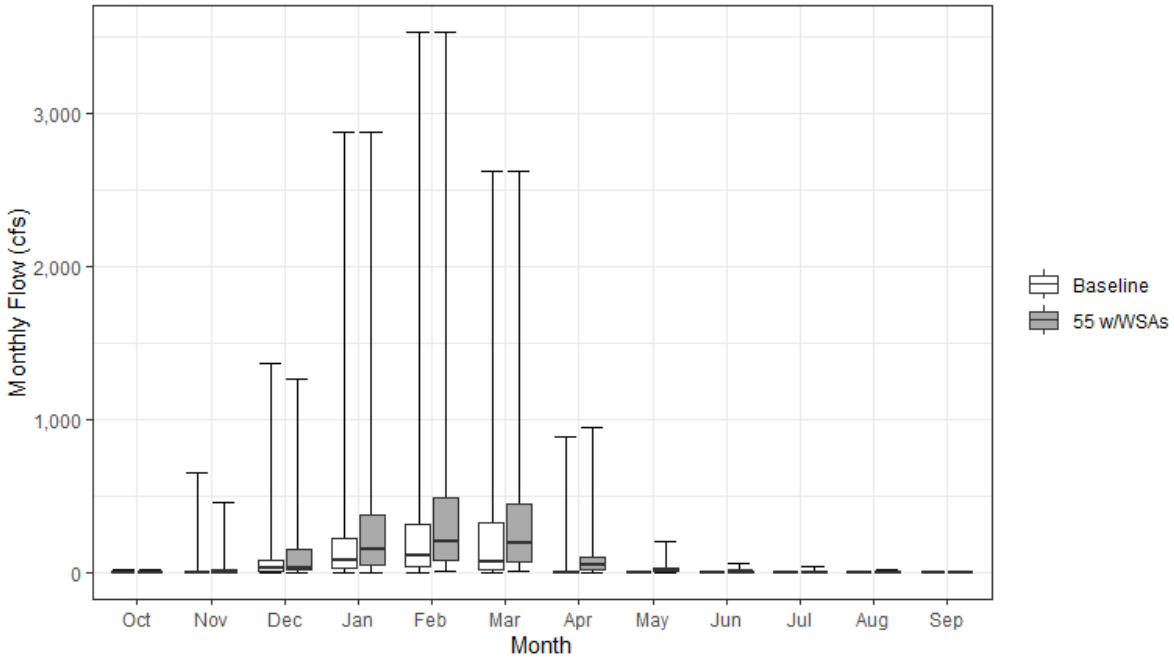


Figure 13.4-14. Monthly Streamflow for the Calaveras River Inflow to the Delta under the Baseline and 55 w/WSAs Scenarios

Table 13.4-41. Average Total January–June Flow for the Calaveras River Inflow to the Delta by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	7	6
D	12	15
BN	33	19
AN	66	20
W	142	14
All	61	15

Table 13.4-42. Average Total July–December Flow for the Calaveras River Inflow to the Delta by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1	1
D	3	1
BN	4	2
AN	9	4
W	19	3
All	9	2

Table 13.4-43. Average Total Annual Flow for the Calaveras River Inflow to the Delta by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	8	7
D	15	16
BN	37	21
AN	75	24
W	161	17
All	70	17

Voluntary Agreement Pathway

No HRL proposal for the Calaveras River has been received, so the VA scenario shows no change in flow on the Calaveras River.

Putah Creek

Regulatory Pathway

Modeled mean monthly flows on lower Putah Creek under the 55 w/WSAs scenario show increases from baseline in the months of November through February, May, and June, decreases from baseline in the months of March and April, and no change from baseline in the months of July through October, falling closer to modeled mean flows for the Low Flow Alternative than the 55 scenario in all months (see Table A1-66 and Table A1-67 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). The largest increase in flow compared to baseline occurs in December, when the average monthly flow increases from 47 cfs to 157 cfs, and the largest decrease occurs in April, when the average monthly flow decreases from 226 cfs to 193 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on lower Putah Creek under the 55 w/WSAs scenario increase compared to baseline in all water year types except for wet years and show an increase across all water year types. This pattern is driven by increases in average total January through June and average total July through December streamflows in all water year types except for wet years when there is a decrease in average total January through June streamflows. Under the 55 w/WSAs scenario, average total January through June streamflows decrease compared to baseline in wet years (19 TAF) and increase in all other water year types, with the largest increase occurring in above normal years (53 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario, falling between baseline and the Low Flow Alternative in all water year types except for wet years when there is a decrease under the 55 w/WSAs scenario and an increase under the Low Flow Alternative. Across all water year types, the increase in average total January through June streamflows under the 55 w/WSAs scenario compared to baseline is 10 TAF. The largest increase in average total July through December streamflows under the 55 w/WSAs scenario occurs in wet years (16 TAF) and the smallest increase occurs in critical years (1 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types and across all water year types. The increase in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 8 TAF.

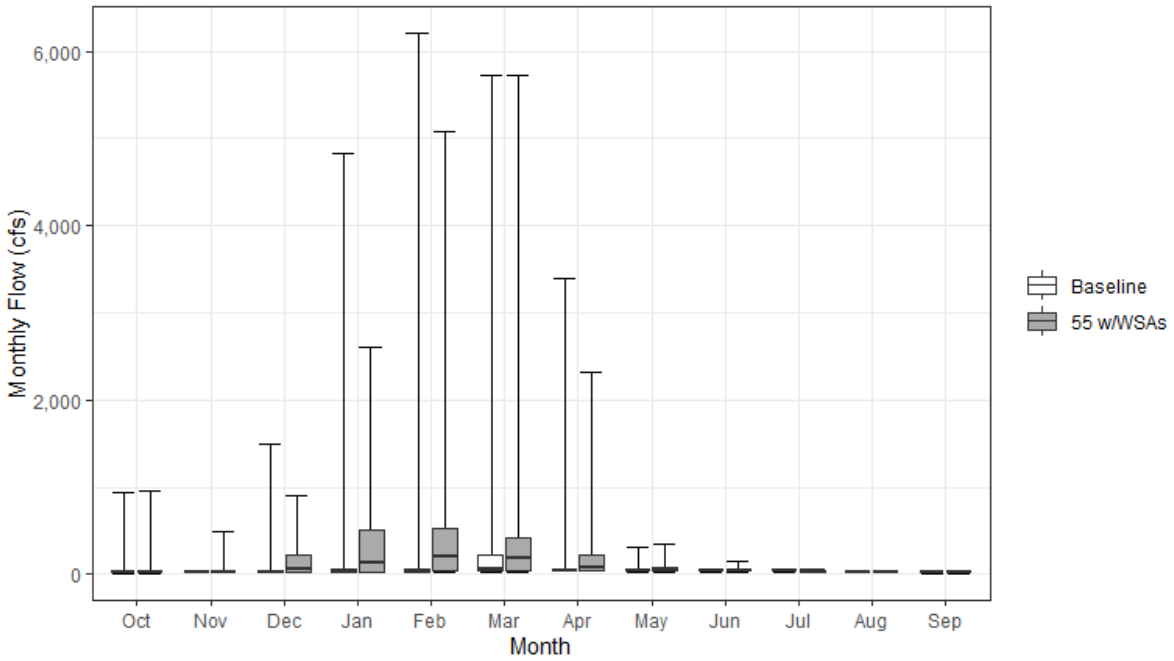


Figure 13.4-15. Monthly Streamflow for Putah Creek above the Yolo Bypass under Baseline and 55 w/WSAs Scenarios

Table 13.4-44. Average Total January–June Flow for Putah Creek above the Yolo Bypass by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	14	6
D	15	19
BN	23	20
AN	28	53
W	190	-19
All	71	10

Table 13.4-45. Average Total July–December Flow for Putah Creek above the Yolo Bypass by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	8	1
D	8	5
BN	8	5
AN	9	8
W	14	16
All	10	8

Table 13.4-46. Average Total Annual Flow for Putah Creek above the Yolo Bypass by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	22	7
D	23	24
BN	31	25
AN	37	61
W	204	-3
All	81	18

Voluntary Agreement Pathway

Modeled mean monthly flows on lower Putah Creek under the VA scenario show increases from baseline in the months of November and December, decreases from baseline in the months of January through April, and no change from baseline in the months of May through October. The largest increase in flow compared to baseline occurs in November, when the average monthly flow increases from 20 cfs to 39 cfs, and the largest decrease occurs in March, when the average monthly flow decreases from 351 cfs to 338 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on lower Putah Creek under the VA scenario decrease compared to baseline in wet years and increase in all other water year types and across all water year types. Results show that there are increases in average total January through June streamflows in dry and critical years, decreases in wet and above normal years, and no change in below normal years. There are increases in average total July through December streamflows in all water year types. Under the VA scenario, average total January through June streamflows are unchanged from baseline in below normal years, show the largest decrease from baseline in wet years (5 TAF), and show the largest increase from baseline in critical and dry years (1 TAF). Across all water year types, average total January through June streamflows decrease by 1 TAF compared to baseline. Average total July through December streamflows increase from baseline in all water year types, with the largest increase occurring in critical, dry, below normal, and above normal years (2 TAF). Across all water year types, average total July through December streamflows increase by 2 TAF compared to baseline.

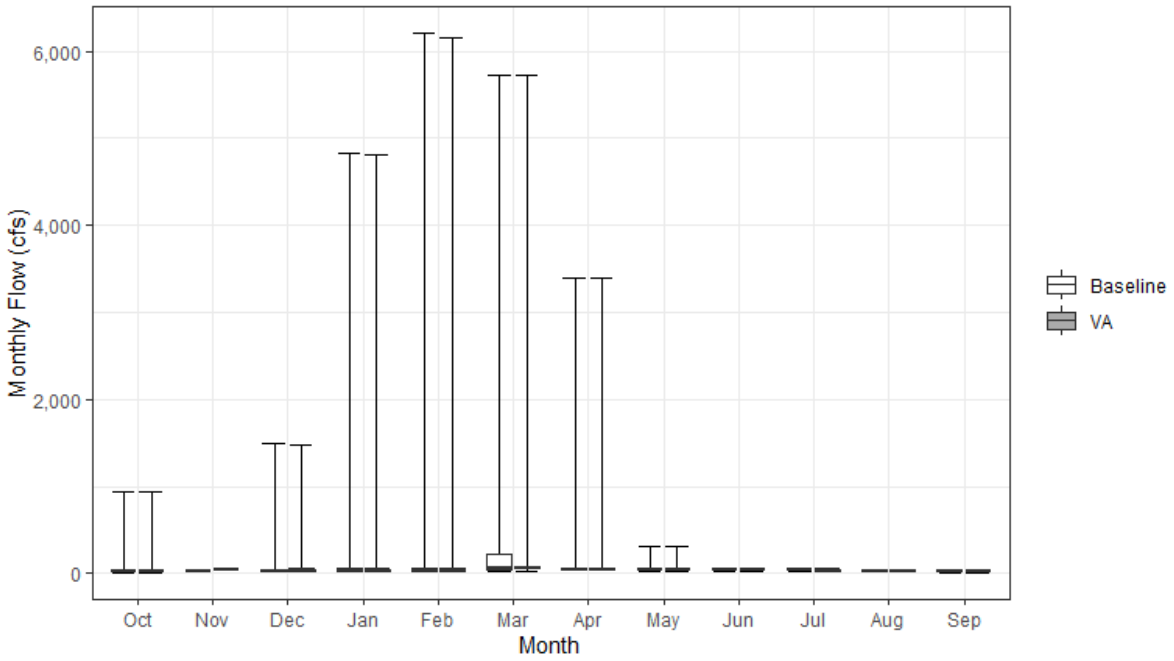


Figure 13.4-16. Monthly Streamflow for Putah Creek above the Yolo Bypass under the Baseline and VA Scenarios

Table 13.4-47. Average Total January–June Flow for Putah Creek above the Yolo Bypass by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	14	1
D	15	1
BN	23	0
AN	28	-1
W	190	-5
All	71	-1

Table 13.4-48. Average Total July–December Flow for Putah Creek above the Yolo Bypass by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	8	2
D	8	2
BN	8	2
AN	9	2
W	14	1
All	10	2

Table 13.4-49. Average Total Annual Flow for Putah Creek above the Yolo Bypass by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	22	3
D	23	3
BN	31	2
AN	37	1
W	204	-4
All	81	1

Cache Creek

Regulatory Pathway

Modeled mean monthly flows on lower Cache Creek under the 55 w/WSAs scenario show increases from baseline in the months of December, January, and March through June, and a decrease from baseline in February, generally falling closer to modeled mean flows for the Low Flow Alternative than the 55 scenario (see Table A1-32 and Table A1-33 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). Modeled mean monthly flows under the 55 w/WSAs scenario show little to no change from baseline in July through November. The largest increase in flow compared to baseline occurs in December, when the average monthly flow increases from 381 cfs to 452 cfs, and the largest decrease occurs in February, when the average monthly flow decreases from 1,389 cfs to 1,368 cfs. The modeling results described here are presented in the figure below.

Average total annual streamflows on lower Cache Creek under the 55 w/WSAs scenario increase compared to baseline in all water year types except for wet years and show an increase across all water year types. Results show that there are increases in average total January through June streamflows in all water year types except for wet years and increases in average total July through December streamflows in all water year types except for critical and dry years. Under the 55 w/WSAs scenario, average total January through June streamflows decrease compared to baseline in wet years (15 TAF) and increase in all other water year types, with the largest increase occurring in below normal years (31 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types. Across all water year types, the increase in average total January through June streamflows under the 55 w/WSAs scenario compared to baseline is 10 TAF. Average total July through December streamflows under the 55 w/WSAs decrease from baseline in critical years (1 TAF), are unchanged from baseline in dry years, and increase from baseline in all other water year types, with the largest increase occurring in wet years (13 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types. Across all water year types, the increase in average total July through December streamflows under the 55 w/WSAs scenario compared to baseline is 4 TAF.

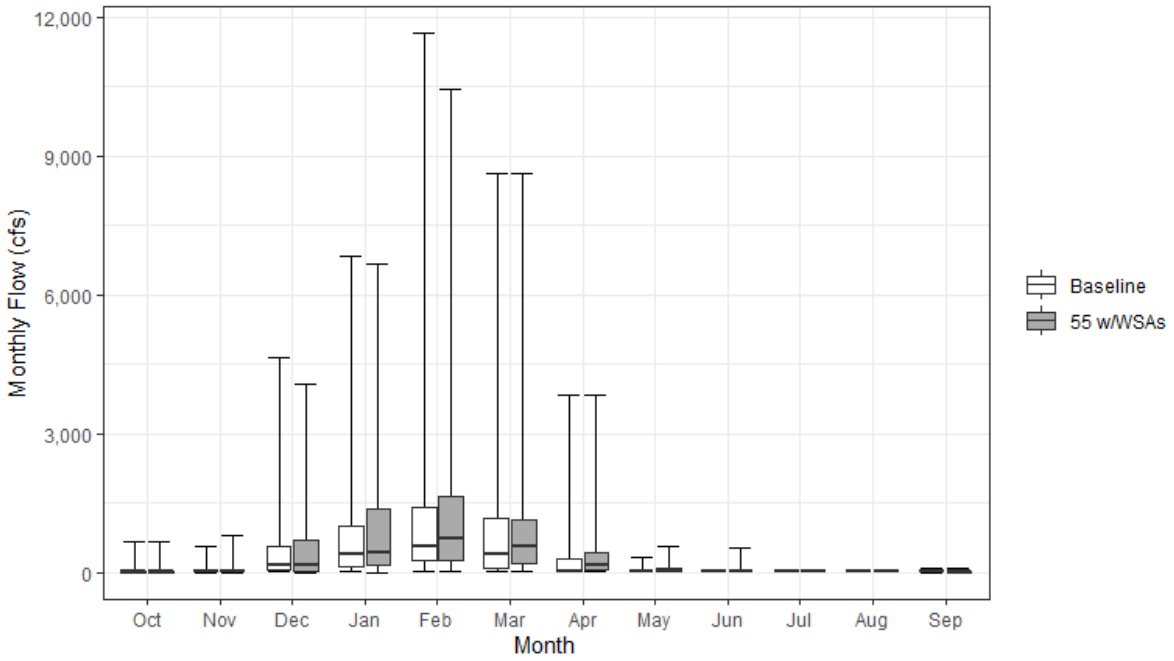


Figure 13.4-17. Monthly Streamflow for Cache Creek above the Yolo Bypass under the Baseline and 55 w/WSAs Scenarios

Table 13.4-50. Average Total January–June Flow for Cache Creek above the Yolo Bypass by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	40	7
D	53	22
BN	101	31
AN	239	20
W	510	-15
All	221	10

Table 13.4-51. Average Total July–December Flow for Cache Creek above the Yolo Bypass by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	14	-1
D	21	0
BN	18	2
AN	29	2
W	56	13
All	31	4

Table 13.4-52. Average Total Annual Flow for Cache Creek above the Yolo Bypass by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	54	6
D	74	22
BN	119	33
AN	268	22
W	566	-2
All	252	14

Voluntary Agreement Pathway

As described in Section 13.2, *Planning Process*, after release of the 2023 draft Staff Report, a proposal for HRL commitments from YCFCWCD was submitted to the State Water Board. The HRL commitments involve YCFCWCD providing 5 TAF of flows from either Putah Creek sources or surface water flows from Cache Creek to lower Putah Creek, either directly or via groundwater recharge and banking. These flows are not proposed to be accounted for as additive to Delta outflows. Providing these flow commitments from Cache Creek is dependent on YCFCWCD HRL participants obtaining a new water right permit to divert water from Cache Creek. The State Water Board has not made any decision on approving a water right application that would provide for the diversion of water from Cache Creek for use in Putah Creek which would be considered as part of a separate State Water Board decision-making process from the Sacramento/Delta update to the Bay-Delta Plan and would include a separate environmental review process. These flows are not included in the SacWAM modeling because the sources of the flow contributions that would be provided to Putah Creek are not fully known at this time and these flows are not proposed to be accounted for as additive to Delta outflows. However, the YCFCWCD HRL proposal could potentially result in changes in Cache Creek streamflows depending on how it is implemented.

Unregulated Tributary Streamflows

Unregulated tributaries are tributaries that lack a major storage reservoir or other flow-regulating infrastructure. There are two general categories of unregulated tributaries in the Sacramento River watershed and Delta eastside tributaries: (1) unregulated tributaries that exhibit low surface water demand relative to water availability; and (2) unregulated tributaries that exhibit higher surface water demand relative to water availability. None of the unregulated tributaries is the subject of an HRL proposal. The one limited exception is that water rights associated with the export of water from the upper watershed of the Cosumnes River constitute a source of supply to El Dorado Irrigation District and are proposed to be covered by the American River HRL proposal. However, even as modeled under the 55 w/WSAs and 55 scenarios, no changes to these upper watershed diversions are needed to meet downstream flow requirements. As a result, there are no modeled changes associated with the VA scenario, and the discussion is confined to the 55 w/WSAs and 55 scenarios.

For unregulated tributaries with low surface water demand, streamflows generally remain unchanged between model scenarios. Tributaries that fall under this category include Battle Creek, Big Chico Creek, and the Cosumnes River. Unregulated tributaries with low surface water demand tend to be less hydrologically altered compared with tributaries with higher surface water demand. These tributaries also tend to exhibit higher percentages of unimpaired flow under baseline

compared with tributaries with higher surface water demand (see Chapter 2, *Hydrology and Water Supply*). As a result, conditions in these tributaries are unlikely to change under the 55 w/WSAs scenario. The Cosumnes River shows this representative tributary streamflow pattern for unregulated tributaries with low surface water demand. The modeling results described here are presented in the following figure.

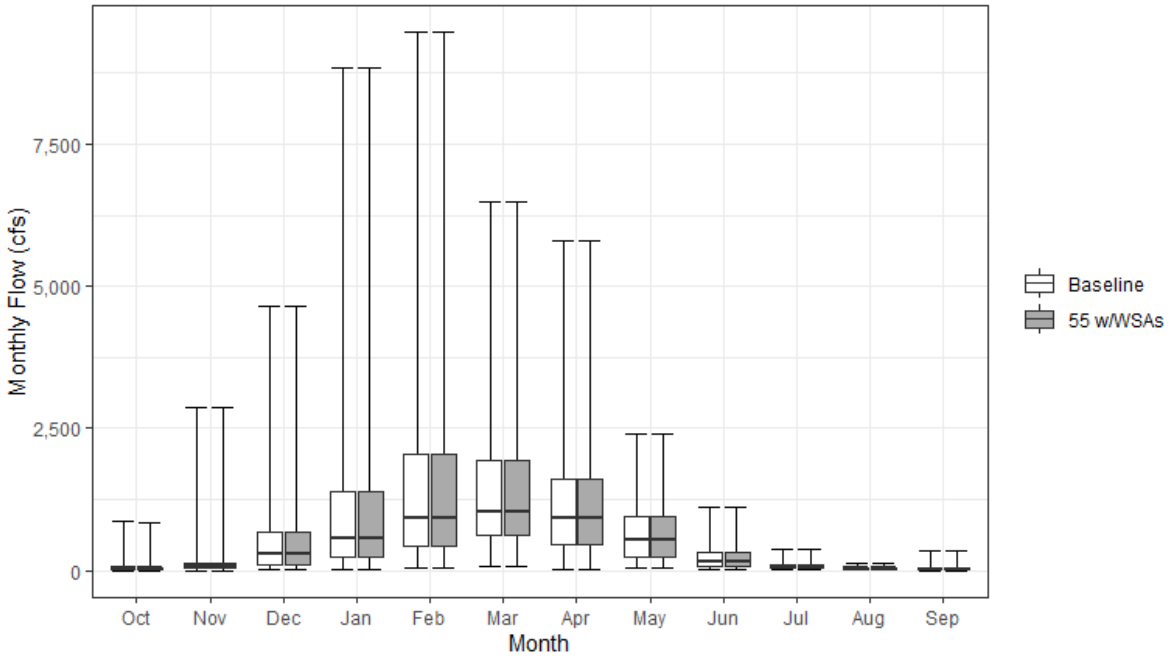


Figure 13.4-18. Monthly Streamflow for the Cosumnes River under the Baseline and 55 w/WSAs Scenarios

For unregulated tributaries with higher surface water demand, streamflows vary little between model scenarios during winter months, but generally show increases in streamflows during late spring through early fall (May through September). Examples of tributaries that fall under this category include Antelope Creek, Mill Creek, Deer Creek, and Thomes Creek. For these tributaries, surface water demand tends to be low during winter and higher during late spring through early fall due to seasonal consumptive water use (e.g., irrigation use). Surface water availability also tends to be lowest during the irrigation season. Based on the model results, the 55 w/WSAs scenario would likely result in increased streamflows and reduced summer surface water diversions for these tributaries but is unlikely to alter streamflows during winter months compared to baseline. Streamflows under the 55 w/WSAs scenario would generally be similar to those observed under the Low Flow Alternative. Mill Creek and Deer Creek show this representative tributary streamflow pattern for unregulated tributaries with higher surface water demand, as shown in the figures below. Results are also shown below for Antelope Creek.

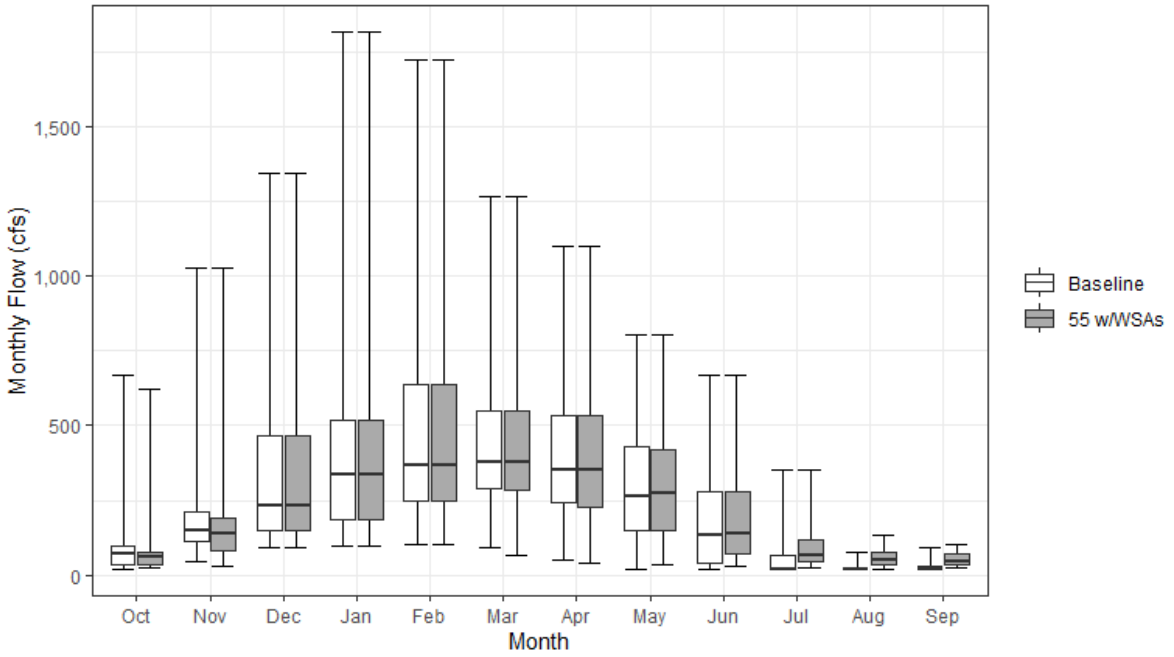


Figure 13.4-19. Monthly Streamflow for Mill Creek under the Baseline and 55 w/WSAs Scenarios

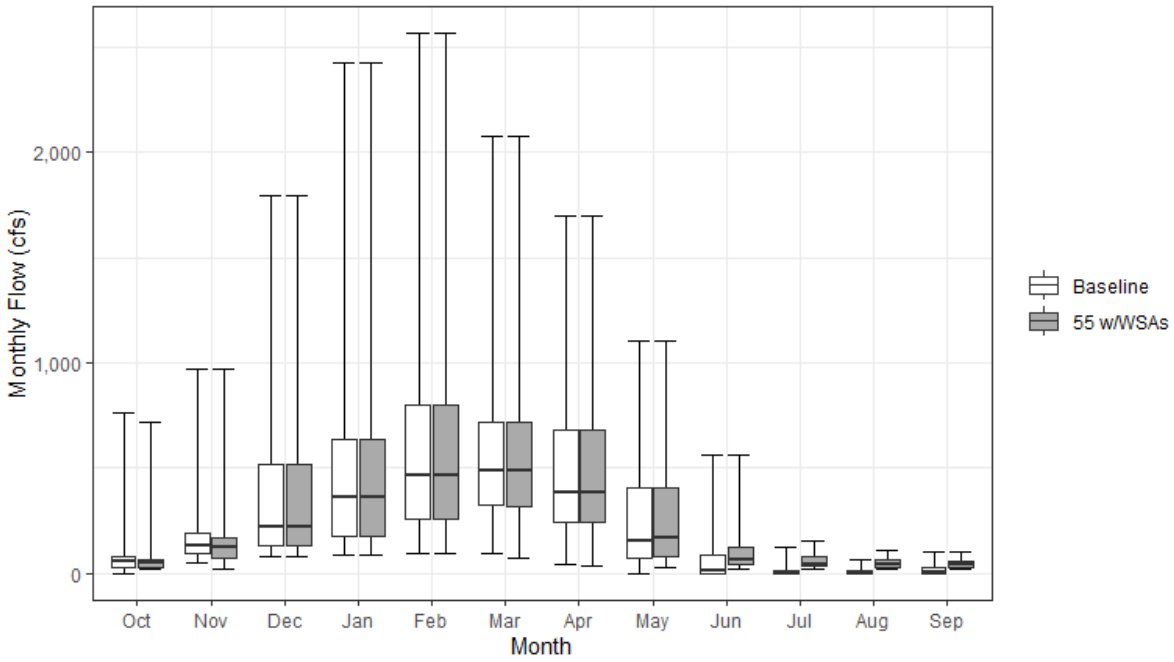


Figure 13.4-20. Monthly Streamflow for Deer Creek under the Baseline and 55 w/WSAs Scenarios

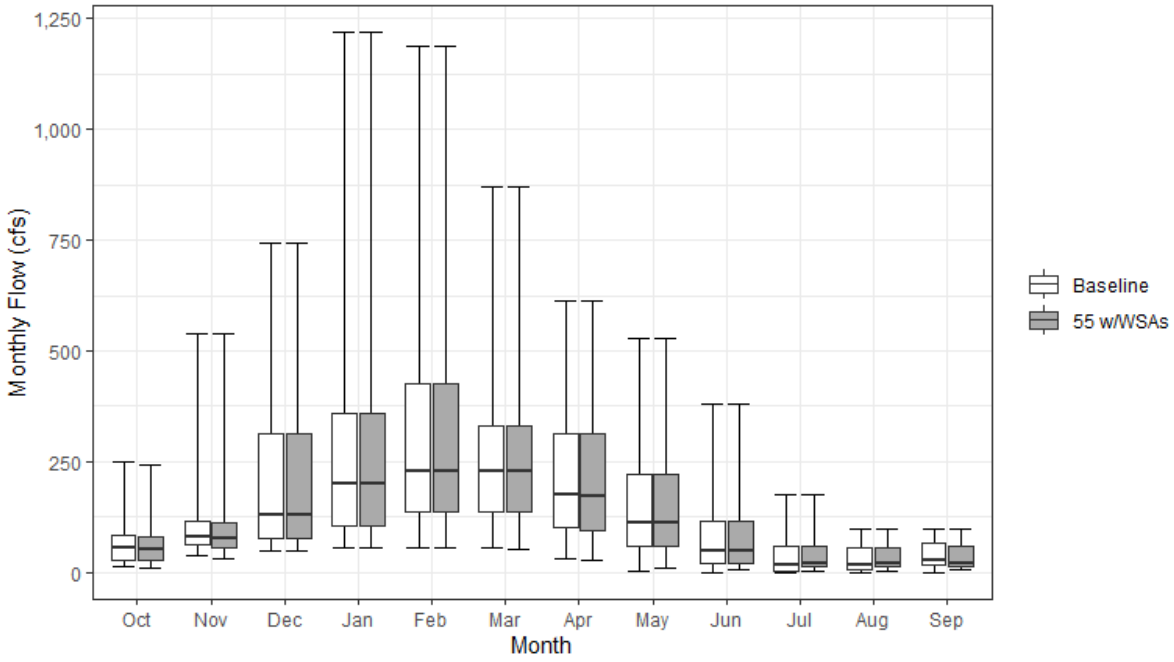


Figure 13.4-21. Monthly Streamflow for Antelope Creek under the Baseline and 55 w/WSAs Scenarios

Sacramento Valley Flood Bypasses

This section discusses changes in hydrology in the Sutter and Yolo Bypasses under the 55 w/WSAs scenario and the VA scenario.

Regulatory Pathway

Increases in streamflow on the mainstem Sacramento River result in very small changes in the frequency and magnitude of spills into the Sutter and Yolo Bypasses. The Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project (Big Notch Project) is expected to increase the frequency and magnitude of spills into the Yolo Bypass from the Sacramento River, but the Big Notch Project is not included in the SacWAM modeling. However, increases in outflows from Cache and Putah Creeks produce increases in flow in the lower half of the Yolo Bypass into the Delta under the 55 w/WSAs scenario, as shown in the figure below. Increased flows on the lower Yolo Bypass may lead to increases in surface area inundation and floodplain habitat.

Average total annual streamflows for the Yolo Bypass below Putah Creek inflow under the 55 w/WSAs scenario show a small increase compared to baseline in all water year types except for wet years and show a small increase across all water year types. Under the 55 w/WSAs scenario, average total January through June streamflows decrease compared to baseline in wet years (189 TAF) and increase in all other water year types, with the largest increase occurring in below normal years (133 TAF). Overall, average total January through June streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario, except in wet years. Across all water year types, average total January through June streamflows under the 55 w/WSAs scenario decrease by 4 TAF compared to baseline. Average total July through December streamflows under the 55 w/WSAs scenario decrease from baseline in above normal years (12 TAF) and increase from baseline in all other water year types, with the largest increase occurring in critical years (22

TAF). Overall, average total July through December streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario, except in critical and wet years. Across all water year types, average total July through December streamflows under the 55 w/WSAs scenario increase by 7 TAF compared to baseline.

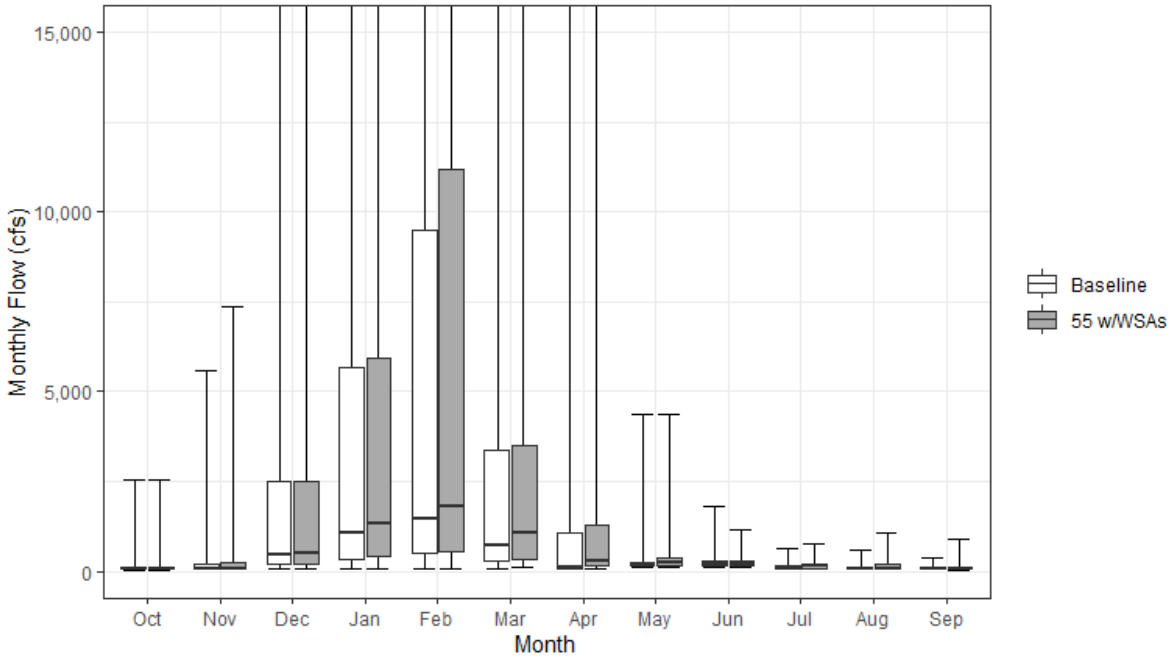


Figure 13.4-22. Monthly Streamflow for Yolo Bypass below Putah Creek Inflow under the Baseline and 55 w/WSAs Scenarios

Table 13.4-53. Average Total January–June Flow for Yolo Bypass below Putah Creek Inflow by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	132	16
D	185	75
BN	439	133
AN	1,797	73
W	5,135	-189
All	1,920	-4

Table 13.4-54. Average Total July–December Flow for Yolo Bypass below Putah Creek Inflow by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	71	22
D	90	8
BN	116	12
AN	201	-12
W	663	1
All	279	7

Table 13.4-55. Average Total Annual Flow for Yolo Bypass below Putah Creek Inflow by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	203	38
D	275	83
BN	555	145
AN	1,998	61
W	5,798	-188
All	2,199	3

Modeled monthly streamflows for Tisdale Weir into the Sutter Bypass for baseline and the 55 w/WSAs scenario are presented in the figure below. Average total annual streamflows for the Tisdale Weir into the Sutter Bypass under the 55 w/WSAs scenario increase compared to baseline in below normal and above normal years, show no change from baseline in critical years, and decrease compared to baseline in dry and wet years, showing a small decrease across all water year types. Under the 55 w/WSAs scenario, average total January through June streamflows decrease compared to baseline in wet years (2 TAF), show no change from baseline in critical years, and increase in all other water year types, with the largest increase occurring in above normal years (49 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types. Across all water year types, average total January through June streamflows under the 55 w/WSAs scenario increase by 9 TAF compared to baseline, similar to the Low Flow Alternative. Average total July through December streamflows under the 55 w/WSAs scenario show no change from baseline in critical and below normal years and decrease from baseline in all other water year types, with the largest decrease occurring in wet years (45 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario except in dry and wet years. Across all water year types, average total July through December streamflows under the 55 w/WSAs scenario decrease by 17 TAF compared to baseline.

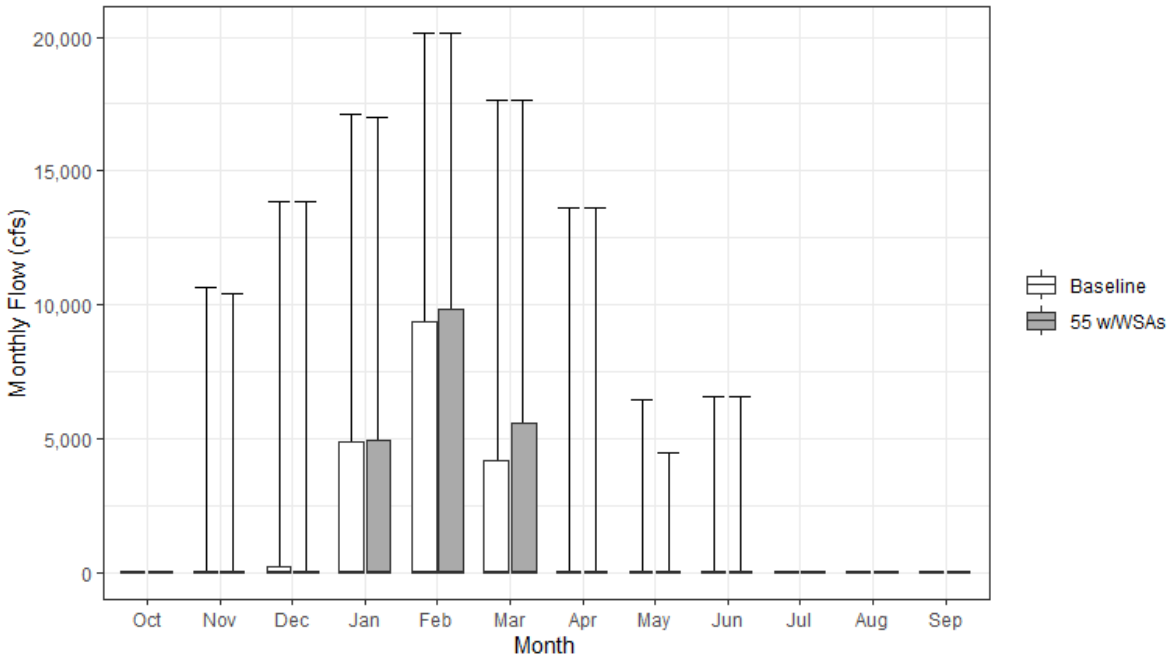


Figure 13.4-23. Monthly Streamflow over the Tisdale Weir into the Sutter Bypass under the Baseline and 55 w/WSAs Scenarios

Table 13.4-56. Average Total January–June Flow over the Tisdale Weir by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	0	0
D	96	9
BN	206	11
AN	1,019	49
W	1,650	-2
All	684	9

Table 13.4-57. Average Total July–December Flow over the Tisdale Weir by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	9	0
D	31	-13
BN	52	0
AN	91	-2
W	356	-45
All	137	-17

Table 13.4-58. Average Total Annual Flow over the Tisdale Weir by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	9	0
D	127	-4
BN	258	11
AN	1,110	47
W	2,006	-47
All	821	-8

Modeled monthly streamflows for Sacramento Slough at the downstream end of the Sutter Bypass for baseline and the 55 w/WSAs scenario are presented in the figure below. Average total annual streamflows for Sacramento Slough at the downstream end of the Sutter Bypass under the 55 w/WSAs scenario increase compared to baseline in below normal and above normal years and decrease in all other water year types, showing a decrease across all water year types. Under the 55 w/WSAs scenario, average total January through June streamflows show the largest increase compared to baseline in above normal years (91 TAF) and the largest decrease compared to baseline in critical years (41 TAF). Average total January through June streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in all water year types. Across all water year types, average total January through June streamflows under the 55 w/WSAs scenario are unchanged compared to baseline. Average total July through December streamflows under the 55 w/WSAs scenario decrease from baseline in all water year types, with the largest decrease occurring in wet years (94 TAF). Average total July through December streamflows under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario except in wet years. Across all water year types, average total July through December streamflows under the 55 w/WSAs scenario decrease by 41 TAF compared to baseline and are more similar to the Low Flow Alternative than the 55 scenario.

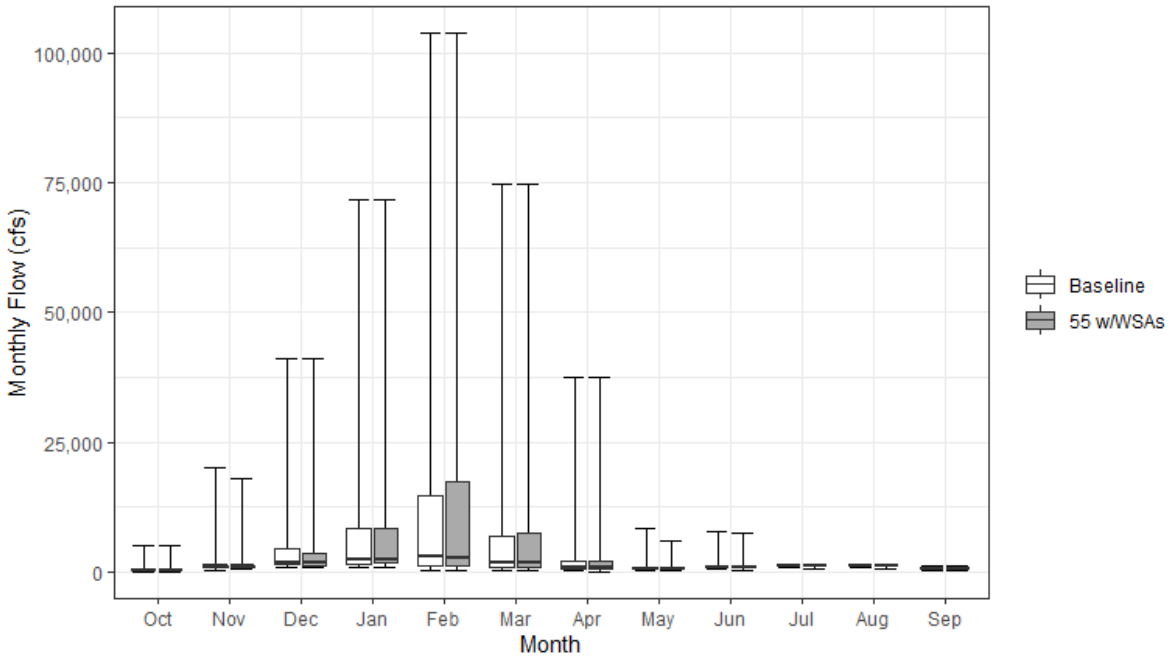


Figure 13.4-24. Monthly Streamflow at Sacramento Slough (Downstream End of Sutter Bypass) under the Baseline and 55 w/WSAs Scenarios

Table 13.4-59. Average Total January–June Flow at Sacramento Slough by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	377	-41
D	540	-6
BN	842	22
AN	2,338	91
W	4,463	-25
All	1,978	0

Table 13.4-60. Average Total July–December Flow at Sacramento Slough by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	332	-31
D	415	-23
BN	454	-7
AN	495	-10
W	1,038	-94
All	607	-41

Table 13.4-61. Average Total Annual Flow at Sacramento Slough by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	709	-72
D	955	-29
BN	1,296	15
AN	2,833	81
W	5,501	-119
All	2,585	-41

Voluntary Agreement Pathway

The Sutter and Yolo Bypasses fill with water from local runoff, agricultural return flows, and spills from the Sacramento River during high flow events. The VA pathway could have minor effects on agricultural return flow volumes due to land fallowing, but any resulting effects on flow in the Sutter and Yolo Bypasses would be very small. High flows on the Sacramento River are not expected to increase as a result of the VA pathway. SacWAM modeling does not show any meaningful change to flows in the Yolo Bypass (as shown in the figure below), however, the VA pathway would result in additional floodplain inundation at times in the Sutter Bypass. The VA pathway includes infrastructure modifications to Tisdale Weir, including a notch in the Tisdale Weir. The Tisdale Weir notch is one component of the Tisdale Weir Rehabilitation and Fish Passage Project, which is intended to rehabilitate the weir to extend the design life and also provide passage for fish to the Sacramento River. The VA pathway proposes to operate the Tisdale Weir notch to increase flows into the Sutter Bypass during December through mid-March. The proposed Tisdale Weir notch would reduce the amount of Sacramento River flow required to overtop the weir, causing higher and more frequent inundation of the Sutter Bypass. Below results are presented for flows in the Yolo Bypass below Putah Creek inflow, flow spilling over the Tisdale Weir, and flow at the bottom of the Sutter Bypass.

The VA scenario shows small changes (primarily early season reductions) in flow to the Yolo Bypass. Average total annual streamflows for the Yolo Bypass below Putah Creek inflow under the VA scenario decrease compared to baseline in all water year types, showing a small decrease across all water year types. Average total January through June streamflows show the largest decrease compared to baseline in below normal years (21 TAF), with a decrease of 13 TAF across all water year types. Average total July through December streamflows under the VA scenario show the largest decrease compared to baseline in above normal years (3 TAF) and increase compared to baseline by 6 TAF in below normal years. Across all water year types, average total July through December streamflows are unchanged compared to baseline.

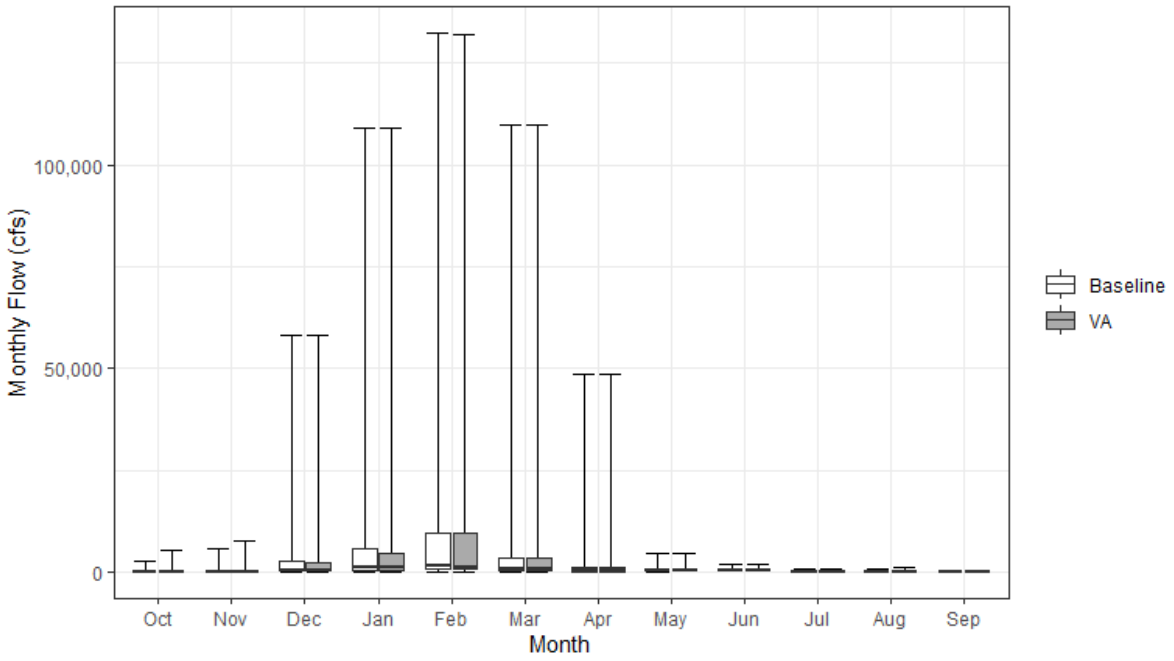


Figure 13.4-25. Monthly Streamflow for Yolo Bypass below Putah Creek Inflow under the Baseline and VA Scenarios

Table 13.4-62. Average Total January–June Flow for Yolo Bypass below Putah Creek Inflow by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	132	-12
D	185	-5
BN	439	-21
AN	1,797	-3
W	5,135	-19
All	1,920	-13

Table 13.4-63. Average Total January–June Flow for Yolo Bypass below Putah Creek Inflow by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	71	-1
D	90	-2
BN	116	6
AN	201	-3
W	663	-1
All	279	0

Table 13.4-64. Average Total Annual Flow for Yolo Bypass below Putah Creek Inflow by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	203	-13
D	275	-7
BN	555	-15
AN	1,998	-6
W	5,798	-20
All	2,199	-13

Modeled monthly streamflows for Tisdale Weir into Sutter Bypass under the baseline and VA scenarios are presented in the figure below. Average total annual streamflows for the Tisdale Weir into the Sutter Bypass under the VA scenario increase compared to baseline in all water year types. This pattern is driven by increases in average total January through June and July through December streamflows in all water year types. Average total January through June streamflows show the largest increase compared to baseline in below normal years (165 TAF), with an increase of 94 TAF across all water year types. Average total July through December streamflows under the VA scenario show the largest increase compared to baseline in wet years (44 TAF) with an increase of 23 TAF across all water year types.

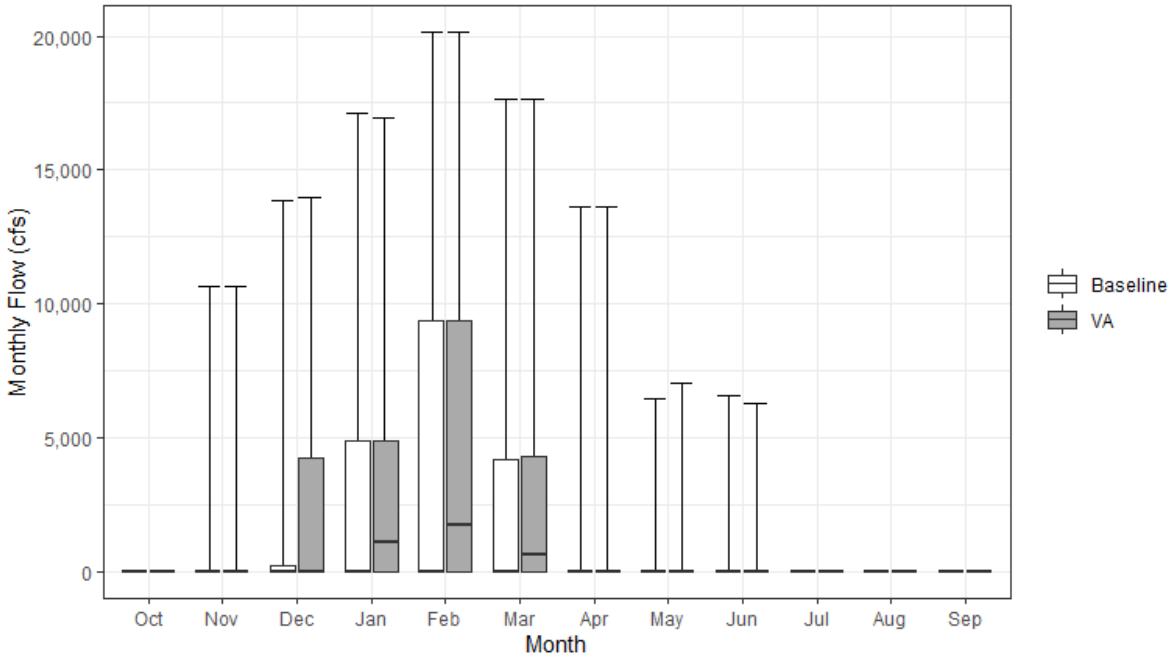


Figure 13.4-26. Monthly Streamflow over the Tisdale Weir into the Sutter Bypass under the Baseline and VA Scenarios

Table 13.4-65. Average Total January–June Flow over the Tisdale Weir by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	0	46
D	96	58
BN	206	165
AN	1,019	153
W	1,650	78
All	684	94

Table 13.4-66. Average Total July–December Flow over the Tisdale Weir by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	9	10
D	31	21
BN	52	5
AN	91	23
W	356	44
All	137	23

Table 13.4-67. Average Total Annual Flow over the Tisdale Weir by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	9	56
D	127	79
BN	258	170
AN	1,110	176
W	2,006	122
All	821	117

Modeled monthly streamflows for Sacramento Slough at the downstream end of the Sutter Bypass for baseline and the VA scenario are presented in the figure below. Average total annual streamflows for the Sacramento Slough under the VA scenario increase compared to baseline in all water year types. This pattern is driven by increases in average total January through June streamflows in all water year types and increases in average total July through December streamflows in all water year types except for below normal years. Average total January through June streamflows show the largest increase compared to baseline in below normal years (143 TAF), with an increase of 79 TAF across all water year types. Average total July through December streamflows under the VA scenario show the largest increase compared to baseline in wet years (28 TAF) and decrease compared to baseline by 15 TAF in below normal years. Across all water year types, average total July through December streamflows increase by 7 TAF under the VA scenario compared to baseline.

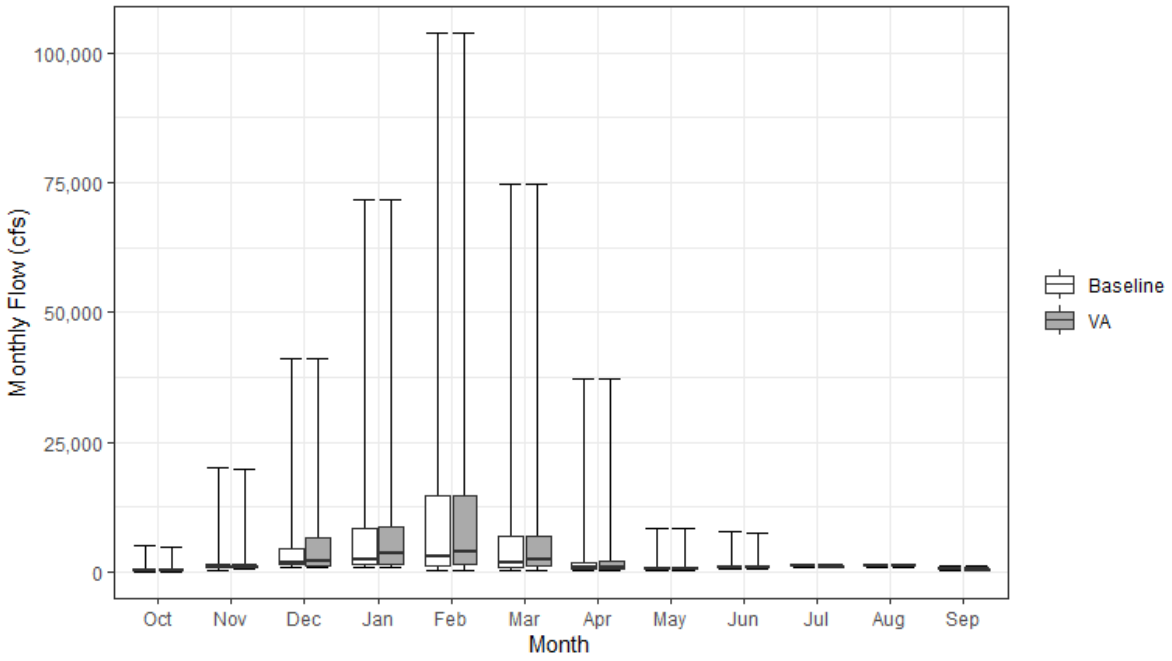


Figure 13.4-27. Monthly Streamflow at Sacramento Slough (Downstream End of Sutter Bypass) under the Baseline and VA Scenarios

Table 13.4-68. Average Total January–June Flow at Sacramento Slough by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	377	39
D	540	41
BN	842	143
AN	2,338	136
W	4,463	66
All	1,978	79

Table 13.4-69. Average Total July–December Flow at Sacramento Slough by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	332	7
D	415	0
BN	454	-15
AN	495	4
W	1,038	28
All	607	7

Table 13.4-70. Average Total Annual Flow at Sacramento Slough by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	709	46
D	955	41
BN	1,296	128
AN	2,833	140
W	5,501	94
All	2,585	86

Sacramento San-Joaquin Delta

Delta Inflow, Exports, Interior Delta Flows, and Delta Outflow

Delta Inflow

Regulatory Pathway

Delta inflow is the sum of tributary inflows, as well as local runoff to the Delta. Given the substantial development of storage on the larger regulated tributaries, the changes in Delta inflow under the 55 w/WSAs scenario resemble those seen for a regulated tributary. Monthly average Delta inflow under the 55 w/WSAs scenario generally falls between the baseline and 55 scenarios, showing increases from baseline in January and March through June and decreases from baseline in July through December and in February, as shown in the figure below. Generally, flows under the 55 w/WSAs scenario fall closest to modeled mean flows for the Low Flow Alternative in winter, spring, and summer months, and the 55 scenario in fall months.

The increase in spring Delta inflow is from flows bypassing reservoirs and diversions to meet the increased tributary inflow and inflow-based outflow requirements. The decrease during summer and fall results from a decrease in stored water available for export and salinity control. However, greater spring outflows push the salinity field downstream, reducing the volume of water needed to maintain salinity control during following months. Reductions during fall can also be caused by a reduced need to create flood space in reservoirs in anticipation of wet season inflows due to reduced carryover storage under higher storage conditions.

Although the timing of Delta inflow is altered, annual average Delta inflow is higher for all water year types except for critical years in the 55 w/WSAs scenario compared to baseline. The decrease in critical year inflow occurs during the July through December period due largely to reductions in flows being provided for export at the SWP and CVP pumping facilities. Annual average Delta inflow under the 55 w/WSAs scenario falls between baseline and the Low Flow Alternative in dry and above normal years, is similar to the Low Flow Alternative in below normal years and falls between the Low Flow Alternative and 55 scenario in wet years. In critical years, average Delta inflows decrease from baseline by 2 percent under the 55 w/WSAs scenario but increase under the flow scenarios (see Table 6.3-1 in Chapter 6, *Changes in Hydrology and Water Supply*).

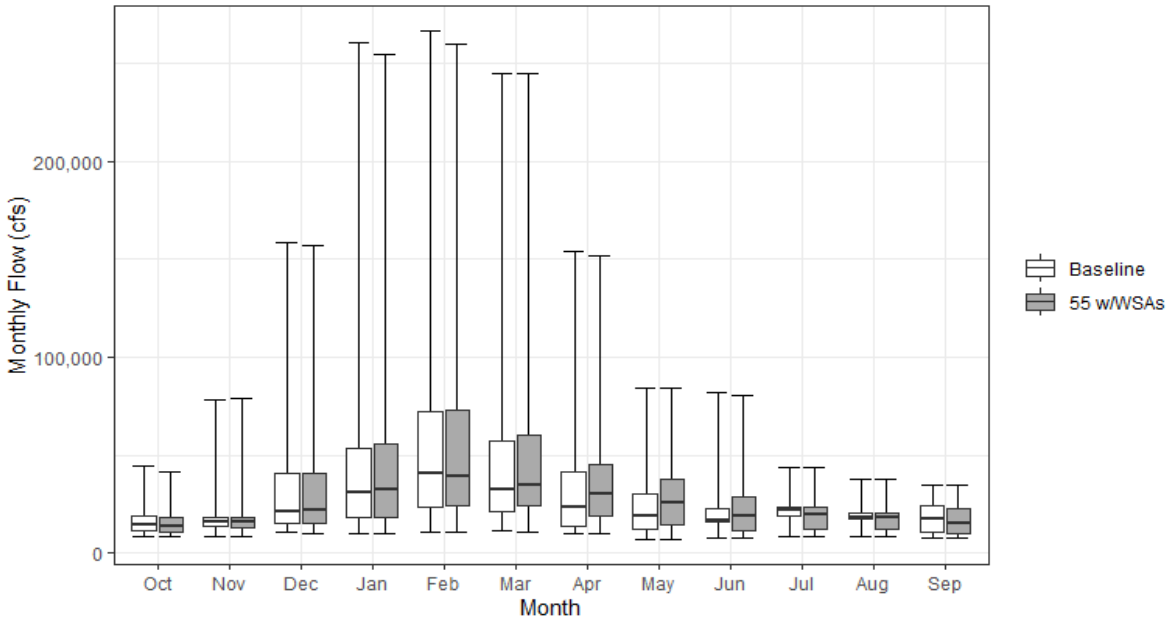


Figure 13.4-28. Monthly Delta Inflow under the Baseline and 55 w/WSAs Scenarios

Table 13.4-71. Average Total January–June Delta Inflow by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	5,261	94
D	7,025	658
BN	10,109	1,085
AN	16,181	1,001
W	25,321	366
All	13,986	602

Table 13.4-72. Average Total July–December Delta Inflow by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	4,463	-299
D	6,036	-631
BN	6,813	-589
AN	8,198	-568
W	10,780	-152
All	7,631	-417

Table 13.4-73. Average Total Annual Delta Inflow by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	9,724	-204
D	13,061	27
BN	16,922	497
AN	24,379	433
W	36,101	213
All	21,617	185

Voluntary Agreement Pathway

Model results for monthly mean Delta inflow under the VA scenario show an increase compared to baseline in the months of March through May and a decrease compared to baseline in the months of June through February, as shown in the figure below. Average total annual Delta inflow under the VA scenario decreases compared to baseline in critical and wet years and increases in all other water year types and shows an increase across all water year types. Under the VA scenario, the largest increase in average total January through June inflows occurs in dry years (334 TAF). Across all water year types, average total January through June Delta inflows increase by 163 TAF compared to baseline. The largest decrease in average total July through December inflows occurs in below normal years (171 TAF) and the smallest decrease occurs in dry years (3 TAF). Across all water year types, average total July through December Delta inflows decrease by 78 TAF compared to baseline.

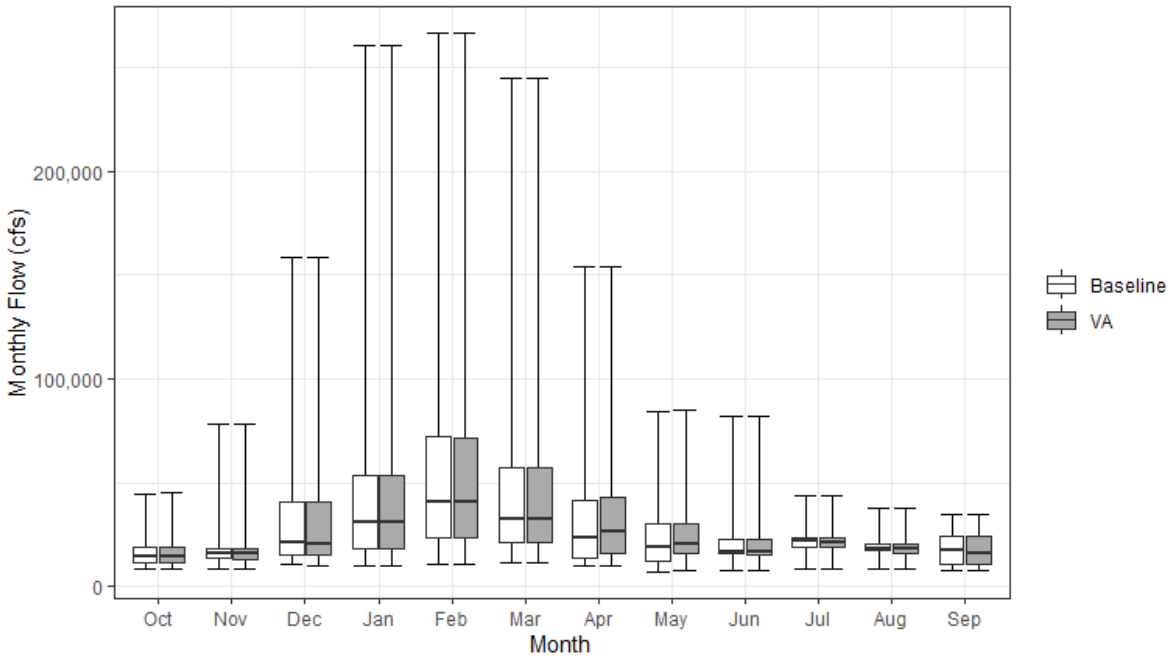


Figure 13.4-29. Monthly Delta Inflow under the Baseline and VA Scenarios

Table 13.4-74. Average Total January–June Delta Inflow by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	5,261	11
D	7,025	334
BN	10,109	283
AN	16,181	260
W	25,321	4
All	13,986	163

Table 13.4-75. Average Total July–December Delta Inflow by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	4,463	-60
D	6,036	-3
BN	6,813	-171
AN	8,198	-96
W	10,780	-77
All	7,631	-78

Table 13.4-76. Average Total Annual Delta Inflow by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	9,724	-49
D	13,061	331
BN	16,922	111
AN	24,379	164
W	36,101	-74
All	21,617	84

South of Delta Exports

Regulatory Pathway

Under existing conditions, between approximately one-third and half of the Sacramento/Delta water supplied is to south of Delta users via South Delta pumping facilities, with higher export rates in wetter years. The figure and tables below present SacWAM modeling results for average south of Delta exports for the baseline and 55 w/WSAs scenarios.

Overall, results suggest that annual average south of Delta exports for the 55 w/WSAs scenario fall between the baseline and 55 scenarios in all months except for April and May. Results for the 55 w/WSAs scenario show increases from baseline in April and May (due primarily to the difference in I:E assumptions between baseline and 55 w/WSAs discussed above), decreases from baseline in June through December, and minimal departures from baseline in January through March. During January through June, results show that south of Delta exports under the 55 w/WSAs scenario could increase in all water year types except dry and critical years compared to baseline as opposed to decreases in all water year types under the 55 scenario.

Across all water year types, average total January through June south of Delta exports under the 55 w/WSAs scenario could increase by 61 TAF compared to baseline, in contrast to a decrease under the 55 scenario and Low Flow Alternative. During July through December, south of Delta exports under the 55 w/WSAs scenario could decrease by 436 TAF compared to baseline, falling between the baseline and 55 scenarios in all water year types. Average total July through December south of Delta exports under the 55 w/WSAs scenario are more similar to reductions under the Low Flow Alternative than the 55 scenario in all water year types. Results suggest that annual average south of Delta exports under the 55 w/WSAs scenario could decrease in all water year types compared to baseline, with an annual average decrease of 375 TAF, a smaller reduction than the decrease shown under the 55 scenario and more similar to the annual change under the Low Flow Alternative (see Table 6.4-3 in Chapter 6, *Changes in Hydrology and Water Supply*).

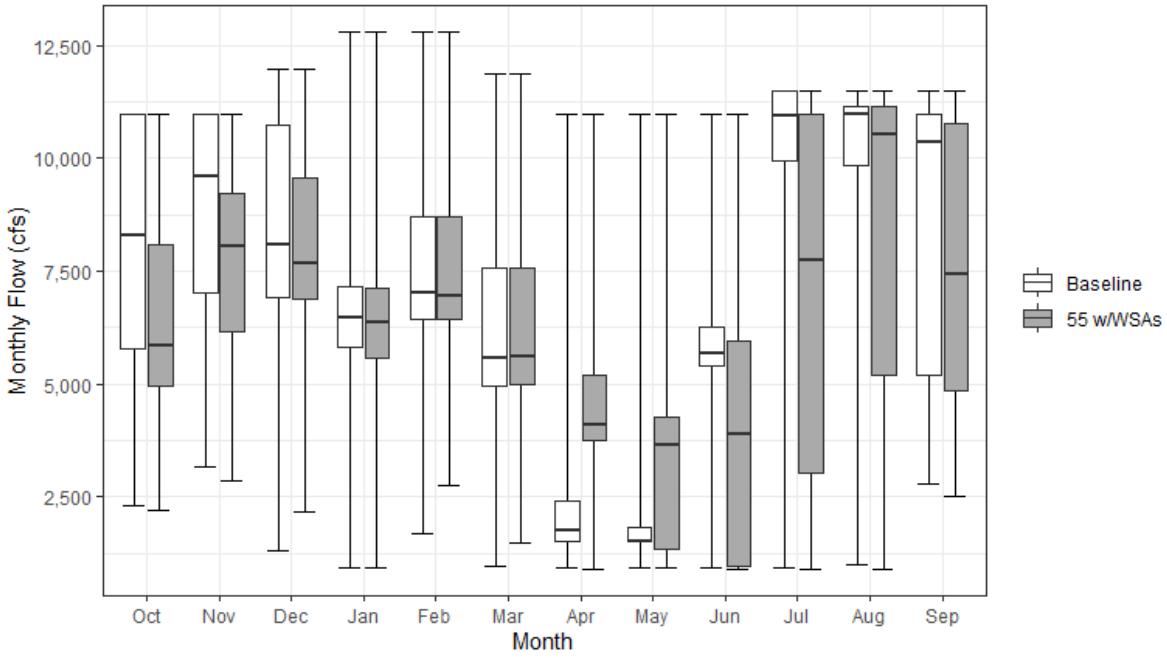


Figure 13.4-30. Monthly South of Delta Exports for the Baseline and 55 w/WSAs Scenarios

Table 13.4-77. Average Total January–June South of Delta Exports by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1,233	-93
D	1,567	-56
BN	1,694	163
AN	1,918	251
W	2,757	87
All	1,940	61

Table 13.4-78. Average Total July–December South of Delta Exports by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1,791	-292
D	2,988	-706
BN	3,455	-568
AN	3,565	-477
W	3,743	-214
All	3,183	-436

Table 13.4-79. Average Total Annual South of Delta Exports by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	3,023	-386
D	4,555	-762
BN	5,149	-405
AN	5,483	-226
W	6,499	-127
All	5,123	-375

Voluntary Agreement Pathway

As modeled, VA scenario exports increase relative to baseline in all but critical years, with a generally greater increase than the 55 w/WSAs. As with the 55 w/WSAs, increased exports occur in April and May. Furthermore, some market price and permanent State water purchases may be provided through exports reductions (up to 113 TAF on a long-term average). Thus, purchases may result in a reduction in the values presented below, though exports would still be expected to increase somewhat relative to baseline under the VA scenario.

Overall, results suggest that annual average south of Delta exports for the VA scenario would be higher than the baseline condition in April and May, with reductions in exports in March relative to baseline, as shown in the figure below. Average total January through June south of Delta exports could increase in all water year types except critical years under the VA scenario compared to baseline, with an average total January through June increase of 159 TAF across all water year types. The increases in exports during the spring could result in changes to interior Delta flows, including at the Lower San Joaquin River at Jersey Point (QWEST). Average total July through December south of Delta exports could decrease in all water year types compared to baseline, with an average total July through December decrease of 69 TAF across all water year types. Average total annual south of Delta exports could increase under the VA scenario in all water year types except critical years compared to baseline, with an annual average increase of 89 TAF across all water year types.

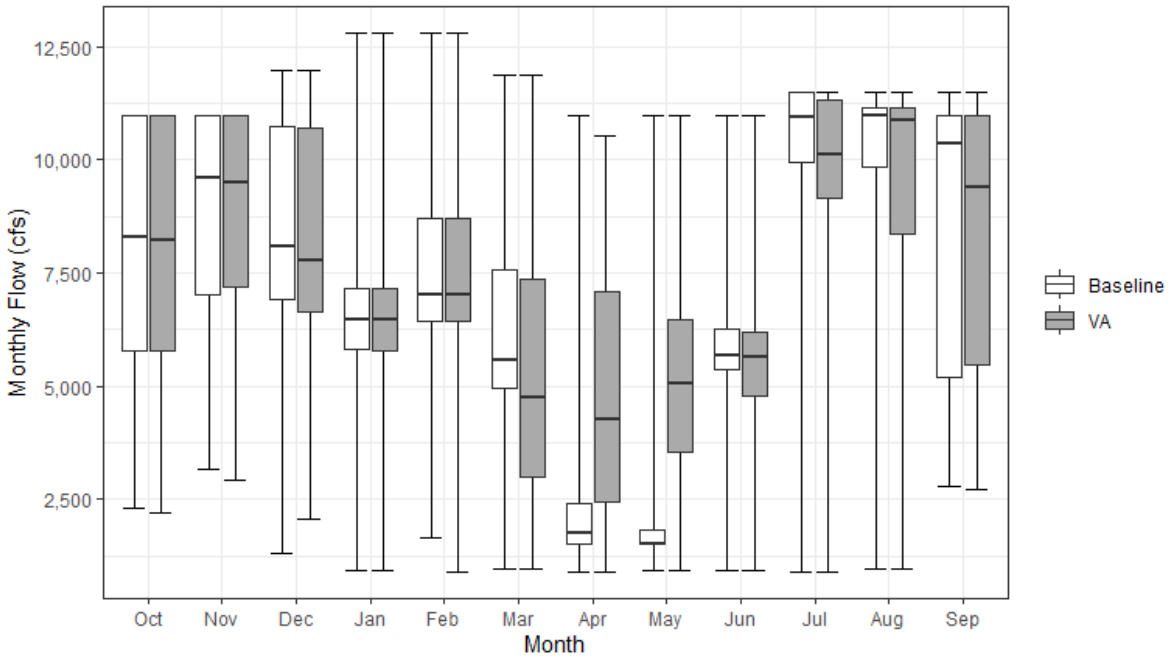


Figure 13.4-31. Monthly South of Delta Exports for the Baseline and VA Scenarios

Table 13.4-80. Average Total January–June South of Delta Exports by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	1,233	-23
D	1,567	116
BN	1,694	240
AN	1,918	222
W	2,757	210
All	1,940	159

Table 13.4-81. Average Total July–December South of Delta Exports by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	1,791	-38
D	2,988	-56
BN	3,455	-139
AN	3,565	-76
W	3,743	-49
All	3,183	-69

Table 13.4-82. Average Total Annual South of Delta Exports by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	3,023	-61
D	4,555	60
BN	5,149	101
AN	5,483	146
W	6,499	162
All	5,123	89

Interior Delta Flows

Regulatory Pathway

Water diversions at the SWP and CVP export facilities (in combination with other conditions) can cause changes in interior Delta flows, including OMR flows. The major freshwater source in the Delta, the Sacramento River, enters on the northern side of the Delta while the two major pumping facilities, the SWP and CVP, are in the south. This results in a net water movement across the Delta in a north-south direction along a web of channels including OMR instead of the more natural pattern from east to west or from land to sea. A negative value, or a reverse flow, indicates a net water movement across the Delta up the lower San Joaquin River and OMR channels to the export facilities. This section includes analyses of changes in interior Delta flows, including OMR flows and the net flow measured at QWEST.

Modeled interior Delta flows under the baseline and flow scenarios include restrictions on both SWP and CVP exports as a function of the San Joaquin River flows (I:E) during April and May that limit exports based on a ratio of San Joaquin River flows between 4 to 1 and 1 to 1. Under the 55 w/WSAs scenario this I:E constraint has been removed from the CVP. This change results in decreased (more negative) OMR flows and increased CVP exports in April and May. SacWAM results indicate that OMR reverse flows are less negative than baseline in the 55 w/WSAs scenario in the driest approximately two-thirds of conditions because exports are reduced to meet the higher Delta outflow requirements. In the remaining one-third of conditions SacWAM results indicate more negative OMR flows due to the difference in CVP I:E constraints between baseline and 55 w/WSAs.

The figure below presents the monthly exceedance frequency distribution of OMR net flow (cfs) for December–June under the baseline and 55 w/WSAs scenarios. The table below includes modeling results for the frequency of months exceeding OMR net flow thresholds, including: 0, -1,250, -2,500, and -5,000 cfs during December through June under the 55 w/WSAs and baseline scenarios. Under the 55 w/WSAs scenario, OMR net flows during 19% of months would be more positive than -1,250 cfs, compared to 27% of months under baseline. The 55 w/WSAs scenario would be expected to have OMR net flows more positive than the -2,500 cfs threshold in 35% of months and more positive than the -5,000 cfs threshold during 83% of months. Modeling results suggest that under baseline, OMR net flows would be more positive than the -2,500 cfs threshold in 31% of months and more positive than the -5,000 cfs threshold during 83% of months.

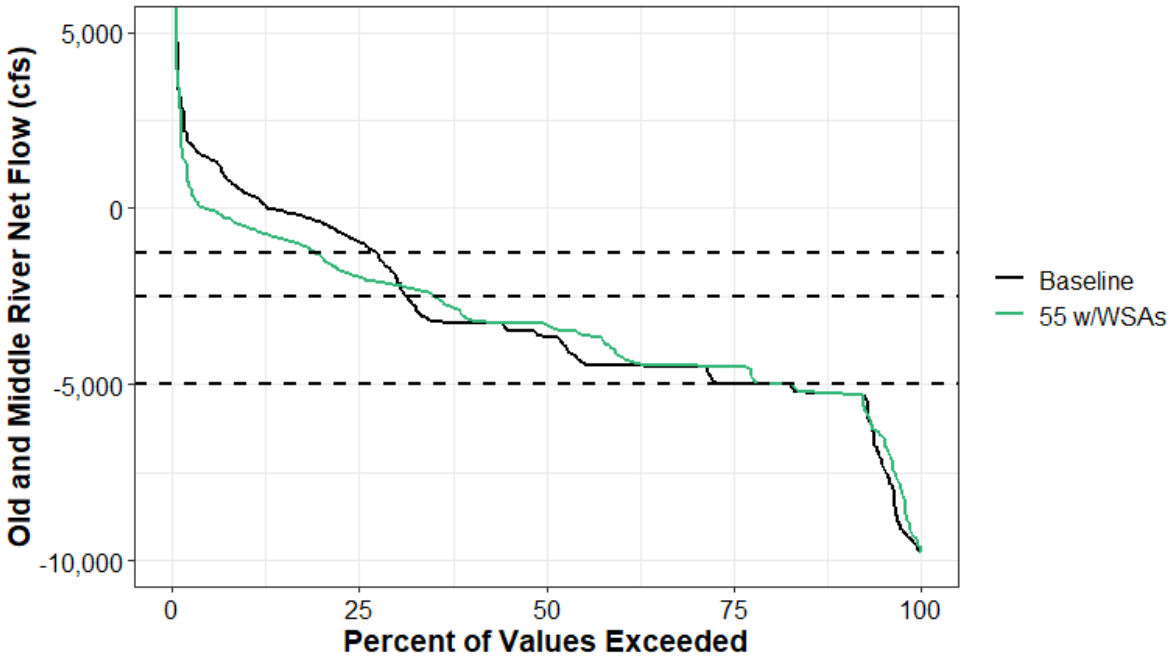


Figure 13.4-32. Monthly Exceedance Frequency Distribution of Old and Middle River Net Flow (cfs) for December–June under the Baseline and 55 w/WSAs Scenarios

Table 13.4-83. Frequency of Months Exceeding Old and Middle River Net Flow thresholds for December–June under Baseline and 55 w/WSAs

Threshold (cfs)	Baseline (%)	55 w/WSAs (%)
0	13	4
-1,250	27	19
-2,500	31	35
-5,000	83	83

The figure below presents monthly flows for QWEST under the baseline and 55 w/WSAs scenarios. As presented in the figure below, modeling results suggest that under the 55 w/WSAs scenario, QWEST would generally decrease during April relative to baseline and increase in all other months.

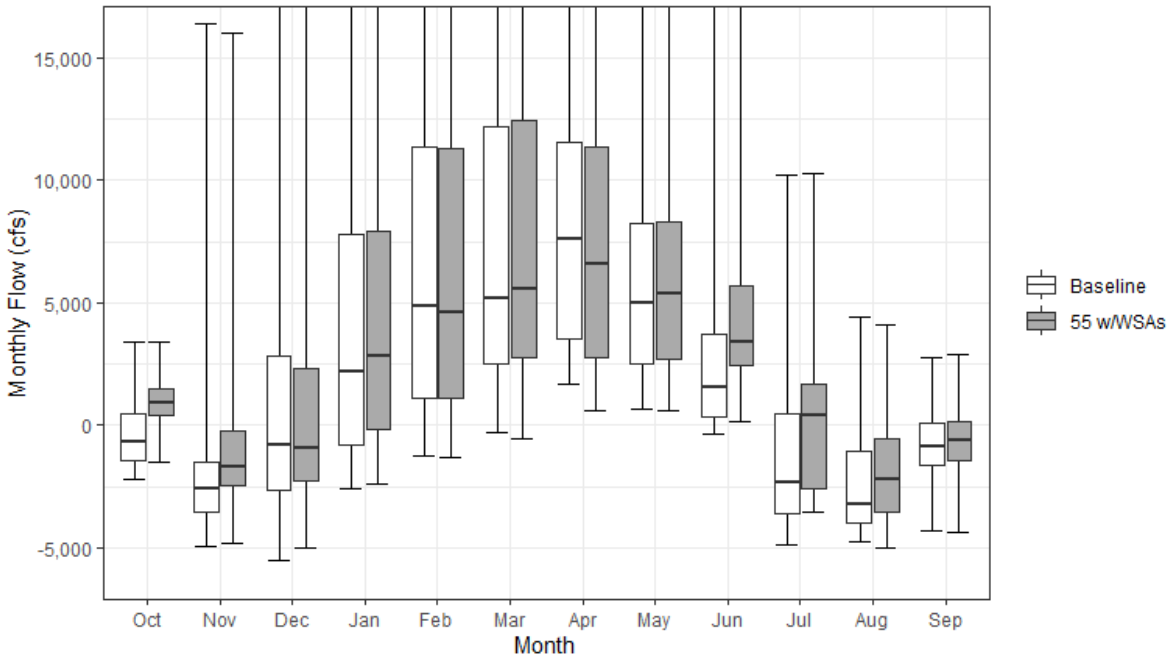


Figure 13.4-33. QWEST under the Baseline and 55 w/WSAs Scenarios

Voluntary Agreement Pathway

Under the VA pathway, in addition to elimination of the I:E constraints for the CVP discussed above, the more stringent I:E constraints that apply to the SWP under the baseline and flow scenarios would not apply to the SWP, consistent with provisions of the 2024 ITP which replaces the I:E constraints with the SWP HRL commitments for export reductions. Because the HRL reductions in exports are generally less than the export reductions that would result from the more stringent I:E requirements, SacWAM results indicate that there would be higher exports and more negative OMR flows under the VA pathway. The unspecified water purchases under the VA pathway could come from export reductions during April and May (see Section 9.5.3.9, *Delta Inflows, Exports, Interior Delta Flows, and Delta Outflow Results*). These possible export reductions are reflected in the VA High Export Cuts scenario evaluated in Chapter 9, *Proposed Voluntary Agreements*.

Consistent with the changes in April and May exports described above, under the VA scenario OMR flows are generally more negative than modeled in the 55 w/WSAs scenario. As in the discussion of exports, purchases of water for Delta outflow originating from export reductions would result in less negative OMR flows.

Modeling results for changes in OMR net flows in December through June are presented below as an exceedance frequency distribution plot. Overall, net negative OMR flows between 0 and -2,500 cfs could occur with greater frequency under the VA scenario, primarily due to the possibility for greater exports in April and May due to the removal of the I:E restrictions for the SWP and CVP compared to baseline. However, the frequency of net flows more negative than -5,000 cfs would not increase under the VA scenario. In addition, modeling results suggest that under the VA scenario, QWEST would generally decrease during April and May relative to baseline and increase in all other months. The modeling results described here are presented in the following figure.

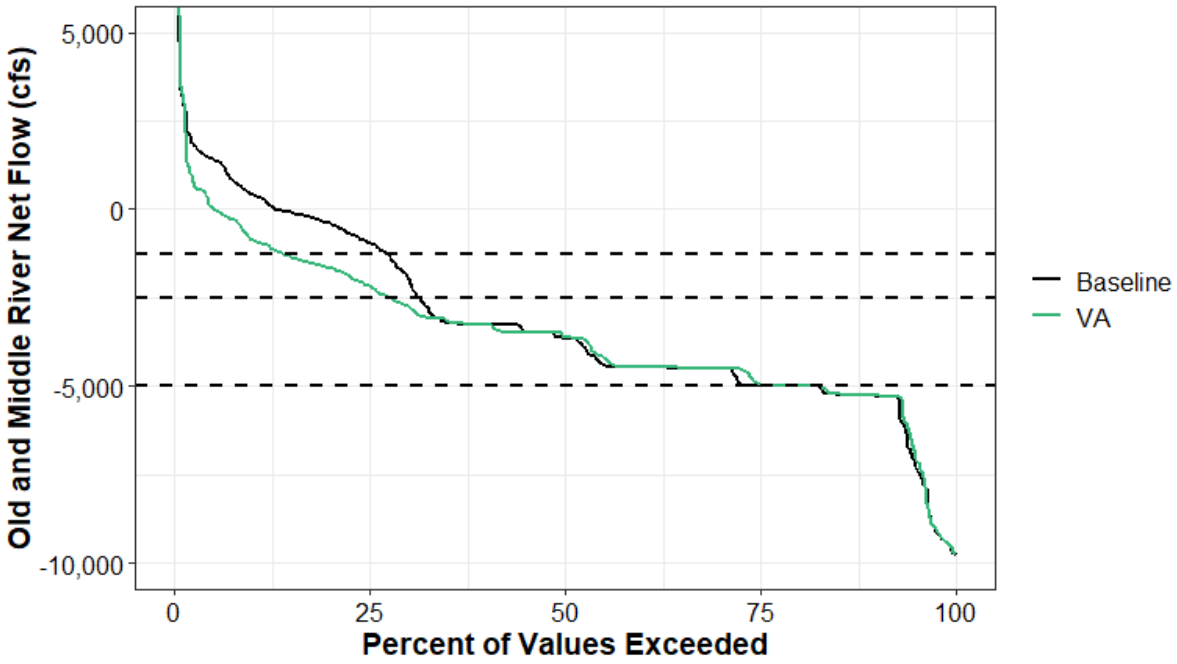


Figure 13.4-34. Monthly Exceedance Frequency Distribution of Old and Middle River Net Flow (cfs) for December–June under the Baseline and VA Scenarios

The table below includes modeling results of changes in OMR net flows for the following thresholds: 0, -1,250, -2,500, and -5,000 cfs during December through June under the VA scenario compared to baseline. Under the VA scenario, modeling results indicate that OMR net flows during 14% of these months would be expected to be more positive than -1,250 cfs, compared to 27% of months under baseline. The VA scenario would be expected to have OMR net flows more positive than the -2,500 cfs threshold in 27% of months and more positive than the -5,000 cfs threshold during 83% of months. Modeling results suggest that the baseline condition would have OMR net flows more positive than the -2,500 cfs threshold in 31% of months and more positive than the -5,000 cfs threshold during 83% of months.

Table 13.4-84. Frequency of Months Exceeding Old and Middle River Net Flow thresholds for December–June under Baseline and VA Scenarios

Threshold (cfs)	Baseline (%)	VA (%)
0	13	5
-1,250	27	14
-2,500	31	27
-5,000	83	83

In addition, modeling results suggest that under the VA scenario, QWEST would generally decrease during April and May relative to baseline and increase in all other months, as shown in the figure below. Results for QWEST under the VA High Export Cuts scenario are available in Chapter 9, *Proposed Voluntary Agreements*.

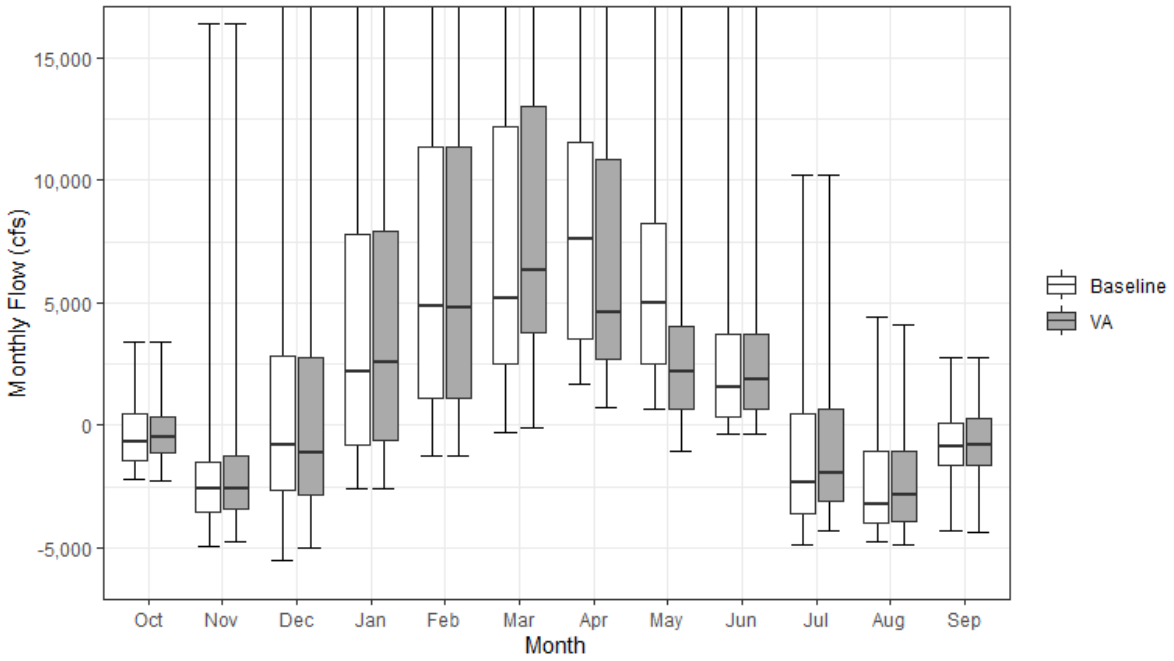


Figure 13.4-35. QWEST under the Baseline and VA Scenarios

Delta Outflow

This section provides SacWAM modeling results for Delta outflow under the 55 w/WSAs scenario and VA scenario. As discussed above in Section 13.4.2, *Modeling Approach*, in 2018 the State Water Board approved updates to the Bay-Delta Plan's LSJR flow objectives and program of implementation (as well as southern Delta salinity updates) which included preparation of environmental documentation. The Board is in the process of implementing those updates through a regulation. Following which, the 2018 LSJR flow objectives will be in effect unless HRL proposals are approved on one or more of the LSJR tributaries. The Board is moving forward with a process to consider updates to the Bay-Delta Plan's LSJR flow objectives that were approved in 2018 to consider the Tuolumne River HRL proposal through a supplemental environmental review process.

The volume contributed to Delta outflow by the Tuolumne River HRL proposal and implementation of the LSJR flow objectives of the 2018 Bay-Delta Plan are summarized below. Potential effects of implementing the Tuolumne HRL commitments or the LSJR 40 percent unimpaired flow (40% UF) objectives from the 2018 Bay-Delta Plan are not included in post-processing of SacWAM results for Delta outflow presented below, because the flow contributions from these sources are subject to decision-making under a separate process. The expected contributions to Delta outflow of implementing the Tuolumne HRL commitments, including the possibility of protecting one or two pulse flows as Delta outflow, or implementing the 40 percent unimpaired flow objectives from the 2018 Bay-Delta Plan on the Merced and Stanislaus Rivers or all three LSJR tributaries are shown separately below for different water year types and on average across all years. These additional sources of Delta outflow are also evaluated in the analysis of the expected benefits of the revised proposed Plan amendments (see Section 13.5, *Beneficial Environmental Effects*). Further analysis in Chapter 13, *Revised Proposed Plan Amendments*, evaluates the respective ends of the range of reasonably foreseeable near-term contributions from the LSJR tributaries, with a lower bound of Tuolumne HRL commitments and an upper bound of full implementation of 40 percent unimpaired

flow objectives for all three tributaries. Other combinations of near-term outcomes fall within this range.

The Tuolumne HRL proposal does not include information regarding how the CVP and SWP would bypass Tuolumne flow commitments through the Delta, so two scenarios are presented based on input from the Tuolumne HRL participants and DWR. The first scenario assumes that the Tuolumne HRL flows provided from March 16 through May 31, covering both the Tuolumne HRL proposal floodplain and outmigration pulses would be accounted for as additive Delta outflow (referred to as "Tuolumne VA 1-Pulse"). The second scenario assumes that only flows provided from April 16 through May 31 during the outmigration pulse would be accounted for as additive Delta outflow (referred to as "Tuolumne VA 2-Pulse"). Estimates of potential flow contributions from LSJR tributaries are based on modeling information developed for the draft Scientific Basis Report Supplement for the Tuolumne River Voluntary Agreement Proposal (SWRCB et al. 2025), extended as necessary to represent the 1923-2021 period summarized in SacWAM results, and averaged by Sacramento 40-30-30 water year types.

Table 13.4-85. Potential Flow Contributions from the Tuolumne VA and 2018 LSJR 40% Unimpaired Flow Alternative

Water Year Type	Tuolumne VA – 1-Pulse (TAF/yr)	Tuolumne VA – 2-Pulse (TAF/yr)	Merced and Stanislaus 40% UF (TAF/yr)	LSJR 40% UF Alternative (TAF/yr)
C	9	20	144	312
D	34	51	219	435
BN	18	31	244	431
AN	5	9	253	385
W	-32	-27	233	276
All	3	13	220	360

Regulatory Pathway

SacWAM results presented in the figure below show that monthly average Delta outflow would increase under the 55 w/WSAs scenario compared to baseline during January and March through June. As also shown in the figure, monthly average Delta outflow also increases compared to baseline during October and November, and decreases slightly during July through September, December, and February. Average total annual Delta outflow would increase compared to baseline in all water year types. Annual average Delta outflow increases in all water year types under the 55 w/WSAs scenario, falling closer to the Low Flow Alternative than the 55 scenario in all water year types (see Table 6.3-2 in Chapter 6, *Changes in Hydrology and Water Supply*). Increased annual average Delta outflow would primarily result from increases during January through June in all water year types. Average total January through June Delta outflow would be expected to increase under the 55 w/WSAs scenario across all water year types and would be more similar to the Low Flow Alternative than the 55 scenario (see Table A1-102 and Table A1-103 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). The largest increases would occur in below normal years under the 55 w/WSAs scenario.

Average total July through December Delta outflow under the 55 w/WSAs scenario would increase compared baseline in critical, dry, and wet years, and decrease slightly compared to baseline in below normal and above normal years. The largest increases would occur in dry years , and the

largest decreases would occur in above normal years . Across all water year types, average total July through December Delta outflow would be expected to increase and would be more similar to the Low Flow Alternative than the 55 scenario.

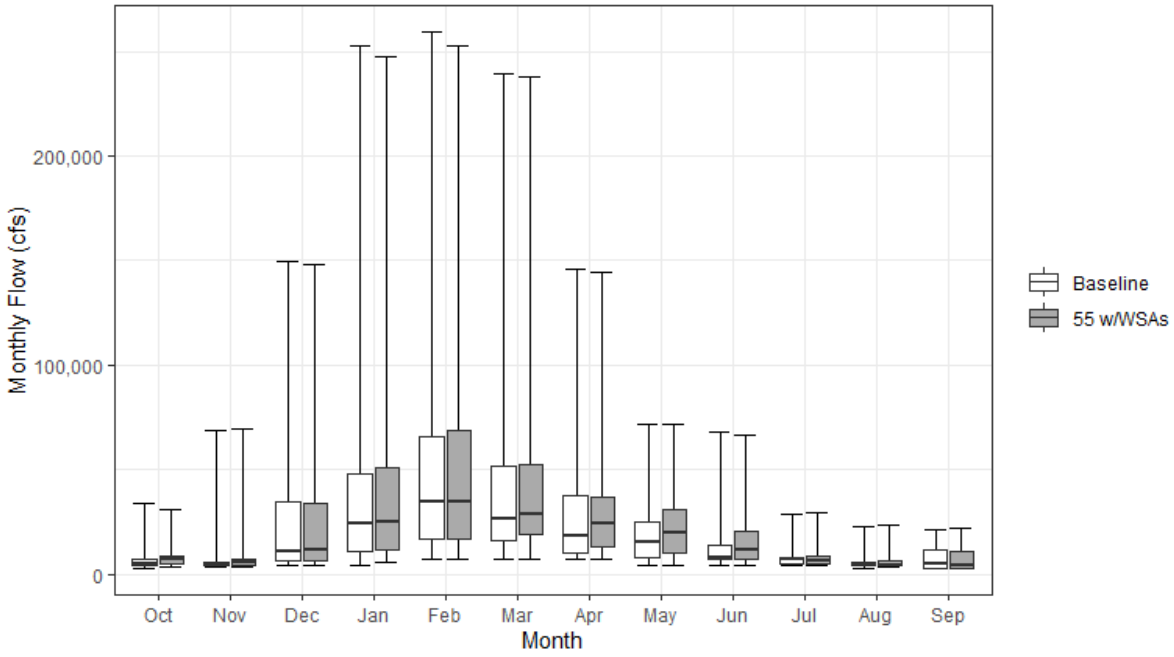


Figure 13.4-36. Monthly Delta Outflow under the Baseline and 55 w/WSAs Scenarios

Table 13.4-86. Average Total January–June Delta Outflow by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	3,555	194
D	5,025	709
BN	8,064	914
AN	14,056	740
W	22,447	277
All	11,745	538

Table 13.4-87. Average Total July—December Delta Outflow by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1,892	5
D	2,300	83
BN	2,603	-17
AN	3,911	-79
W	6,391	65
All	3,727	26

Table 13.4-88. Average Total Annual Delta Outflow by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	5,447	199
D	7,324	792
BN	10,667	897
AN	17,967	660
W	28,837	342
All	15,472	564

Voluntary Agreement Pathway

SacWAM results presented in the figure below show that under the VA scenario, the largest increase in monthly average Delta outflow would occur in March and April, and smaller changes would occur in other months. As also shown in the figure, Delta outflow would decrease on average during September through December, February, and May.

Average total annual Delta outflow under the VA scenario would increase in all water year types, except wet years. The largest increase in annual Delta outflow would occur in dry years, and annual Delta outflow would be expected to decrease in wet years but to a lesser extent.

Model results indicate that Delta outflow would increase during January through June in all water year types except for wet years. Under the VA scenario, the largest increase in average total January through June Delta outflow would be expected in dry years , and a decrease would be expected in wet years but to a lesser extent. Across all years, total January through June Delta outflow would be expected to increase.

Model results indicate that Delta outflow would decrease during July through December in all water year types except for dry years. Under the VA scenario, the largest decrease in average total July through December Delta outflow would be expected in below normal years , and an increase would be expected in dry years. Across all years, total July through December Delta outflow would be expected to decrease .

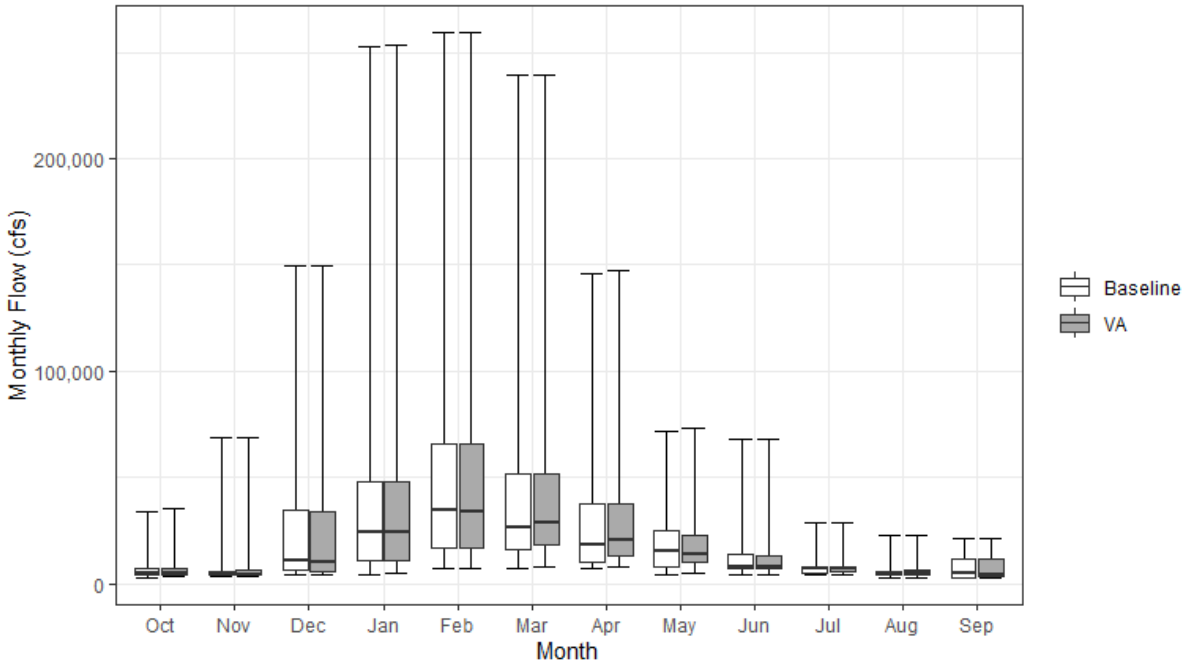


Figure 13.4-37. Monthly Delta Outflow under the Baseline and VA Scenarios

Table 13.4-89. Average Total January–June Delta Outflow by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	3,555	107
D	5,025	398
BN	8,064	131
AN	14,056	188
W	22,447	-78
All	11,745	130

Table 13.4-90. Average Total July—December Delta Outflow by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	1,892	-22
D	2,300	54
BN	2,603	-32
AN	3,911	-18
W	6,391	-28
All	3,727	-8

Table 13.4-91. Average Total Annual Delta Outflow by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	5,447	85
D	7,324	452
BN	10,667	99
AN	17,967	170
W	28,837	-106
All	15,472	122

Streamflows in Other Regions

Regulatory Pathway

SacWAM results show that Sacramento/Delta supplies to other regions under the 55 w/WSAs scenario would be reduced compared to baseline conditions. On average across all water year types, reductions in Sacramento/Delta supplies to other regions would be less than under the 55 scenario and would be more similar to those under the Low Flow Alternative. These changes could affect the levels in export reservoirs in the Bay Area, San Joaquin Valley, Central Coast, and Southern California regions that receive Sacramento/Delta supplies. In response to reduced Sacramento/Delta supplies, reservoir operators could reduce the demand on the reservoirs or reduce storage in the reservoirs. Either response could result in lower streamflows below the reservoirs.

Consistent with provisions in Section 4.4.10.1 of the December 2025 revised draft Bay-Delta Plan that implementation of the Bay-Delta Plan does not result in redirected impacts to native fish and wildlife resources in the Trinity River watershed, including temperature and instream flow impacts, modeled imports to the Sacramento River through the Clear Creek Tunnel in the 55 w/WSAs and other flow scenarios were limited to be no more than in the baseline scenario (see Section A1.8.1, *Trinity Imports*, of Appendix A1). Accordingly, streamflows in the Trinity River are not expected to change under the regulatory pathway.

Export reservoirs in other regions and their receiving streams are not explicitly modeled in SacWAM. As discussed in Section 6.3.1.4, *Streamflows in Other Regions*, many of the streams below the export reservoirs have streamflow requirements that would not allow for reductions below the historical minimum flows. However, some of these streamflow requirements are based on hydrologic conditions or reservoir storage; if reservoir storage is reduced, the streamflow requirements are also reduced. Further, it is possible that flow requirements may change in the future. Therefore, there is uncertainty in how reservoir operators may respond to changes in Sacramento/Delta supplies, and it is possible that streamflows below export reservoirs receiving Sacramento/Delta supplies could be reduced. Changes in reservoir storage in other regions are discussed further below.

Overall, because reductions in Sacramento/Delta supplies to other regions under the 55 w/WSAs scenario are generally more similar to the Low Flow Alternative than the 55 scenario, changes in reservoir operations and streamflows below export reservoirs would be expected to be less than under the 55 scenario and more similar to the Low Flow Alternative.

Voluntary Agreement Pathway

The VA pathway could also affect streamflows and reservoir levels in other regions. Specifically, changes in Sacramento/Delta supplies could potentially affect reservoir levels in export reservoirs located outside of the Sacramento/Delta watershed that receive Sacramento/Delta supplies and could potentially affect streamflows below export reservoirs. These changes are not modeled in SacWAM except for San Luis Reservoir. Results for San Luis Reservoir show that storage in San Luis Reservoir could change compared to baseline. Changes to storage in other export reservoirs would be expected to be small.

Consistent with provisions in Section 4.4.10.1 of the December 2025 revised draft Bay-Delta Plan that implementation of the Bay-Delta Plan does not result in redirected impacts to native fish and wildlife resources in the Trinity River watershed, including temperature and instream flow impacts, modeled imports to the Sacramento River through the Clear Creek Tunnel in the VA scenario were limited to be no more than in the baseline scenario (see Section H1a.3.1, *Updates to the Voluntary Agreements Scenario*, of Appendix H1a). Accordingly, streamflows in the Trinity River are not expected to change under the VA pathway.

As discussed below under Section 13.4.4, *Changes in Surface Water Supply*, the SacWAM results indicate that the VA scenario could potentially result in a slight increase in Sacramento/Delta supplies to other regions, so export reservoir levels would likely be similar to or slightly higher than baseline. However, the VA scenario could also result in reduced Delta exports as a result of additional HRL flow contributions that would be provided through unspecified water purchases. If these flows are provided through additional water purchases from south of Delta sellers, Delta exports could be reduced, which could result in slight reductions in San Luis Reservoir and other export reservoir levels. Similarly, streamflows below export reservoirs are not modeled, but would likely be similar to baseline under the VA pathway.

Summary of Changes in Flows

Regulatory Pathway

Overall, the 55 w/WSAs scenario would result in increased flows in many locations in the Sacramento/Delta watershed on a seasonal or annual basis. Compared to baseline conditions, model results show increased streamflows under the 55 w/WSAs scenario on many Sacramento/Delta tributaries during January through June and decreased streamflows during July through December (e.g., lower American and Feather Rivers). However, on some tributaries, streamflows are expected to increase during both January through June and July through December (e.g., lower Calaveras River) or decrease during January through June and remain unchanged or increase slightly during July through December (e.g., lower Bear River). For unregulated tributaries with low surface water demand, streamflows generally remain unchanged in the 55 w/WSAs scenario. For unregulated tributaries with higher surface water demand, streamflows generally remain unchanged during the winter months and increase during the spring through fall irrigation season. Although results for the 55 w/WSAs scenario vary among individual Sacramento/Delta tributaries, in general, modeled streamflows under the 55 w/WSAs scenario are more similar to those under the Low Flow Alternative than the 55 scenario, generally showing the largest increases compared to baseline in the spring months and the largest decreases compared to baseline in the summer months.

Given the substantial development of storage on the larger regulated tributaries, the changes in Delta inflow under the 55 w/WSAs scenario resemble those seen for a regulated tributary. Monthly

average Delta inflow under the 55 w/WSAs scenario generally falls between the baseline and 55 scenarios, showing increases from baseline in January and March through June and decreases from baseline in July through December and in February. Generally, flows under the 55 w/WSAs scenario fall closest to modeled mean flows for the Low Flow Alternative in winter, spring, and summer months, and the 55 scenario in fall months. Although the timing of Delta inflow is altered under the 55 w/WSAs scenario, annual average Delta inflow is higher under the 55 w/WSAs scenario compared to baseline.

SacWAM modeled results show that monthly average Delta outflow would increase under the 55 w/WSAs scenario compared to baseline during January and March through June. Monthly average Delta outflow also increases compared to baseline during October and November, and decreases during July through September, December, and February. Average total annual Delta outflow would increase compared to baseline in all water year types.

Voluntary Agreement Pathway

As discussed in Section 13.2, *Planning Process*, the MOU proposing HRL commitments proposes a combination of flow and non-flow habitat restoration actions on the American, Feather, Sacramento, Yuba, Mokelumne, and Bear Rivers, Putah Creek, Auburn Ravine, and in the Delta. Accordingly, modeling results for the VA scenario show changes in streamflows on the American, Feather, Sacramento, Yuba, and Mokelumne Rivers, on Putah Creek, and in the Delta, and changes in streamflows are expected for the Bear River and Auburn Ravine, although these flow commitments were not modeled in SacWAM. For tributaries with HRL commitments, model results generally show an increase from baseline for January through June and a decrease from baseline for July through December, but with smaller departures from baseline compared to the 55 w/WSAs scenario. Average total annual Delta inflow under the VA scenario decreases compared to baseline in critical and wet years and increases in all other water year types and shows an increase across all water year types.

Seasonal total Delta outflow increases for the VA scenario during January through June, except for wet years. Changes in seasonal total Delta outflow for July through December are mixed, with reductions in some year types in the VA scenario. For the VA scenario, increases in Delta outflow are most noticeable in March and April.

As discussed in Section 13.3.4, *Voluntary Agreement Pathway*, the VA pathway would apply to the water rights that are part of approved HRLs (i.e., the specific water rights identified in Appendix B.1 of the revised proposed Plan amendments), during the term of the VA pathway. Under the VA pathway, water rights that are not part of approved HRLs would be subject to the regulatory pathway. The SacWAM modeling of the VA scenario is focused on the HRL flow contributions identified in the MOU and does not apply the regulatory pathway for water rights not included as part of approved HRL proposals, which would result in additional changes in hydrology during the term of the VA pathway that would be most pronounced for non-HRL regions and would more closely resemble changes in hydrology under the 55 w/WSAs scenario for these water rights. However, as discussed above, the specific water rights identified in Appendix B.1 constitute the majority of the water diverted and used within the Sacramento/Delta watershed. At the watershed scale, during the term of the VA pathway, changes in hydrology would be expected to be similar to those estimated by the SacWAM modeling of the VA scenario, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway.

13.4.3.2 Reservoir Storage and Elevation

This section presents SacWAM results for changes in reservoir storage under the 55 w/WSAs scenario and the VA scenario. Results are first presented for rim reservoirs in the Sacramento/Delta watershed. A summary of changes in upper watershed reservoir storage is also provided. This section also discusses total carryover storage by tributary watershed. In addition, this section discusses changes in reservoir storage in other regions of the study area. This section concludes with a summary of changes in reservoir storage.

This section presents results in tabular format and using exceedance curves. An exceedance curve shows the frequency with which a given value is equaled or exceeded within a data set. In this document, exceedance curves are plotted with the percent of values equaled or exceeded on the x-axis, and the variable of concern on the y-axis. Chapter 6, *Changes in Hydrology and Water Supply*, provides additional information about exceedance curves.

Sacramento River Watershed and Delta Eastside Tributaries Rim Reservoirs

This section presents a summary of findings related to the SacWAM results for end-of-April and end-of-September reservoir storage for major storage reservoirs located on Sacramento/Delta tributaries. The storage patterns for the rim reservoirs and reservoirs in the upper watersheds above the rim reservoirs are discussed separately below. Finally, potential changes to reservoir storage for export reservoirs are discussed. Appendix H1a2*, Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*, also presents summary graphs and tables for end-of-April and end-of-September reservoir storage and elevation for modeled reservoirs under the 55 w/WSAs scenario and VA scenario. The end-of-April values are presented to represent the storage at the end of the wet season going into the irrigation season. The end-of-September values were chosen to represent carryover storage because they are at the end of the dry season and prior to the typical onset of fall precipitation. The end-of-September values are the initial condition for the reservoir in a new water year and serve as a safety factor for water supply and downstream flow control. Without carryover storage, a dry year or series of dry years could leave reservoirs empty, or with no water remaining to meet outflow and downstream temperature requirements. While greater levels of carryover storage increase certainty of supply and downstream control, they leave less space to capture additional water during the wet season.

Results in this section are first presented for the 55 w/WSAs scenario, followed by results for the VA scenario.

Regulatory Pathway

Overall, operations of the rim reservoirs are constrained under the 55 w/WSAs scenario because new instream flow requirements limit the ability to store water in spring and cold water pool requirements limit how far rim reservoirs can be drawn down in the drier years. In general, this results in lower storage at the end of April entering the irrigation season, and less total water being released in summer months. The actual level of a given reservoir could differ from that modeled as operations are refined with increased understanding of actions needed to protect cold water habitat.

Summaries of reservoir storage included in this section are shown to characterize the type of changes in reservoir operation throughout the Sacramento River watershed and Delta eastside tributaries regions. Model results for the following rim reservoirs are provided below as exceedance frequency charts for end-of-April and end-of-September storage: Black Butte Reservoir (Stony

Creek), Camanche Reservoir (Mokelumne River), Camp Far West Reservoir (Bear River), Clear Lake (Cache Creek), Folsom Reservoir (American River), Lake Berryessa (Putah Creek), New Bullards Bar Reservoir (Yuba River), New Hogan Reservoir (Calaveras River), Oroville Reservoir (Feather River), Pardee Reservoir (Mokelumne River), Shasta Reservoir (Sacramento River), and Whiskeytown Reservoir (Clear Creek).

End-of-April storage is typically lower in the 55 w/WSAs scenario than baseline because the unimpaired flow requirements require a bypass of reservoir inflow, whereas in the baseline scenario, all reservoir inflow that is not required to be released for existing flow requirements, existing downstream demand, or flood control is stored. The times when end-of-April storage is higher in the 55 w/WSAs scenario than baseline occur when the end-of-September storage from the previous year was sufficiently higher to carry through to April. This can occur during drier years, when flood control releases are not necessary.

In general, for the 55 w/WSAs scenario, the rim reservoirs are operated similarly or more conservatively than under baseline conditions, meaning they show either increases in carryover storage or relatively minor decreases in carryover storage. The purpose of simulating this type of reservoir operation is to maintain as much or more cold water pool for use at the end of the season than under baseline conditions, as a representation of the cold water narrative objective. Appendix H1a, *Sacramento Water Allocation Model Methods*, and Appendix A1c, *Preliminary Assessment of Effect of Reservoir Storage on Reservoir Release Temperatures*, provide more detail on how the carryover targets were developed and how they were implemented in SacWAM.

The tables below present average end-of-April storage and percent differences from baseline in rim reservoirs for all years and critical years, and average end-of-September storage and percent differences from baseline in rim reservoirs for all years and critical years. This is followed by results for individual reservoirs under the 55 w/WSAs scenario.

Table 13.4-92. Average End-of-April Storage and Percent Differences from Baseline in Rim Reservoirs in the 55 w/WSAs Scenario for All Years

Reservoir	Baseline TAF	55 w/WSAs TAF / (%)
Black Butte Reservoir	112	-24 / (-22)
Camanche Reservoir	294	-16 / (-6)
Camp Far West	92	-3 / (-3)
Clear Lake	1,078	-25 / (-2)
Folsom Lake	797	-50 / (-6)
Lake Berryessa	1,178	-59 / (-5)
New Bullards Bar Reservoir	818	-34 / (-4)
New Hogan Reservoir	174	-17 / (-10)
Oroville Reservoir	2,946	-285 / (-10)
Pardee Reservoir	174	-10 / (-6)
Shasta Lake	4,084	-13 / (-0)
Whiskeytown Reservoir	233	-3 / (-1)

Table 13.4-93. Average End-of-April Storage and Percent Differences from Baseline in Rim Reservoirs in the 55 w/WSAs Scenario for Critical Years

Reservoir	Baseline TAF	55 w/WSAs TAF / (%)
Black Butte Reservoir	59	-24 / (-41)
Camanche Reservoir	171	21 / (12)
Camp Far West	85	-8 / (-10)
Clear Lake	936	-20 / (-2)
Folsom Lake	500	23 / (5)
Lake Berryessa	808	12 / (1)
New Bullards Bar Reservoir	663	-67 / (-10)
New Hogan Reservoir	94	8 / (8)
Oroville Reservoir	1,892	-43 / (-2)
Pardee Reservoir	166	-28 / (-17)
Shasta Lake	2,880	251 / (9)
Whiskeytown Reservoir	228	-2 / (-1)

Table 13.4-94. Average Carryover Storage and Percent Differences from Baseline in Rim Reservoirs in the 55 w/WSAs Scenario for All Years

Reservoir	Baseline TAF	55 w/WSAs TAF / (%)
Black Butte Reservoir	52	-10 / (-20)
Camanche Reservoir	243	-11 / (-4)
Camp Far West	50	-0 / (-0)
Clear Lake	876	-9 / (-1)
Folsom Lake	606	-19 / (-3)
Lake Berryessa	969	-43 / (-4)
New Bullards Bar Reservoir	597	-19 / (-3)
New Hogan Reservoir	99	3 / (4)
Oroville Reservoir	2,057	-141 / (-7)
Pardee Reservoir	188	-5 / (-3)
Shasta Lake	2,871	3 / (0)
Whiskeytown Reservoir	234	0 / (0)

Table 13.4-95. Average Carryover Storage and Percent Differences from Baseline in Rim Reservoirs in the 55 w/WSAs Scenario for Critical Years

Reservoir	Baseline TAF	55 w/WSAs TAF / (%)
Black Butte Reservoir	25	-5 / (-19)
Camanche Reservoir	120	30 / (25)
Camp Far West	35	1 / (4)
Clear Lake	807	-13 / (-2)
Folsom Lake	369	17 / (5)
Lake Berryessa	610	28 / (5)
New Bullards Bar Reservoir	463	-44 / (-9)
New Hogan Reservoir	51	25 / (48)
Oroville Reservoir	962	271 / (28)
Pardee Reservoir	181	-19 / (-11)
Shasta Lake	1,520	688 / (45)
Whiskeytown Reservoir	234	0 / (0)

Model results for Black Butte Reservoir, presented in the figure below, show that average end-of-April and end-of-September storage decrease from baseline under the 55 w/WSAs scenario. End-of-April storage decreases from baseline in all but the highest and lowest storage conditions, when results show no change from baseline. End-of-September storage shows no change from baseline in the lowest half of storage conditions, decreases from baseline in moderate conditions, and increases from baseline in the highest storage conditions. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April and end-of-September storage under the 55 w/WSAs scenario are more similar to those seen under the Low Flow Alternative than the 55 scenario, except in the wettest and driest conditions when storage levels are similar under all flow scenarios. Average end-of-April and end-of-September storage under the 55 w/WSAs scenario fall very close to the Low Flow Alternative (See Appendix H1a3).

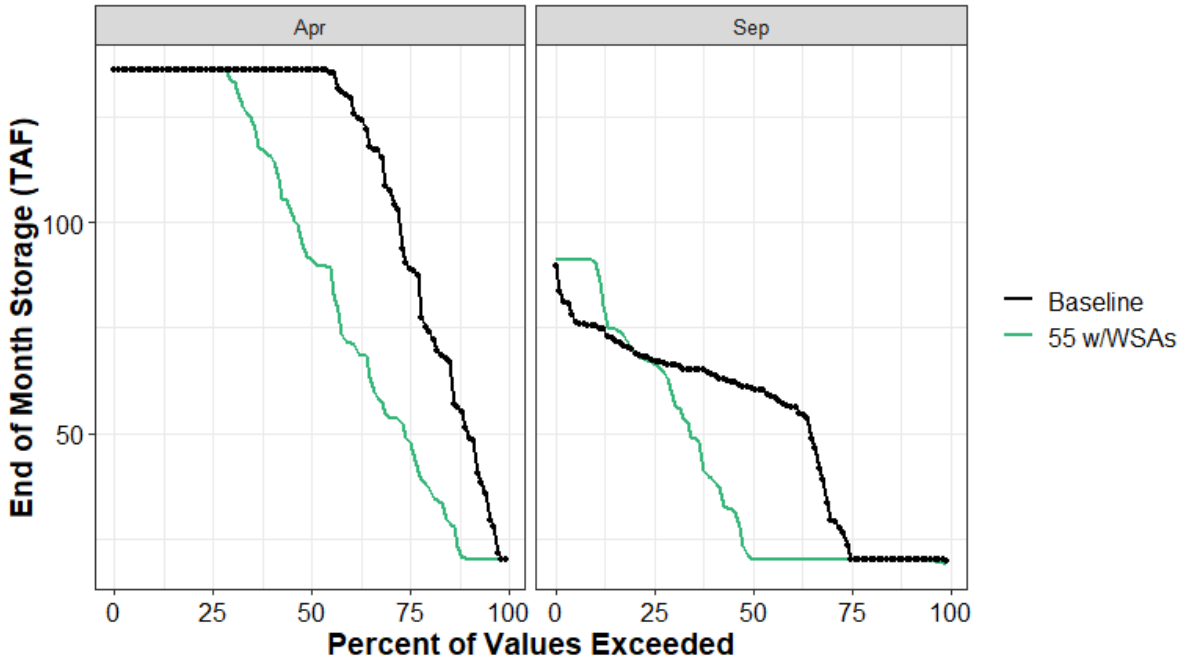


Figure 13.4-38. Black Butte Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for Camanche Reservoir, presented in the figure below, show that average end-of-April and end-of-September storage decrease from baseline under the 55 w/WSAs scenario. End-of-April storage decreases from baseline in all but the lowest storage conditions. End-of-September storage increases from baseline in the lowest storage conditions, decreases from baseline in moderate conditions, and shows no change from baseline in the highest storage conditions. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April storage in Camanche Reservoir under the 55 w/WSAs scenario are more similar to those seen under the Low Flow Alternative than the 55 scenario. Results for end-of-September storage fall between those seen under the Low Flow Alternative and the 55 scenario in low storage conditions and are equivalent across all flow scenarios in higher storage conditions. Average end-of-April and end-of-September storage under the 55 w/WSAs scenario fall very close to the Low Flow Alternative (See Appendix H1a3). Because Camanche and Pardee Reservoirs are operated in tandem, these results should be considered along with those for Pardee Reservoir, below.

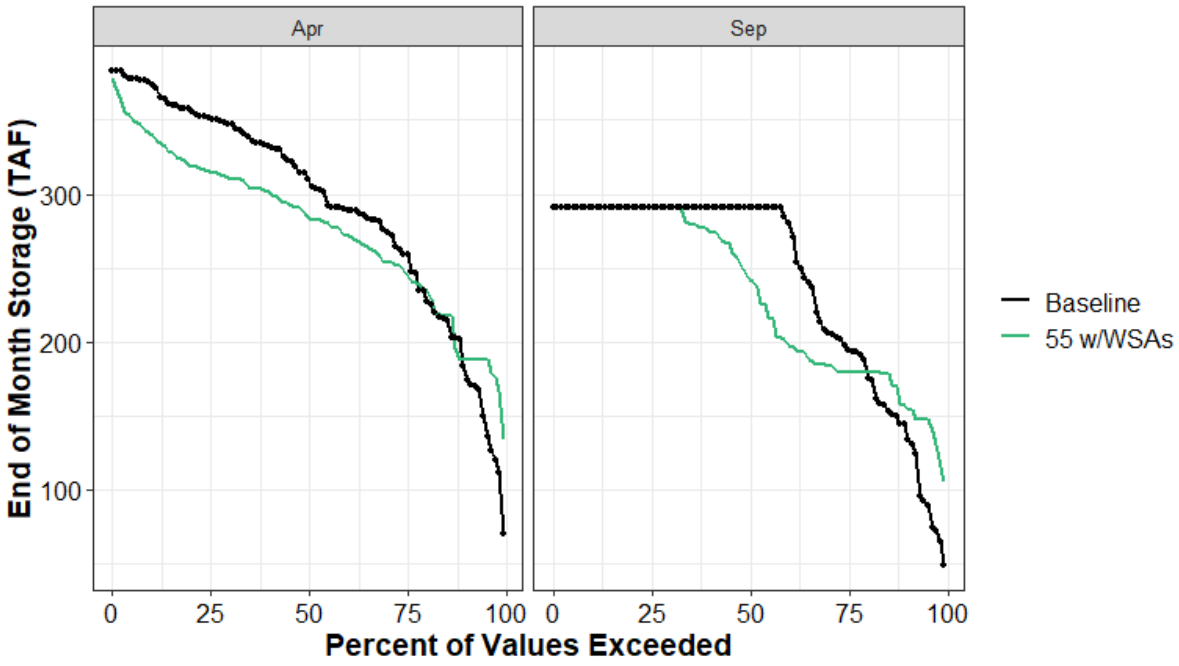


Figure 13.4-39. Camanche Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for Camp Far West Reservoir, presented in the figure below, show that average end-of-April storage decreases slightly from baseline while average end-of-September storage is unchanged from baseline under the 55 w/WSAs scenario. End-of-April storage decreases from baseline in low storage conditions and is similar to baseline in moderate and high storage conditions. End-of-September storage is similar to baseline in most storage conditions. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April and end-of-September storage in Camp Far West Reservoir under the 55 w/WSAs scenario are more similar to those seen under the Low Flow Alternative than the 55 scenario, except in the highest storage conditions when storage levels are similar across all flow scenarios. Average end-of-April storage under the 55 w/WSAs scenario falls closer to the Low Flow Alternative than the 55 scenario while average end-of-September storage is similar across all scenarios (See Appendix H1a3).

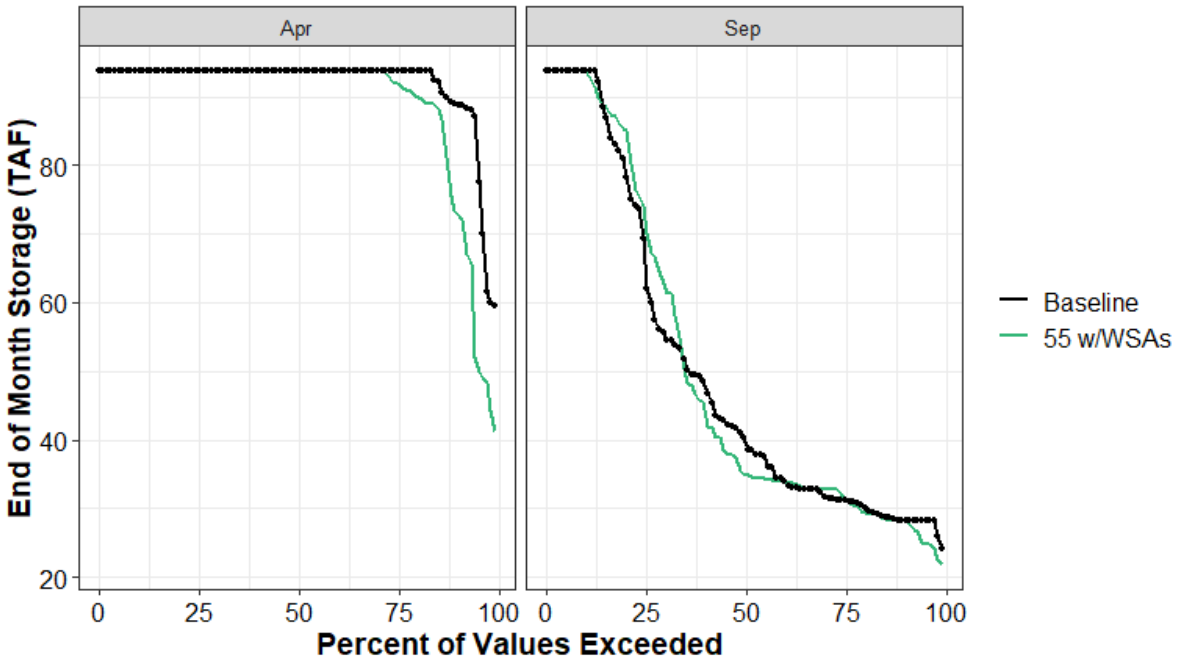


Figure 13.4-40. Camp Far West Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for Clear Lake, presented in the figure below, show that average end-of-April and end-of-September storage under the 55 w/WSAs scenario decreases from baseline. End-of-April and end-of-September storage decrease from baseline in all but the highest storage conditions when end-of-April storage is equivalent to baseline and end-of-September storage increases from baseline. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April and end-of-September storage in Clear Lake under the 55 w/WSAs scenario are similar across the 55 w/WSAs scenario, Low Flow Alternative, and 55 scenario under all storage conditions, though average end-of-April storage under the 55 w/WSAs scenario falls closer to the Low Flow Alternative than the 55 scenario (See Appendix H1a3).

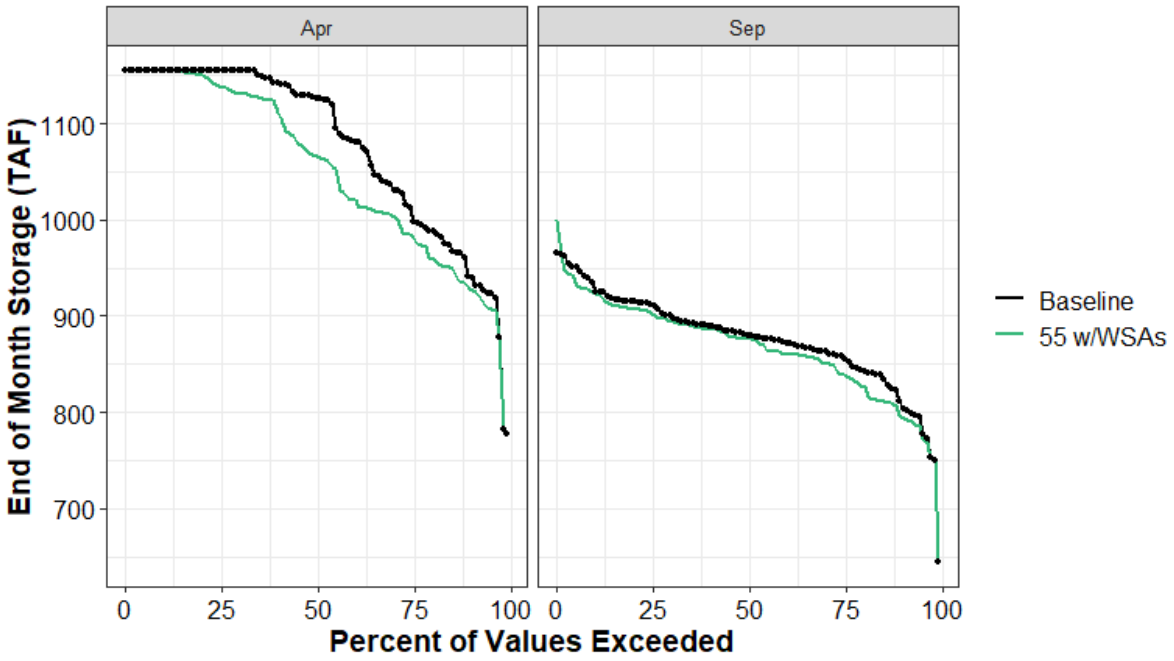


Figure 13.4-41. Clear Lake End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for Folsom Lake, presented in the figure below, show that average end-of-April and end-of-September storage decrease from baseline under the 55 w/WSAs scenario. End-of-April and end-of-September storage increase from baseline in the lowest storage conditions, decrease from baseline in moderate conditions, and are equivalent to baseline in the highest storage conditions. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April and end-of-September storage in Folsom Lake under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario, except in the highest storage conditions when storage levels are equivalent under all flow scenarios. Average end-of-April and end-of-September storage under the 55 w/WSAs scenario fall closer to the Low Flow Alternative than the 55 scenario (See Appendix H1a3).

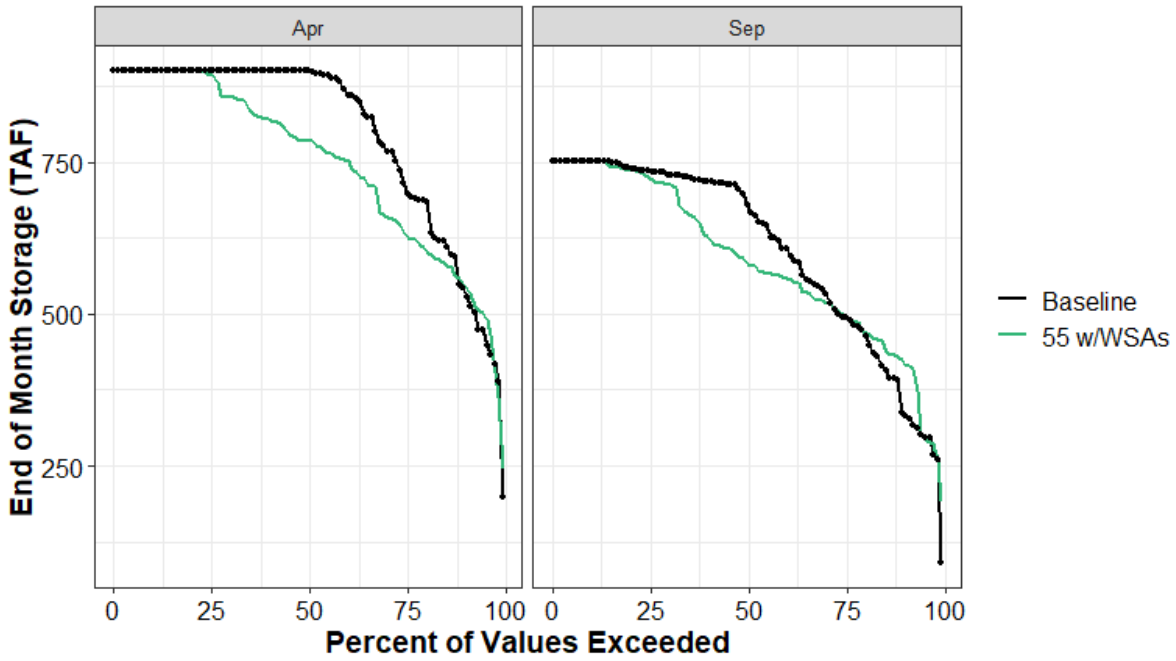


Figure 13.4-42. Folsom Lake End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for Lake Berryessa, presented in the figure below, show that average end-of-April and end-of-September storage decrease from baseline under the 55 w/WSAs scenario. Both end-of-April and end-of-September storage increase from baseline in the lowest storage conditions and decrease from baseline in higher storage conditions. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April and end-of-September storage in Lake Berryessa under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario in higher storage conditions, though both end-of-April and end-of-September storage levels under the 55 w/WSAs scenario are lower than those seen under the flow scenarios in lower storage conditions. Average end-of-April storage under the 55 w/WSAs scenario falls closer to the Low Flow Alternative than the 55 scenario, while average end-of-September storage under the 55 w/WSAs scenario is lower than the 55 scenario (See Appendix H1a3). These patterns reflect increased opportunity to store inflow under moderate to wet conditions and reduced constraints on delivery of stored water under drier conditions.

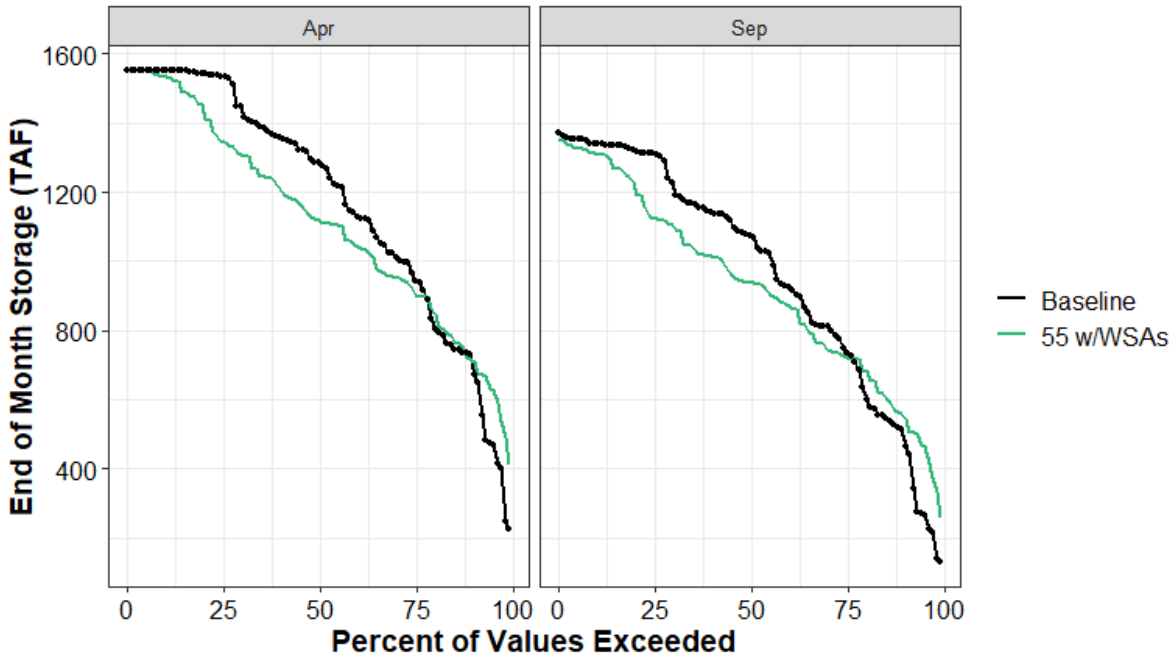


Figure 13.4-43. Lake Berryessa End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for New Bullards Bar Reservoir, presented in the figure below, show that average end-of-April and end-of-September storage decrease from baseline under the 55 w/WSAs scenario. End-of-April and end-of-September storage decreases from baseline in all but the lowest and highest storage conditions when storage levels are similar to baseline. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April storage under the 55 w/WSAs scenario are more similar to those seen under the 55 scenario than the Low Flow Alternative except in the lowest storage conditions. Results for end-of-September storage under the 55 w/WSAs scenario are generally more similar to the 55 scenario than the Low Flow Alternative in intermediate to lower storage conditions. In higher storage conditions, end-of-September carryover storage levels are significantly higher under the flow scenarios due to the changes to buffer pool assumptions. Average end-of-April and end-of-September storage under the 55 w/WSAs scenario fall closer to the 55 scenario than the Low Flow Alternative (See Appendix H1a3). Specifically, based on updated temperature data and comments received, the buffer pool in New Bullards Bar Reservoir was lowered to allow the reservoir to be drawn down further throughout the summer. Previously, the buffer pool had an end of September value of 750 TAF in the 55 scenario. In the 55 w/WSAs scenario, the end of September buffer pool is 650 TAF.

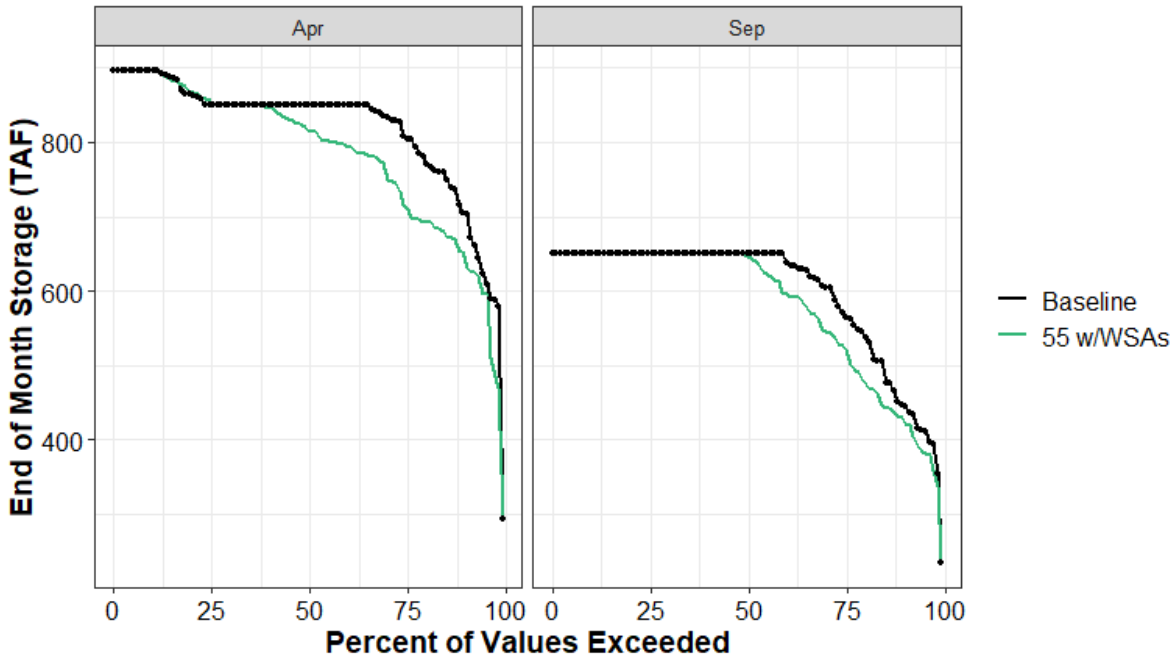


Figure 13.4-44. New Bullards Bar Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for New Hogan Reservoir, presented in the figure below, show that average end-of-April storage decreases from baseline while average end-of-September storage increases from baseline under the 55 w/WSAs scenario. Both end-of-April and end-of-September storage increase from baseline in the lowest storage conditions and decrease from baseline in higher storage conditions, though the decreases from baseline under higher storage conditions are much smaller in end-of-September storage levels. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April storage in New Hogan Reservoir under the 55 w/WSAs scenario are more similar to the 55 scenario in higher storage conditions and more similar to the Low Flow Alternative in lower storage conditions. Results for end-of-September storage under the 55 w/WSAs scenario align closely with results seen for the Low Flow Alternative and are lower than those seen under the 55 scenario in all except the lowest storage conditions due to refinements to carryover assumptions and reduced constraints on deliveries for water supply included in the 55 w/WSAs scenario. Average end-of-April and end-of-September storage under the 55 w/WSAs scenario falls closer to the Low Flow Alternative than the 55 scenario (See Appendix H1a3).

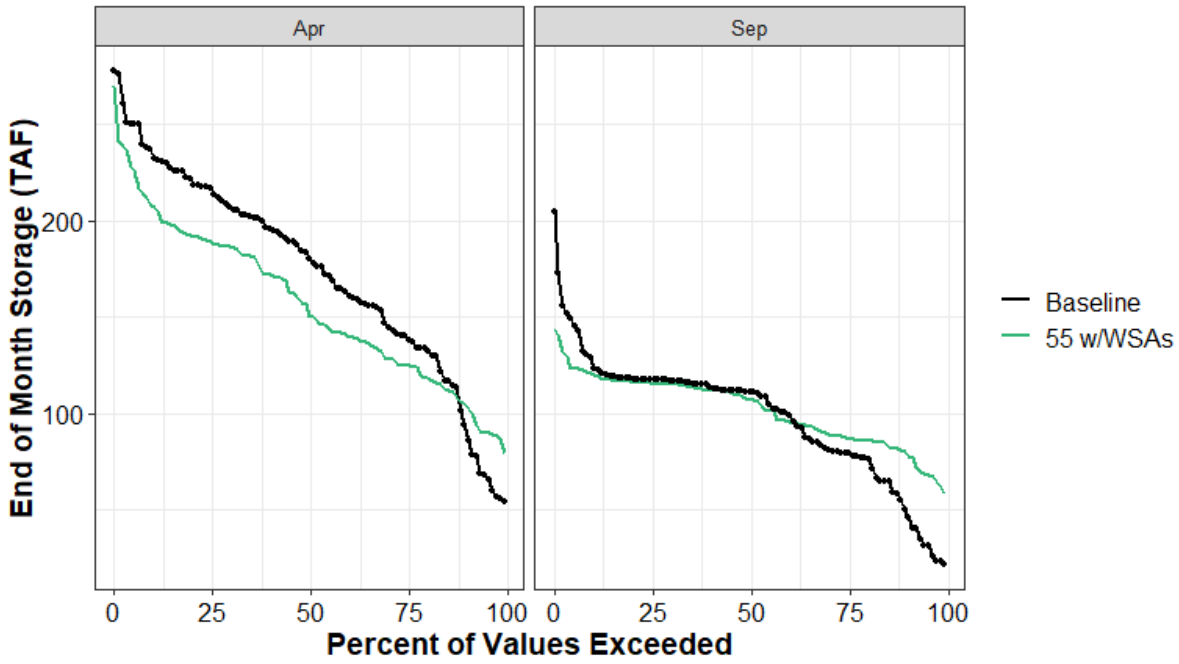


Figure 13.4-45. New Hogan Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for Oroville Reservoir, presented in the figure below, show that average end-of-April and end-of-September storage decrease from baseline under the 55 w/WSAs scenario. Both end-of-April and end-of-September storage increase from baseline in the lowest storage conditions and decrease from baseline in higher storage conditions. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April and end-of-September storage in Oroville Reservoir under the 55 w/WSAs scenario show greater storage than under the 55 scenario and are more similar to those seen under the Low Flow Alternative than the 55 scenario in all storage conditions. Average end-of-April and end-of-September storage for the 55 w/WSAs scenario fall closer to the Low Flow Alternative than the 55 scenario (See Appendix H1a3).

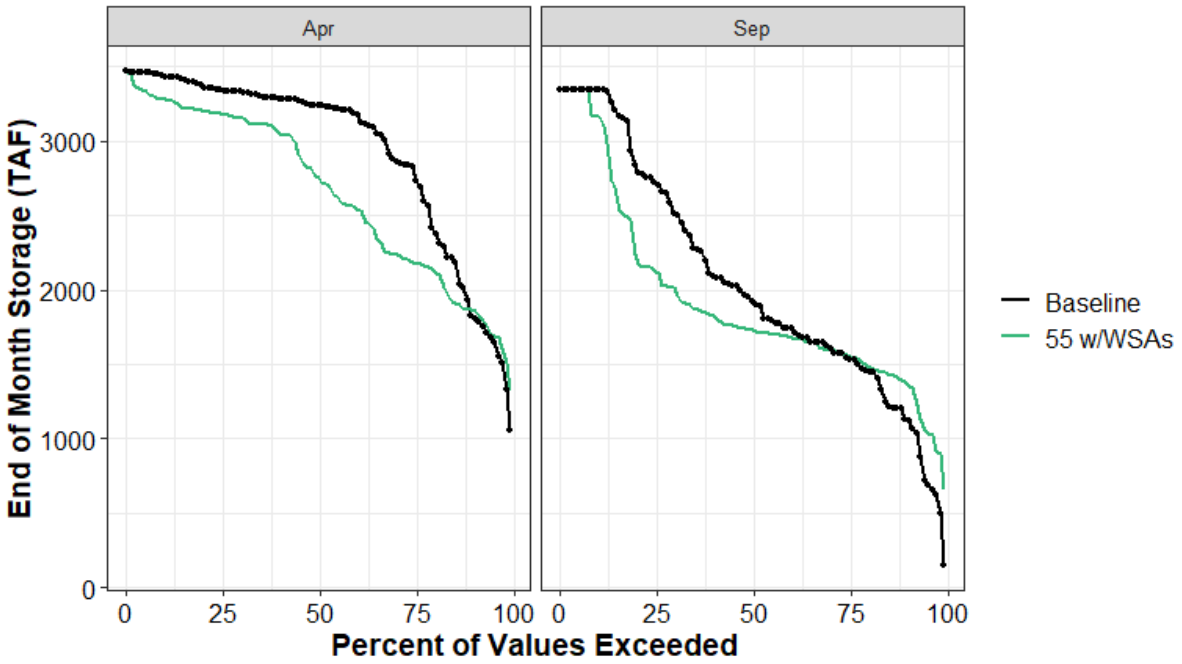


Figure 13.4-46. Oroville Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for Pardee Reservoir, presented in the figure below, show that average end-of-April and end-of-September storage decrease from baseline under the 55 w/WSAs scenario. Both end-of-April and end-of-September storage decrease from baseline in lower storage conditions and are equivalent to baseline in higher storage conditions. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April and end-of-September storage in Pardee Reservoir under the 55 w/WSAs scenario show lower storage than the flow scenarios, generally falling closer to the 55 scenario than the Low Flow Alternative in lower storage conditions with storage levels being equivalent across flow scenarios in higher storage conditions (See Appendix H1a3). Larger reductions in storage are generally seen during multi-year drought sequences, when the sum of water supply deliveries from Pardee Reservoir and downstream obligations including flow requirements and supplies to in-basin users exceed inflow.

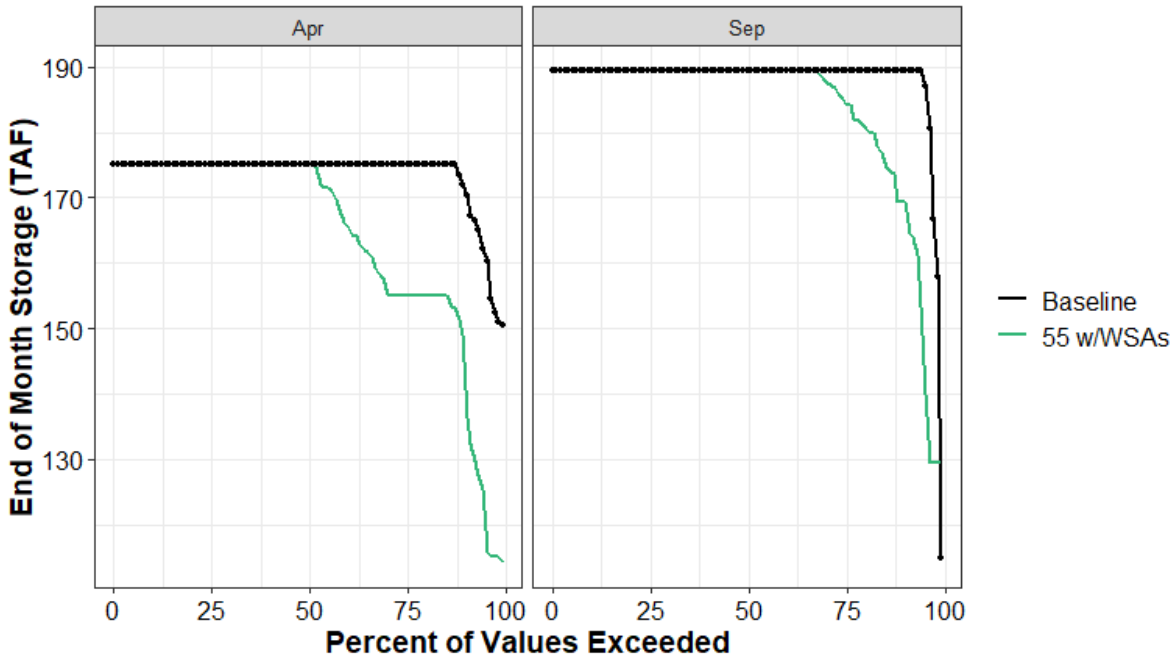


Figure 13.4-47. Pardee Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for Shasta Reservoir, presented below, show that average end-of-April and end-of-September storage is similar to baseline under the 55 w/WSAs scenario. Both end-of-April and end-of-September storage increase from baseline in low storage conditions and decrease from baseline in higher storage conditions. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April and end-of-September storage in Shasta Reservoir under the 55 w/WSAs scenario fall between the Low Flow Alternative and the 55 scenario during intermediate storage conditions, are higher than the flow scenarios during the lowest storage conditions, and are equivalent across the flow scenarios in the highest storage conditions. Results for end-of-April and end-of-September storage show greater storage than under the 55 scenario, which is also reflective of provisions included in the 2024 Long-Term Operations of the CVP and SWP that include reduced diversion in the driest conditions. Average end-of-April and end-of-September storage under the 55 w/WSAs scenario fall closer to the Low Flow Alternative than the 55 scenario (See Appendix H1a3).

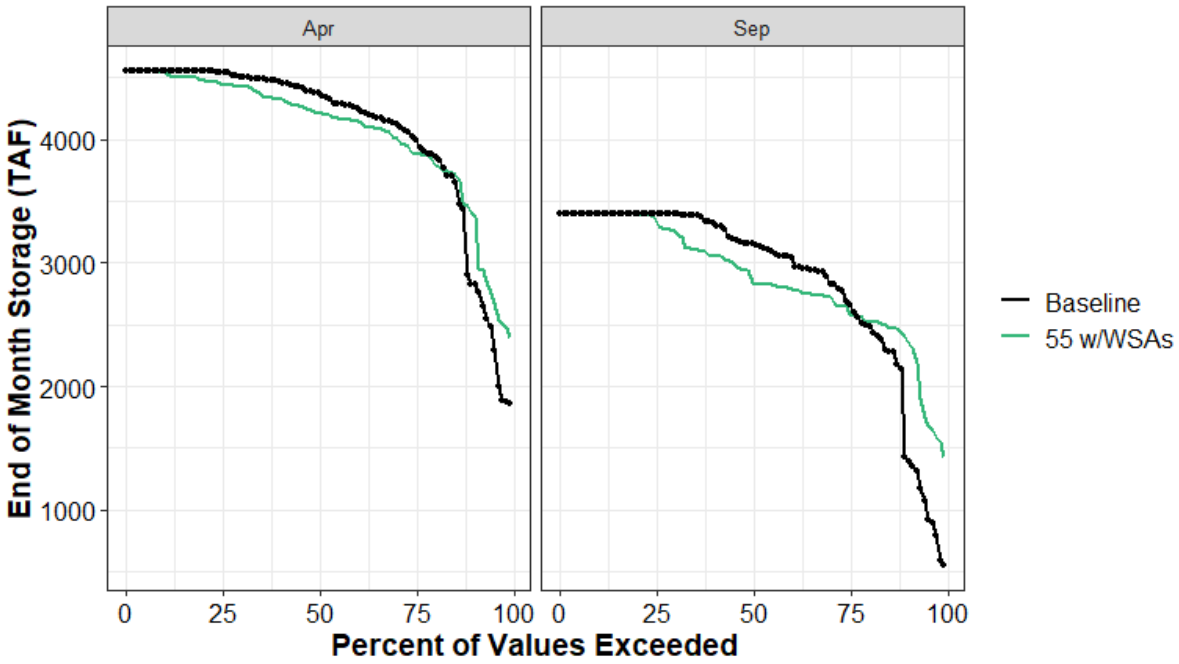


Figure 13.4-48. Shasta Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Model results for Whiskeytown Reservoir, presented in the figure below, show that average end-of-April storage decreases slightly from baseline under the 55 w/WSAs scenario, while end-of-September storage is unchanged. End-of-April storage decreases slightly from baseline in lower storage conditions and is unchanged from baseline in higher storage conditions, while end-of-September storage remains constant across all storage conditions. Detailed results, including cumulative distributions of end-of-April and end-of-September storage levels, are provided in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Overall, results for end-of-April storage in Whiskeytown Reservoir under the 55 w/WSAs scenario are somewhat higher than under the 55 scenario and are more similar to the Low Flow Alternative than the 55 scenario. Results for end-of-September storage are equivalent across all scenarios. (See Appendix H1a3).

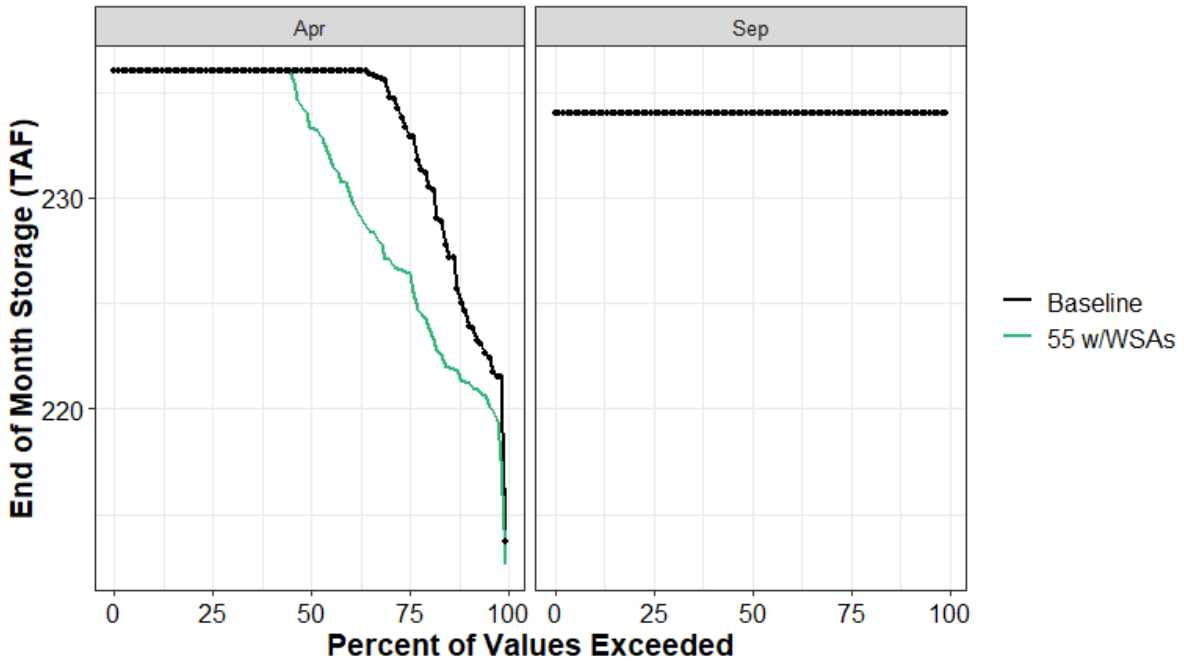


Figure 13.4-49. Whiskeytown Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and 55 w/WSAs Scenarios

Voluntary Agreement Pathway

Overall, under the VA pathway, changes in reservoir levels on tributaries with HRL commitments would be very similar to results presented in Chapter 9, *Proposed Voluntary Agreements,* for the term of the VA pathway. For most reservoirs involved in HRL commitments, end-of-April storage shows some reduction in the VA scenario relative to baseline but shows little change in end-of-September storage. The most striking exception is New Bullards Bar Reservoir, which under the Yuba River HRL proposal is operated to a lower end-of-September storage target in dry, below normal, and above normal years.

Several rim reservoirs are located on tributaries without HRL commitments. As discussed above, the VA pathway would apply to the water rights that are part of approved HRLs (i.e., the specific water rights identified in Appendix B.1 of the revised proposed Plan amendments), during the term of the VA pathway. Under the VA pathway, non-HRL water rights would be subject to the regulatory pathway. The SacWAM modeling of the VA scenario is focused on HRL flow contributions identified in the MOU. For rim reservoirs on tributaries without HRL commitments, changes in reservoir levels would likely be similar to those under the 55 w/WSAs scenario, for the term of the VA pathway.

The tables below present average end-of-April storage and percent differences from baseline in rim reservoirs for all years and critical years, and average end-of-September storage and percent differences from baseline in rim reservoirs for all years and critical years. This is followed by results for individual reservoirs under the VA scenario.

Table 13.4-96. Average End-of-April Storage and Percent Differences from Baseline in Rim Reservoirs in the VA Scenario for All Years

Reservoir	Baseline TAF	VA Scenario TAF / (%)
Camanche Reservoir	294	-6 / (-2)
Folsom Lake	797	-12 / (-2)
Lake Berryessa	1,178	-11 / (-1)
New Bullards Bar Reservoir	818	-27 / (-3)
Oroville Reservoir	2,946	-3 / (-0)
Shasta Lake	4,084	-23 / (-1)

Table 13.4-97. Average End-of-April Storage and Percent Differences from Baseline in Rim Reservoirs in the VA Scenario for Critical Years

Reservoir	Baseline TAF	VA Scenario TAF / (%)
Camanche Reservoir	171	-3 / (-2)
Folsom Lake	500	-11 / (-2)
Lake Berryessa	808	-14 / (-2)
New Bullards Bar Reservoir	663	-20 / (-3)
Oroville Reservoir	1,892	28 / (1)
Shasta Lake	2,880	32 / (1)

Table 13.4-98. Average Carryover Storage and Percent Differences from Baseline in Rim Reservoirs in the VA Scenario for All Years

Reservoir	Baseline TAF	VA Scenario TAF / (%)
Camanche Reservoir	243	-1 / (-0)
Folsom Lake	606	6 / (1)
Lake Berryessa	969	-10 / (-1)
New Bullards Bar Reservoir	597	-26 / (-4)
Oroville Reservoir	2,057	26 / (1)
Shasta Lake	2,871	-32 / (-1)

Table 13.4-99. Average Carryover Storage and Percent Differences from Baseline in Rim Reservoirs in the VA Scenario for Critical Years

Reservoir	Baseline TAF	VA Scenario TAF / (%)
Camanche Reservoir	120	-2 / (-2)
Folsom Lake	369	-6 / (-2)
Lake Berryessa	610	-13 / (-2)
New Bullards Bar Reservoir	463	-10 / (-2)
Oroville Reservoir	962	34 / (3)
Shasta Lake	1,520	23 / (2)

As presented in the figure below, model results for Camanche Reservoir under the VA scenario show that average end-of-April and end-of-September storage decrease slightly from baseline. End-of-April storage decreases from baseline in all storage conditions, while end-of-September storage decreases slightly from baseline in lower storage conditions and remains unchanged in higher storage conditions. Across all years, end-of-April storage decreases from baseline by about 2 percent while end-of-September storage is largely unchanged from baseline, decreasing by less than 1 percent.

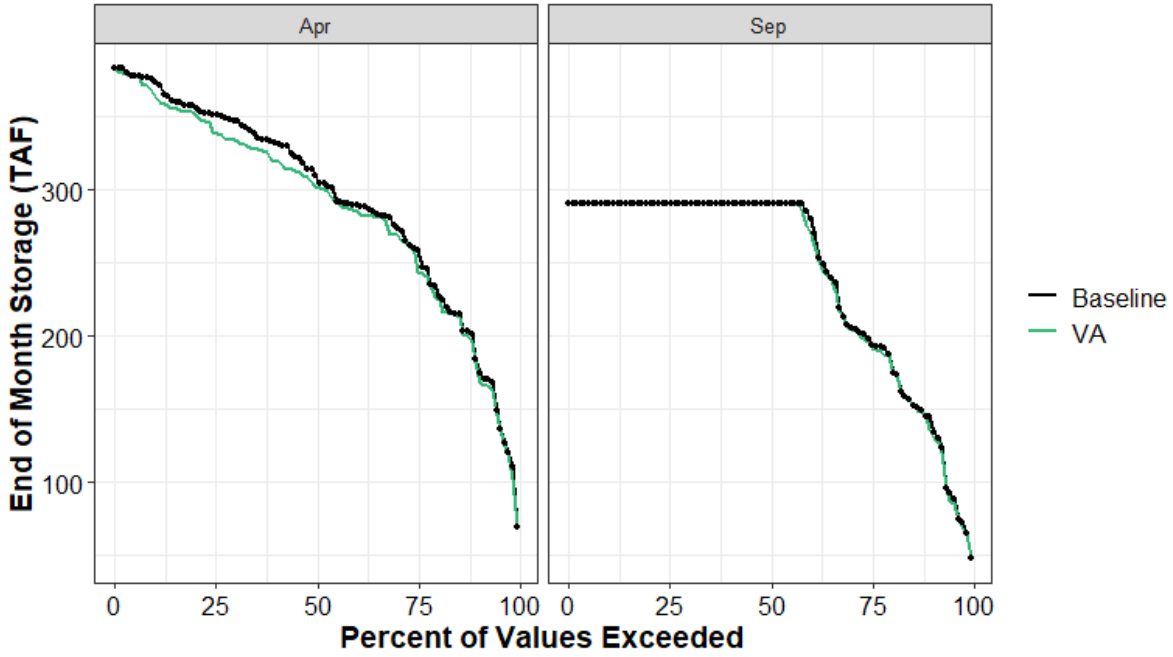


Figure 13.4-50. Camanche Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and VA Scenarios

The figure below presents model results for end-of-April storage and end-of-September storage for baseline and the VA scenario for Folsom Lake. Model results for Folsom Lake under the VA scenario show that average end-of-April storage decreases by around 1 percent from baseline while average end-of-September storage increases by around 1 percent from baseline. End-of-April storage decreases from baseline in all but the highest storage conditions when storage levels remain unchanged from baseline. End-of-September storage increases from baseline in all but the highest storage conditions when storage levels remain unchanged from baseline.

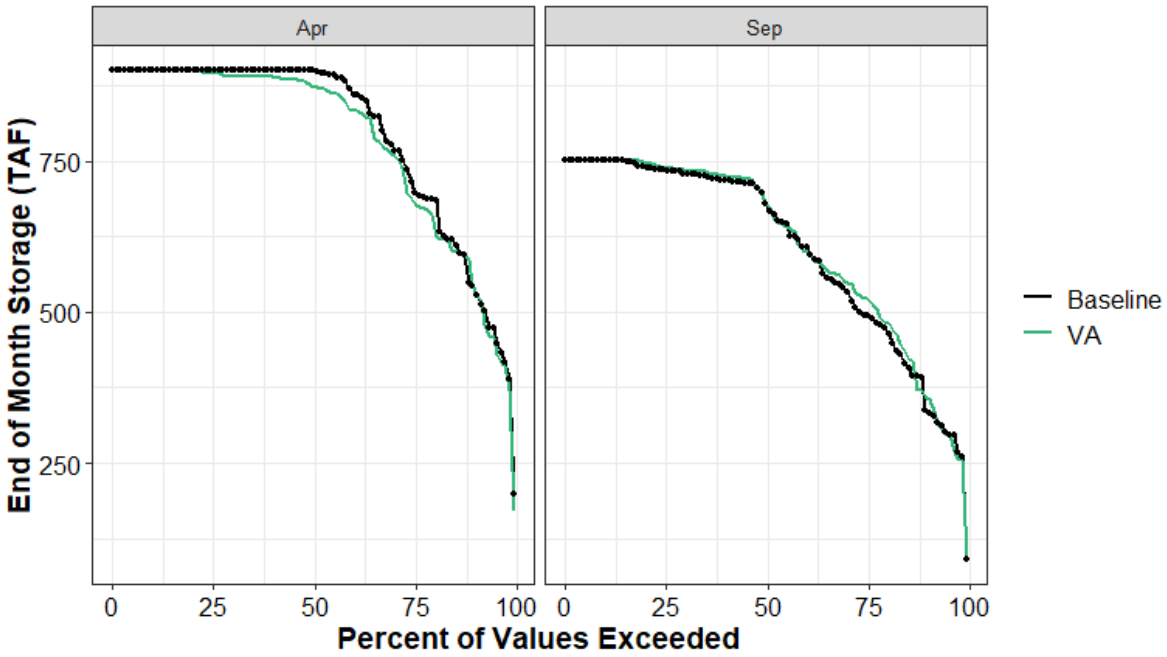


Figure 13.4-51. Folsom Lake End-of-April and End-of-September Carryover Storage under the Baseline and VA Scenarios

Model results for Lake Berryessa under the VA scenario, presented in the figure below, show that average end-of-April and end-of-September storage decrease from baseline by around 1 percent. Both end-of-April and end-of-September storage levels decrease from baseline in all but the highest storage conditions when they are unchanged from baseline.

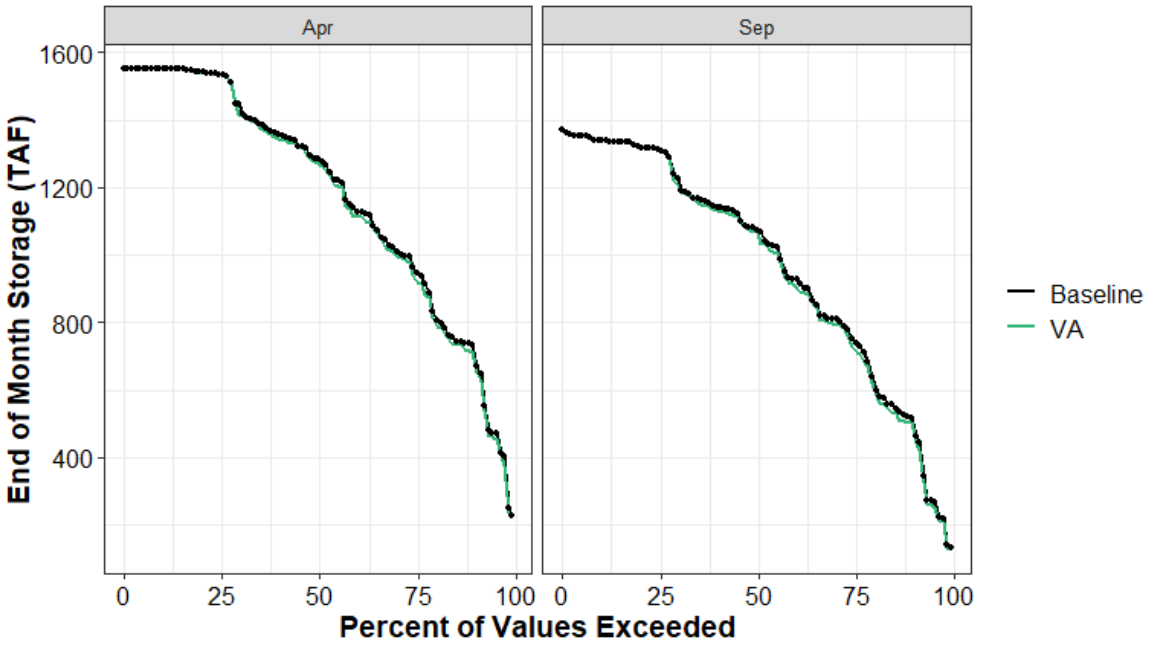


Figure 13.4-52. Lake Berryessa End-of-April and End-of-September Carryover Storage under the Baseline and VA Scenarios

Model results for New Bullards Bar Reservoir under the VA scenario, presented in the figure below, show that average end-of-April and end-of-September storage decrease from baseline by about 3 percent and 4 percent, respectively. End-of-April and end-of-September storage decrease from baseline in all but the highest storage conditions, with smaller decreases under the lowest storage conditions.

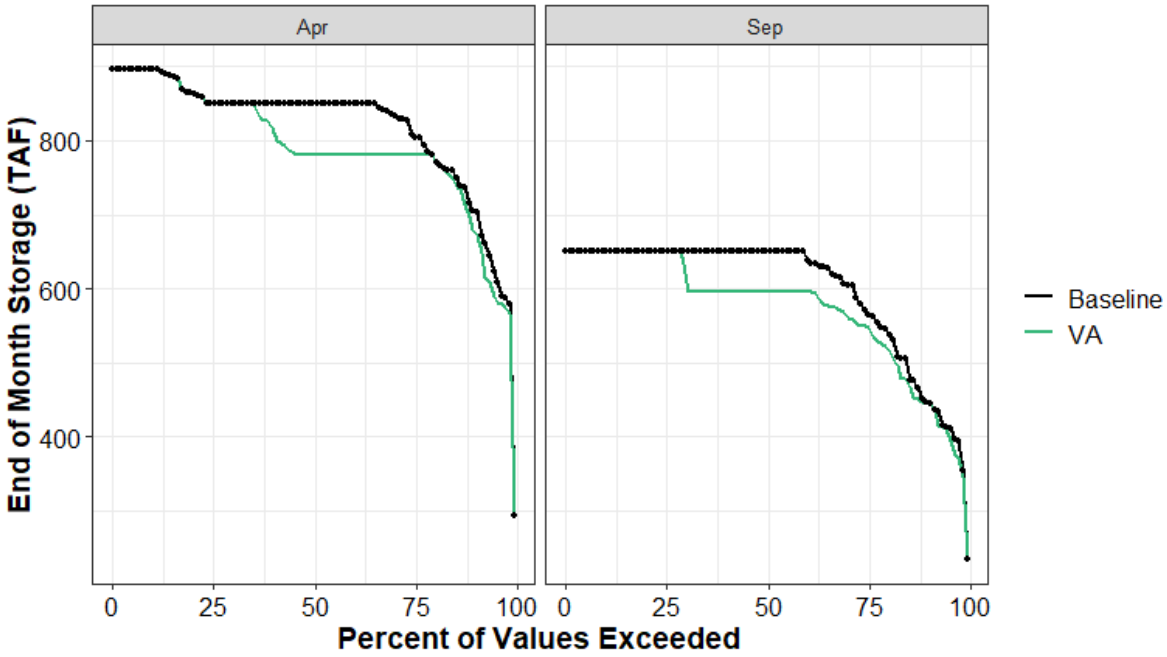


Figure 13.4-53. New Bullards Bar Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and VA Scenarios

Model results for Oroville Reservoir under the VA scenario, presented in the figure below, show that end-of-April and end-of-September storage is similar to baseline, with average end-of-April storage decreasing by less than 1 percent and average end-of-September storage increasing by less than 1 percent.

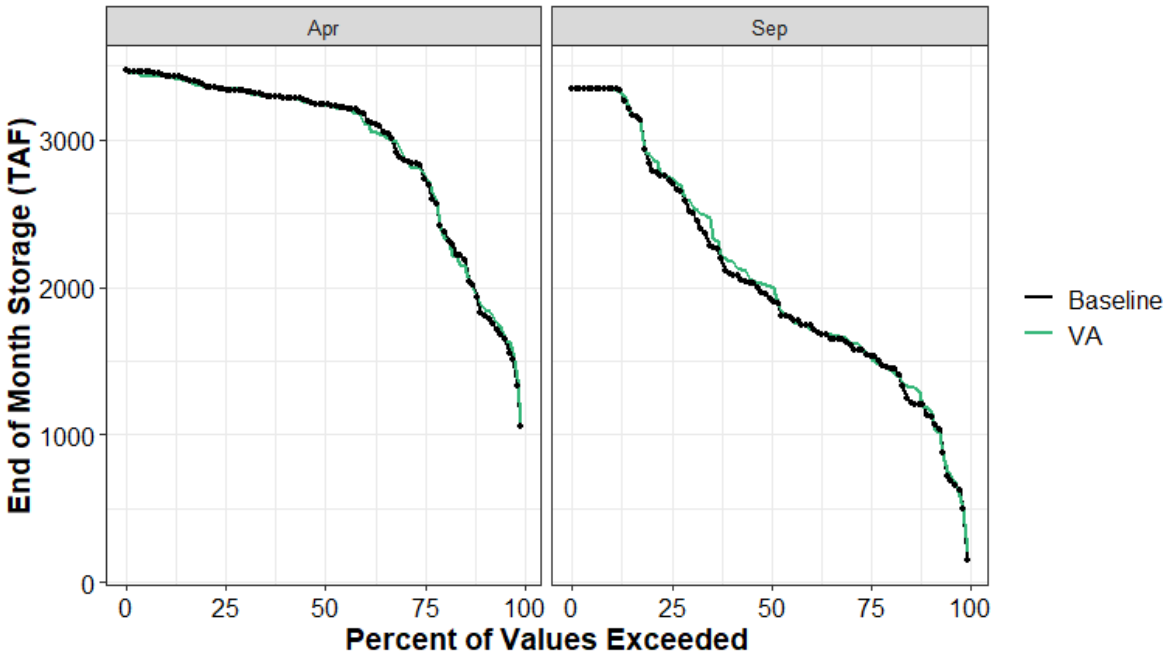


Figure 13.4-54. Oroville Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and VA Scenarios

Model results for Shasta Reservoir under the VA scenario, presented in the figure below, show that average end-of-April storage and end-of-September storage decrease from baseline by less than 1 percent. End-of-April storage increases from baseline in the lowest storage conditions and decreases from baseline in higher storage conditions. End-of-September storage increases from baseline in the lowest storage conditions, decreases from baseline in moderate conditions, and remains unchanged from baseline in higher storage conditions.

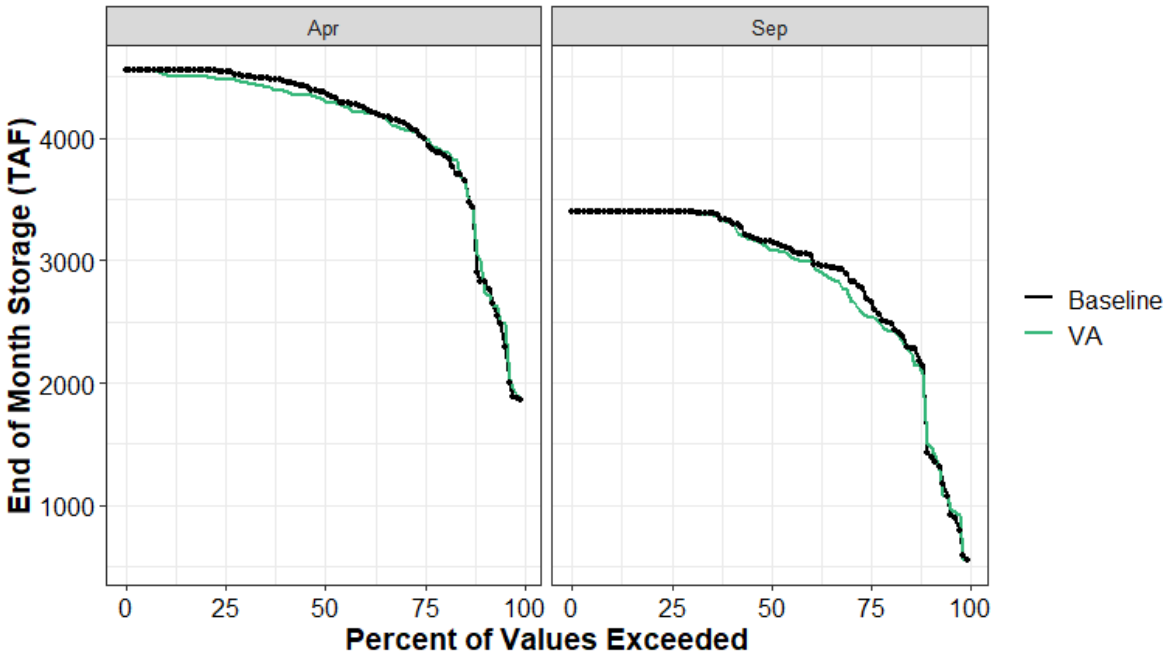


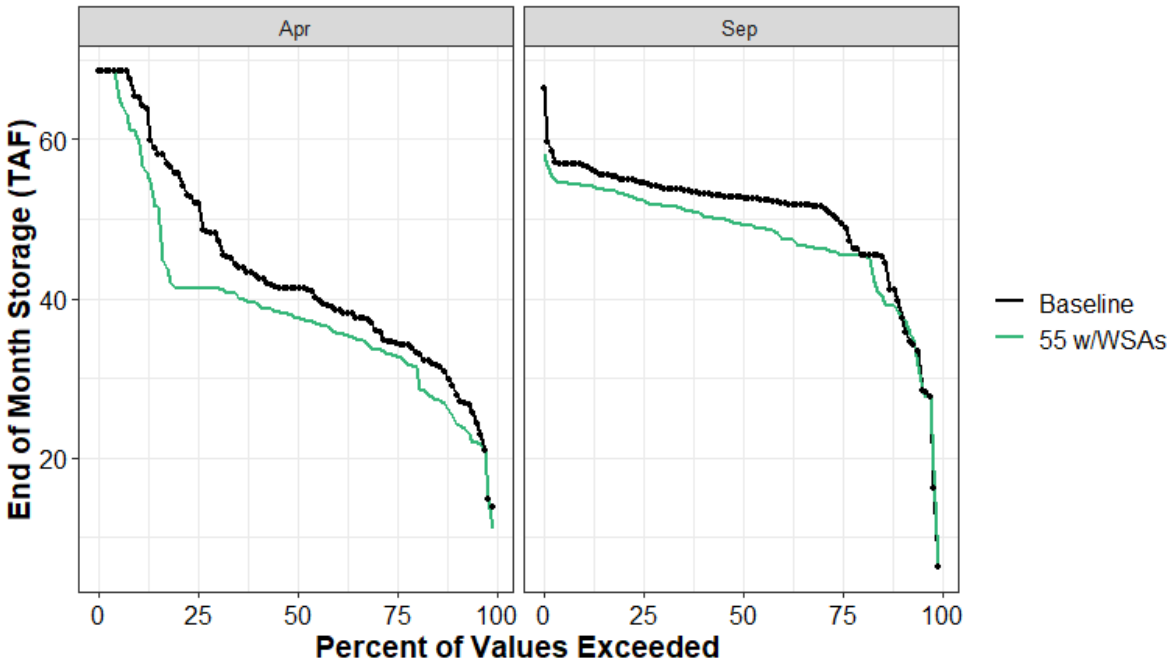
Figure 13.4-55. Shasta Reservoir End-of-April and End-of-September Carryover Storage under the Baseline and VA Scenarios

Upper Watershed Reservoirs

Regulatory Pathway

Most of the upper watershed reservoirs in the Sacramento River watershed and Delta eastside tributaries regions show no significant change in storage under the 55 w/WSAs scenario, however, similar to the flow scenarios evaluated in Chapter 6, *Changes in Hydrology and Water Supply,* several upper watershed reservoirs have potential to see large changes in operation, particularly facilities that include interbasin diversions that move water from one watershed to another.

DWR reservoirs such as Antelope Reservoir, Lake Davis, and Frenchman Reservoir, with a combined maximum storage of about 162 TAF, may be required to bypass inflow or release from storage to meet the new flow requirements, resulting in lower reservoir levels. Increased inflow requirements into Pardee Reservoir could result in lower storage in Salt Springs and Lower Bear River Reservoirs because more water would be required to bypass the reservoirs in spring. Reduced transfers to the Bear River would lower storage levels in Bowman, Lake Fordyce, Jackson Meadows, Rollins, and Lake Spaulding Reservoirs. End-of-September storage for Bowman Reservoir is shown in the figure below to illustrate the pattern observed in the modeling of these reservoirs. As also shown in the figure, the 55 w/WSAs scenario shows lower end-of-April and end-of-September carryover storage than baseline, but more than the 55 scenario (See Table A1-154 and Table A1-156 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). Again, the modeling scenarios represent only one possible operation of these systems. The cold water habitat requirements under the regulatory pathway described in the revised proposed Plan amendments include various flexibilities that could reduce the drawdown effects reflected in the modeling scenarios.



Changes in end-of-April and end-of-September carryover storage across the scenarios for Bowman Reservoir represent the typical storage patterns in the upper Yuba River watershed associated with interbasin diversions.

Figure 13.4-56. Bowman Reservoir End-of-April and End-of-September Carryover Storage

Voluntary Agreement Pathway

Results showing modeled end-of-September and end-of-April storage for upper watershed reservoirs for baseline and the VA scenario can be found in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*. The upper watershed reservoirs in the Sacramento River watershed and Delta eastside tributaries regions show no significant change in storage under the VA scenario compared to baseline, with the exception of Hell Hole Reservoir which shows significant decreases in end-of-September storage. Hell Hole Reservoir has been reoperated in the VA scenario to provide spring releases. However, the VA pathway could result in additional effects to reservoir storage and elevation in upper watershed reservoirs that are not reflected in the modeling. For example, there could be reductions in upper watershed reservoir storage levels at times depending on how flows are deployed in upper watersheds and the sources of unspecified water purchases that are not known. As noted above, the modeling scenario for reservoir operations represents only one possible operation of these systems and changes in upper watershed reservoir storage levels under the VA pathway are possible.

Some upper watershed reservoirs are located on tributaries without HRL commitments. As discussed above, under the VA pathway, non-HRL water rights would be subject to the regulatory pathway. The SacWAM modeling of the VA scenario is focused on HRL flow contributions identified in the MOU. However, for upper watershed reservoirs on tributaries without HRL commitments, changes in reservoir levels would likely be similar to those under the 55 w/WSAs scenario, for the term of the VA pathway.

Reservoir Fluctuation

Table H1a2-136 in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*, shows average annual fluctuations in water surface elevation calculated as the average of annual maximum minus average minimum water surface elevations for the baseline, 55 w/WSAs, and VA scenarios. Under the 55 w/WSAs scenario, most of the changes in fluctuation are negative, indicating less fluctuation compared to baseline. Of the few locations with increased reservoir fluctuation under the 55 w/WSAs scenario, the largest increases occur in East Park and Stony Gorge Reservoirs (East Park Reservoir supplies water to Stony Gorge Reservoir), with smaller increases in Indian Valley, Los Vaqueros, Pardee, Rollins, and Scotts Flat Reservoirs. All of these increases are less than 10 feet. Reservoir fluctuations under the 55 w/WSAs scenario are generally more similar to those observed under the Low Flow Alternative than the 55 scenario (see Table H1a3-136 in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*).

Under the VA scenario, most reservoirs experience no change in fluctuation compared to baseline. Four reservoirs have decreased fluctuations under the VA scenario compared to baseline, including Folsom Lake and Oroville, and San Luis Reservoirs. These decreases range from 2.1 feet in Folsom Reservoir to 13.2 feet in San Luis Reservoir. Four reservoirs have increased fluctuations under the VA scenario compared to baseline, including Lake Berryessa, New Bullards Bar, Shasta Lake, and Hell Hole Reservoir. These increases range from 0.3 feet in Lake Berryessa to 1.4 feet in Shasta Lake.

Total Carryover Storage by Tributary Watershed

Regulatory Pathway

Because of the inherent flexibility built into the revised proposed Plan amendments for implementation of cold water habitat and flow requirements and given that specific water rights allocations are not necessarily represented with precision in the modeling of flow scenarios, how the flow requirements are met may vary from the specific scenarios modeled. It is informative to examine total watershed storage, as summarized in the tables below. Most watersheds show a decrease in average carryover storage in the 55 w/WSAs scenario relative to baseline. Total watershed carryover storage during critical years increases in most of the watersheds except Cache Creek, Stony Creek, and Yuba River watersheds. Generally, results under the 55 w/WSAs scenario are similar to those under the 55 scenario.

Table 13.4-100. Average End-of-September Watershed Total Storage for Baseline (thousand acre-feet) and Percent Difference from Baseline

Watershed	Baseline TAF	55 w/WSAs (%)
American	1,104	-2
Bear	114	0
Cache	987	-2
Calaveras	99	4
Clear	234	0
Cosumnes [a]	33	0
Feather	3,244	-4
Mokelumne	641	-3
Putah	969	-4
Sacramento [b]	2,893	0
Stony	133	-18
Yuba	866	-2

[a] The only reservoir represented in SacWAM in the Cosumnes watershed is Sly Park Reservoir, which does not show any change to operations in any scenario presented.
[b] Sacramento River watershed total storage in this context represents Shasta Lake and Keswick Reservoir storage, excluding storage in all other watersheds listed in the table.

Table 13.4-101. Average Critical Year End-of-September Watershed Total Storage for Baseline (thousand acre-feet) and Percent Difference from Baseline

Watershed	Baseline TAF	55 w/WSAs (%)
American	837	2
Bear	91	3
Cache	836	-1
Calaveras	51	48
Clear	234	0
Cosumnes [a]	30	0
Feather	1,986	14
Mokelumne	458	2
Putah	610	5
Sacramento [b]	1,542	45
Stony	75	-38
Yuba	689	-6

[a] The only reservoir represented in SacWAM in the Cosumnes watershed is Sly Park Reservoir, which does not show any change to operations in any scenario presented.
[b] Sacramento River watershed total storage in this context represents Shasta Lake and Keswick Reservoir storage, excluding storage in all other watersheds listed in the table.

Voluntary Agreement Pathway

Total watershed storage under the VA scenario is summarized in the tables below. The VA scenario shows very little change to end-of-September storage in any watershed.

Table 13.4-102. Average End-of-September Watershed Total Storage for Baseline (thousand acre-feet) and Percent Difference from Baseline

Watershed	Baseline TAF	VA (%)
American	1,104	0
Bear	114	0
Cache	987	0
Calaveras	99	0
Clear	234	0
Cosumnes [a]	33	0
Feather	3,244	1
Mokelumne	641	0
Putah	969	-1
Sacramento [b]	2,893	-1
Stony	133	0
Yuba	866	-3

[a] The only reservoir represented in SacWAM in the Cosumnes watershed is Sly Park Reservoir, which does not show any change to operations in any scenario presented.
[b] Sacramento River watershed total storage in this context represents Shasta Lake and Keswick Reservoir storage, excluding storage in all other watersheds listed in the table.

Table 13.4-103. Average Critical Year End-of-September Watershed Total Storage for Baseline (thousand acre-feet) and Percent Difference from Baseline

Watershed	Baseline TAF	VA (%)
American	837	-1
Bear	91	0
Cache	836	0
Calaveras	51	0
Clear	234	0
Cosumnes [a]	30	0
Feather	1,986	2
Mokelumne	458	0
Putah	610	-2
Sacramento [b]	1,542	2
Stony	75	0
Yuba	689	-1

[a] The only reservoir represented in SacWAM in the Cosumnes watershed is Sly Park Reservoir, which does not show any change to operations in any scenario presented.
[b] Sacramento River watershed total storage in this context represents Shasta Lake and Keswick Reservoir storage, excluding storage in all other watersheds listed in the table.

Reservoirs in Other Regions

Regulatory Pathway

Southern California, San Francisco Bay Area, and Central Coast export reservoirs are not explicitly modeled in SacWAM; however, changes in reservoir levels in export reservoirs could occur under the revised proposed Plan amendments. Under the 55 w/WSAs scenario, Sacramento/Delta supplies

to the Southern California, San Francisco Bay Area, and Central Coast regions would be reduced, which could result in lower reservoir storage in export reservoirs. Overall, because changes in Sacramento/Delta supplies to these regions would be less than under the 55 scenario and more similar to changes under the Low Flow Alternative (discussed further in Section 13.4.4, *Changes in Surface Water Supply*), changes in reservoir storage in export reservoirs would also be less than under the 55 scenario and more similar to the Low Flow Alternative. Exceptions to this include Los Vaqueros Reservoir and San Luis Reservoir, which are modeled in SacWAM and which show increased storage under the 55 w/WSAs scenario, as shown in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*. How operators of export reservoirs may operate these reservoirs with less imported water is uncertain; however, two possibilities are discussed in Section 6.3.2.5, *Reservoirs in Other Regions*: reservoirs could be lower, or no change could occur. Historical observations of storage in export reservoirs during periods of lower exports show lower storage patterns for some reservoirs. Understanding the roles these reservoirs play in the water supply reliability for local regions suggests that average storage may not be reduced when inflow is reduced in the long term.

Consistent with provisions in Section 4.4.10.1 of the December 2025 revised draft Bay-Delta Plan that implementation of the Bay-Delta Plan does not result in redirected impacts to native fish and wildlife resources in the Trinity River watershed, including temperature and instream flow impacts, modeled imports to the Sacramento River through the Clear Creek Tunnel in the 55 w/WSAs and other flow scenarios were limited to be no more than in the baseline scenario (see Section A1.8.1, *Trinity Imports*, of Appendix A1). Accordingly, storage in Trinity Reservoir is not expected to change under the regulatory pathway. Slight differences in modeled storage shown in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*, and Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*, are modeling artifacts associated with limiting Trinity imports rather than setting them equal to a fixed input time series.

Voluntary Agreement Pathway

Under the VA scenario, changes in Sacramento/Delta supplies could potentially affect reservoir levels in export reservoirs located outside of the Sacramento/Delta watershed that receive Sacramento/Delta supplies. These changes are not modeled in SacWAM except for San Luis Reservoir, which shows that storage in San Luis Reservoir could change compared to baseline. Changes to storage in other export reservoirs would be expected to be small. As discussed below in Section 13.4.4, *Changes in Surface Water Supply*, the SacWAM results indicate that the VA pathway could potentially result in a slight increase in Sacramento/Delta supplies to other regions, so export reservoir levels would likely be similar to or could be slightly higher compared to baseline. However, the VA pathway could also result in reduced Delta exports as a result of additional flows that would be provided through unspecified water purchases. If these flows are provided through additional water purchases from south of Delta sellers, Delta exports could be reduced, which would result in slight reductions in San Luis Reservoir and other export reservoir levels.

While Millerton Reservoir in the San Joaquin Valley does not directly receive Sacramento/Delta supply, reservoir changes could occur if calls on Friant are made by the San Joaquin River exchange contractors in response to reduced Sacramento/Delta supply under the regulatory pathway. Calls on Friant water from the San Joaquin River and Millerton Lake would effectively shift water supply from Friant Division, which uses Millerton Lake water for agricultural and municipal use, to the exchange contractors.

Consistent with provisions in Section 4.4.10.1 of the December 2025 revised draft Bay-Delta Plan that implementation of the Bay-Delta Plan does not result in redirected impacts to native fish and wildlife resources in the Trinity River watershed, including temperature and instream flow impacts, modeled imports to the Sacramento River through the Clear Creek Tunnel in the VA scenario were limited to be no more than in the baseline scenario (see Section H1a.3.1, *Updates to the Voluntary Agreements Scenario*, of Appendix H1a). Accordingly, storage in Trinity Reservoir is not expected to change under the VA pathway. Slight differences in modeled storage shown in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*, are modeling artifacts associated with limiting Trinity imports rather than setting them equal to a fixed input time series.

Summary of Changes in Reservoir Storage and Elevation

Overall, the revised proposed Plan amendments could result in changes in reservoir levels, including lower reservoir levels in some locations, though reservoir owners and operators may develop operational scenarios that reduce the reservoir drawdown effects currently reflected in the modeling results.

Regulatory Pathway

As described above, model results for end-of-April and end-of-September storage under the 55 w/WSAs scenario show varied responses among rim reservoirs in terms of departures from baseline and relative similarities to flow scenario results, though some general patterns do emerge. Modeled end-of-April storage levels under the 55 w/WSAs scenario generally show decreases from baseline in all but the driest years and across all years, with some reservoirs showing increases from baseline and others showing decreases from baseline in the driest years. Across all years, end-of-April storage levels under the 55 w/WSAs scenario show a smaller departure from baseline than under the 55 scenario for all reservoirs except for Pardee Reservoir which exhibits a larger decrease from baseline under the 55 w/WSAs scenario than the 55 scenario. Generally, end-of-April storage levels under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario, with the exception of Pardee Reservoir, New Bullards Bar, and New Hogan Reservoir which exhibit storage levels more similar to the 55 scenario than the Low Flow Alternative.

Modeled end-of-September storage levels under the 55 w/WSAs scenario generally show increases from baseline in the driest years (with a few exceptions) and decreases from baseline in wetter years and across all water year types, though results for Shasta Lake and New Hogan Reservoir show small increases from baseline across all water years types, and results for Camp Far West and Whiskeytown Reservoir show no change from baseline across all water year types. Across all years, end-of-September storage levels under the 55 w/WSAs scenario show a smaller departure from baseline than under the 55 scenario for most reservoirs with the exceptions of Folsom Lake, New Bullards Bar, Lake Berryessa, and Pardee Reservoir, which exhibit a larger decrease from baseline under the 55 w/WSAs scenario than the 55 scenario, and Camp Far West and Whiskeytown Reservoir, which exhibit equivalent departures from baseline under the 55 w/WSAs and 55 scenarios. Generally, end-of-September storage levels under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario, with the notable exceptions of New Bullards Bar and Lake Berryessa, which exhibit storage levels more similar to the 55 scenario than the Low Flow Alternative, and Pardee and Whiskeytown Reservoirs, for which storage levels remain constant across all flow scenarios.

Voluntary Agreement Pathway

The modeling results show that changes in reservoir levels would occur for several reservoirs under the VA pathway, including Camanche Reservoir (Mokelumne River), Camp Far West Reservoir (Bear River), Folsom Reservoir (American River), Lake Berryessa (Putah Creek), New Bullards Bar Reservoir (Yuba River), Oroville Reservoir (Feather River), and Shasta Reservoir (Sacramento River), which are located on tributaries with HRL commitments. In general, changes in reservoir levels for these reservoirs would be less under the VA scenario compared to the 55 w/WSAs scenario, for the term of the VA pathway. As discussed above, the VA pathway would apply to HRL water rights, during the term of the VA pathway, and other reservoirs would be subject to the regulatory pathway. Changes in reservoir levels for these other reservoirs would be expected to be similar to those under the 55 w/WSAs scenario for the term of the VA pathway.

13.4.4 Changes in Surface Water Supply

This section presents the SacWAM modeling results for changes in Sacramento/Delta surface water supply for the 55 w/WSAs scenario and VA scenario by region, using SacWAM version 2025.08.28. For convenience, the study area has been divided into seven regions for water supply analysis purposes based on geography and water supply, as shown in Figure 2.8-1a in Chapter 2, *Hydrology and Water Supply*. The water supply regions in the study area are Sacramento River watershed, Delta eastside tributaries, Delta, Bay Area, Central Coast, San Joaquin Valley, and Southern California. Water supply is summarized by where the water is ultimately supplied, not by where the water may be diverted. For example, water is diverted from the Mokelumne River for use in the Bay Area region; this water is included in the Bay Area water supply discussion, not in the Delta eastside tributaries region discussion. Only a portion of the total water supply to each region may be affected by the revised proposed Plan amendments. This portion is termed *Sacramento/Delta supply* or *Sacramento/Delta water*.

The water supply estimates presented in this section do not include conveyance losses, water held in storage, or water diverted to non-consumptive uses such as hydropower. The values summarized in the graphs and tables in this section are seasonal (January through June and July through December) and annual total volumes by water year of total Sacramento/Delta supply to the study area regions. These amounts are further broken out into agricultural, municipal, and refuge uses.

Graphical and tabular summaries are given of cumulative distributions of surface water supply (boxplots and cumulative distribution tables) and tabular summaries of average water supply by the historical Sacramento Valley 40-30-40 Hydrologic Classification water year type. The water year type classification includes five types in ascending levels of water availability: critical (C), dry (D), below normal (BN), above normal (AN), and wet (W).

The VA pathway includes flow commitments that would be provided through CVP/SWP export reductions identified in the MOU, and flow commitments that would be provided through water purchase programs. The sources for the PWA Water Purchase Fixed Price Program are identified and as such are modeled. However, the unspecified water purchases (PWA Water Purchase Market Price Program and permanent state water purchases) would be from unspecified willing sellers, which could include inflow sources within the Sacramento/Delta watershed or reductions in exports, both of which could result in additional Delta outflows. Because the unspecified water purchases could be provided from reductions in exports or increases in inflows, the water supply effects of both of these scenarios are evaluated in this section. Under both scenarios, the unspecified

water purchases are assumed to occur during April and May to the extent possible, though those purchases could also result in flows at other times. The unspecified water purchases would be expected to be provided primarily or entirely from agricultural water users. Results are shown assuming with and without additional export reductions and with and without additional Delta inflows and associated water supply reductions from the Sacramento/Delta watershed. Results presented below for "VA Low Sac/Delta Supply" assume that the unspecified water purchases would be provided from willing sellers in the Sacramento River watershed. Results presented for "VA High Export Cuts" assume that the unspecified water purchases are derived from reductions in exports. Unspecified water purchases could also be provided through a combination of willing sellers in the Sacramento/Delta watershed and from export reductions, and the actual change from baseline would be within the range reflected in the results.

13.4.4.1 Total Water Supply

Water supplied to beneficial uses goes to a variety of uses such as agriculture, urban (municipal and industrial), and wildlife refuges.[4] The sources of water supplies range from local surface water supplies, groundwater, and water imported from across the state. The total regional water supply is estimated using historical water deliveries data (see Section 2.8, *Existing Water Supply*), and the portion of the surface water supply that may be affected is estimated by SacWAM. As described in Section 6.2, *SacWAM Model Assumptions*, SacWAM simulations assumed no change in groundwater pumping for each of the scenarios. Therefore, the Sacramento/Delta supply results presented here include only surface water. Note that, in response to reductions in Sacramento/Delta supply, water users may seek to obtain more water from groundwater resources in areas where groundwater is available. In addition, changes in water supplies could reduce the level of applied water, which in turn could reduce incidental groundwater recharge (e.g., recharge from conveyance losses and deep percolation). This is discussed in more detail elsewhere in this Staff Report, including in Section 6.6, *Other Water Management Actions*, and in Section 7.12.2, *Groundwater,* Section 9.7.12.2, *Groundwater,* and Section 13.7.12.2, *Groundwater*.

The table below presents the annual average water supply to each region in the study area by type of use (agriculture, urban, and refuge). Total water supply (surface water, other sources, and groundwater) is estimated using historical water deliveries data (Section 2.8, *Existing Water Supply*). Baseline Sacramento/Delta supply is estimated using SacWAM results and methods described in Section 2.8. Reductions in Sacramento/Delta supply are obtained from SacWAM results based on methods described in Section 2.8. The following sections provide further detail on each of the regions and uses. Table 13.4-104 shows that in some regions there are large differences between the baseline Sacramento/Delta surface water supply and the historical total water supply because these regions rely on supplies other than from the Sacramento/Delta. For example, the Central Coast has an estimated total historical water supply of 1,334 TAF/yr but only 87 TAF/yr is supplied from the Sacramento/Delta watershed and the remainder comes from other sources.

[4] For the purposes of this document, a reference to *municipal use* includes domestic and industrial uses unless otherwise specified. The terms *urban* and *municipal and industrial (M&I)* are also sometimes used in this document to generally reference municipal water supplies.

Table 13.4-104. Annual Average Water Supplied to Each Region in the Study Area (TAF/yr)

		Sacramento River Watershed	Delta Eastside Tributaries	Delta	San Francisco Bay Area	Central Coast	San Joaquin Valley	Southern California	Study Area Total
Historical Water Deliveries Data	Total	8,050	986	1,368	1,251	1,334	18,437	9,449	40,875
	Agriculture	6,773	824	1,185	137	1,055	16,803	4,863	31,640
	Municipal	826	154	136	1,089	279	1,053	4,518	8,055
	Refuge	451	8	48	26	0	581	68	1,182
Baseline	Sac/Delta	5,367	206	1,153	696	87	2,845	1,688	12,042
	Agriculture	4,680	125	1,135	27	37	2,445	15	8,464
	Municipal	485	81	18	669	49	100	1,673	3,075
	Refuge	201	0	0	0	0	300	0	501
55 w/WSAs	Sac/Delta	5,135	182	1,154	649	82	2,771	1,412	11,385
		(-4%)	(-12%)	(0%)	(-7%)	(-6%)	(-3%)	(-16%)	(-5%)
		[-3%]	[-2%]	[0%]	[-4%]	[0%]	[0%]	[-3%]	[-2%]
	Agriculture	4,473	111	1,136	24	39	2,385	12	8,180
	Municipal	461	71	19	625	43	87	1,400	2,706
	Refuge	200	0	0	0	0	299	0	499
VA Low Sac/Delta Supply	Sac/Delta	5,144	205	1,154	700	89	2,895	1,717	11,904
		(-4%)	(0%)	(0%)	(1%)	(2%)	(2%)	(2%)	(-1%)
		[-3%]	[0%]	[0%]	[0%]	[0%]	[0%]	[0%]	[0%]
	Agriculture	4,469	125	1,136	28	38	2,493	15	8,304
	Municipal	473	80	18	672	51	103	1,702	3,099
	Refuge	201	0	0	0	0	300	0	501
VA High Export Cuts	Sac/Delta	5,257	205	1,154	700	89	2,783	1,717	11,904
		(-2%)	(0%)	(0%)	(1%)	(2%)	(-2%)	(2%)	(-1%)
		[-1%]	[0%]	[0%]	[0%]	[0%]	[0%]	[0%]	[0%]
	Agriculture	4,582	125	1,136	28	38	2,380	15	8,304
	Municipal	473	80	18	672	51	103	1,702	3,099
	Refuge	201	0	0	0	0	300	0	501

The historical water deliveries data values represent an estimate of the total annual supplies to each region, and the values presented for the 55 w/WSAs and VA scenarios represent the Sacramento/Delta surface water portion as modeled from SacWAM. The percentages in round parentheses represent the estimated reduction in Sacramento/Delta supply relative to baseline, while those in square brackets represent the estimated reduction relative to historical water deliveries for each scenario. When comparing historical water deliveries data estimates to SacWAM results, the reader should keep in mind that they are not meant to be an exact comparison because of differences in methods and time periods. However, these comparisons are presented to give a general idea of the magnitudes of changes relative to the total supply. More information on the differences in the methods can be found in Section 2.8, *Existing Water Supply.*

13.4.4.2 Sacramento/Delta Water in the Study Area

Sacramento/Delta water is defined here as the portion of the surface water supply to regions that originates in or is diverted from waterbodies in the Sacramento River watershed, Delta eastside tributaries, and Delta regions, and may be affected under the revised proposed Plan amendments. Because groundwater supply was assumed not to change in the SacWAM modeling, Sacramento/Delta supply includes only surface water supplies. Only a portion of the water supplied to each of the regions is derived from surface water from the Sacramento/Delta watershed. See Section 6.4.2, *Sacramento/Delta Water in the Study Area*, for additional contextual information.

Regulatory Pathway

As presented in the figure below, SacWAM results for average annual total Sacramento/Delta water supply in the study area under the 55 w/WSAs scenario show reductions compared to baseline in all water year types. Overall, these reductions are less than those under the 55 scenario and more similar to reductions under the Low Flow Alternative in all water year types, although results vary by region and type of use (agriculture, municipal, wildlife refuge uses) as detailed further below. Under the 55 w/WSAs scenario, reductions compared to baseline range from 1,166 TAF (12 percent) in critical years to 270 TAF (2 percent) in above normal years. The average annual water supply reduction from baseline across all water year types is 657 TAF (5 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-2 in Chapter 6, *Changes in Hydrology and Water Supply*).

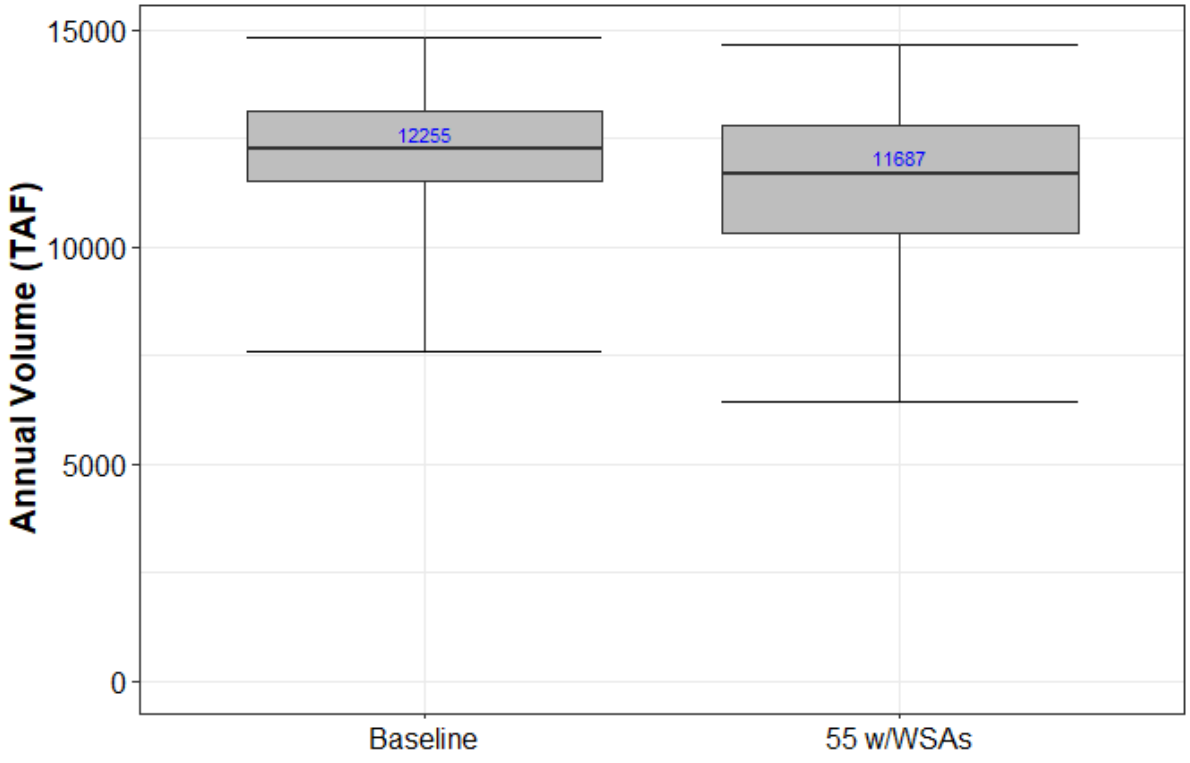


Figure 13.4-57. Annual Total Sacramento/Delta Supply for Baseline and 55 w/WSAs Scenarios

Table 13.4-105. Average Annual Total Sacramento/Delta Supply by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	9,441	-1,166
D	11,594	-1,070
BN	12,189	-593
AN	12,411	-270
W	13,514	-277
All	12,041	-657

Voluntary Agreement Pathway

Model results for annual total Sacramento/Delta supply for baseline and the VA scenario are presented in the figure and table below. SacWAM results for average annual total Sacramento/Delta water supply in the study area under the VA scenario show reductions compared to baseline in all water year types except for wet years when supplies increase by 19 TAF (less than 1 percent). Under the VA scenario, the largest reduction compared to baseline is 315 TAF (3 percent) in dry years. The average annual water supply reduction from baseline across all water year types is 137 TAF (1 percent) under the VA scenario, which is less than the reduction under the 55 w/WSAs scenario and also less than the reduction under the Low Flow Alternative. However, results vary by region and type of use (agriculture, municipal, wildlife refuge) as detailed further in the regional discussions below.

The results for changes in average annual total Sacramento/Delta water supply in the study area under the VA scenario are the same under "VA Low Sac/Delta Supply" and "VA High Export Cuts" and are not presented as a range.

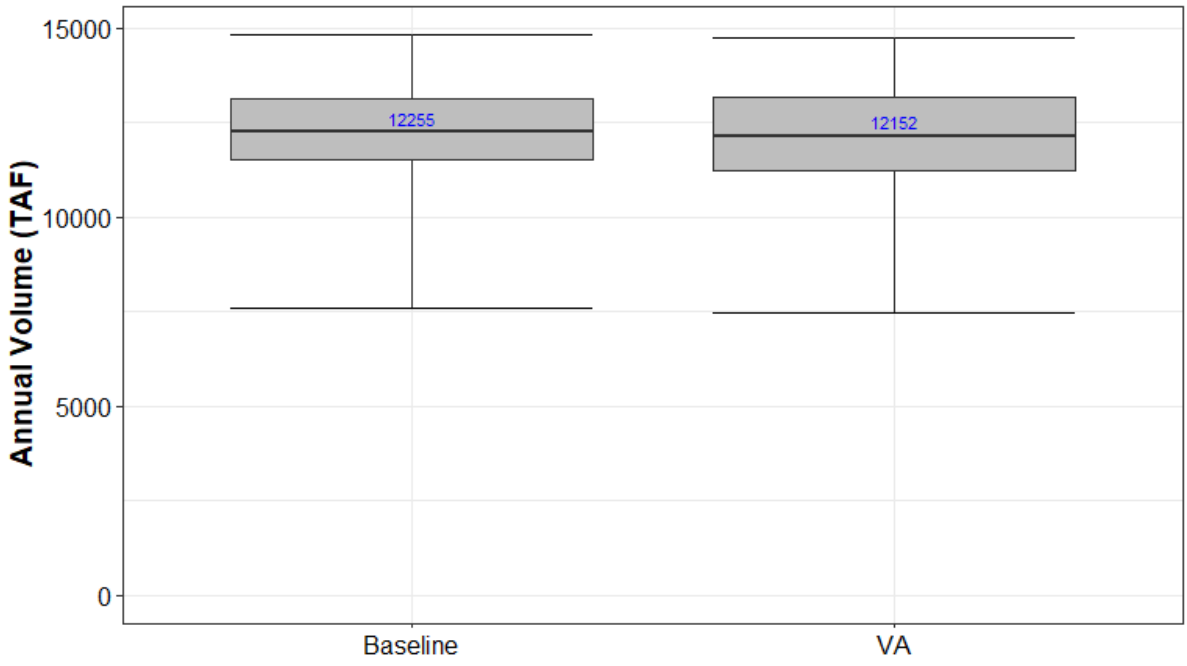


Figure 13.4-58. Annual Total Sacramento/Delta Supply for Baseline and VA Scenarios

Table 13.4-106. Average Annual Sacramento/Delta Supply by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	9,441	-94
D	11,594	-315
BN	12,189	-165
AN	12,411	-215
W	13,514	19
All	12,041	-137

13.4.4.3 Sacramento/Delta Supply to the Sacramento River Watershed, Delta, and Delta Eastside Tributaries Regions (Sacramento/Delta watershed)

Sacramento/Delta Supply to the Sacramento River Watershed

The Sacramento River watershed includes the Sacramento River and its tributaries. This region is bounded by the Sierra Nevada on the east, the Coast Ranges on the west, the Cascade and Trinity Mountains on the north, and the Bay-Delta to the south. With respect to the SacWAM domain, this includes all Water Budget Areas (WBA) except for 50, 60N, 60S, and 61N. Sacramento/Delta water supply in the Sacramento River watershed includes surface water delivered to consumptive uses in the upper watersheds and surface water delivered to agriculture, refuge, and urban uses throughout the Sacramento Valley. See Section 6.4.3*, Sacramento/Delta Supply to the Sacramento River Watershed*, for additional contextual information. Sacramento/Delta water supply is primarily delivered to agriculture in the Sacramento River watershed, but municipal and industrial and refuge supplies also may be affected and therefore are presented separately below.

The 2024 LTO includes an agreement between Reclamation and the Sacramento River Settlement Contractors, referred to as the Drought Protection Program, in which the settlement contractors would voluntarily reduce allocations by up to 500 TAF during the lowest storage years for Shasta Reservoir. This would increase carryover storage and provide water temperature benefits during those conditions.

Regulatory Pathway

As presented in the figure and table below, SacWAM results for average annual total Sacramento/Delta water supply to the Sacramento River watershed under the 55 w/WSAs scenario show reductions compared to baseline in all water year types. Overall, these reductions are less than under the 55 scenario and more similar to those under the Low Flow Alternative. The reductions compared to baseline range from 772 TAF (16 percent) in critical years to 68 TAF (1 percent) in above normal years. The average annual water supply reduction across all water year types is 232 TAF (4 percent), which is similar to the Low Flow Alternative (see Table 6.4-4 in Chapter 6, *Changes in Hydrology and Water Supply*).

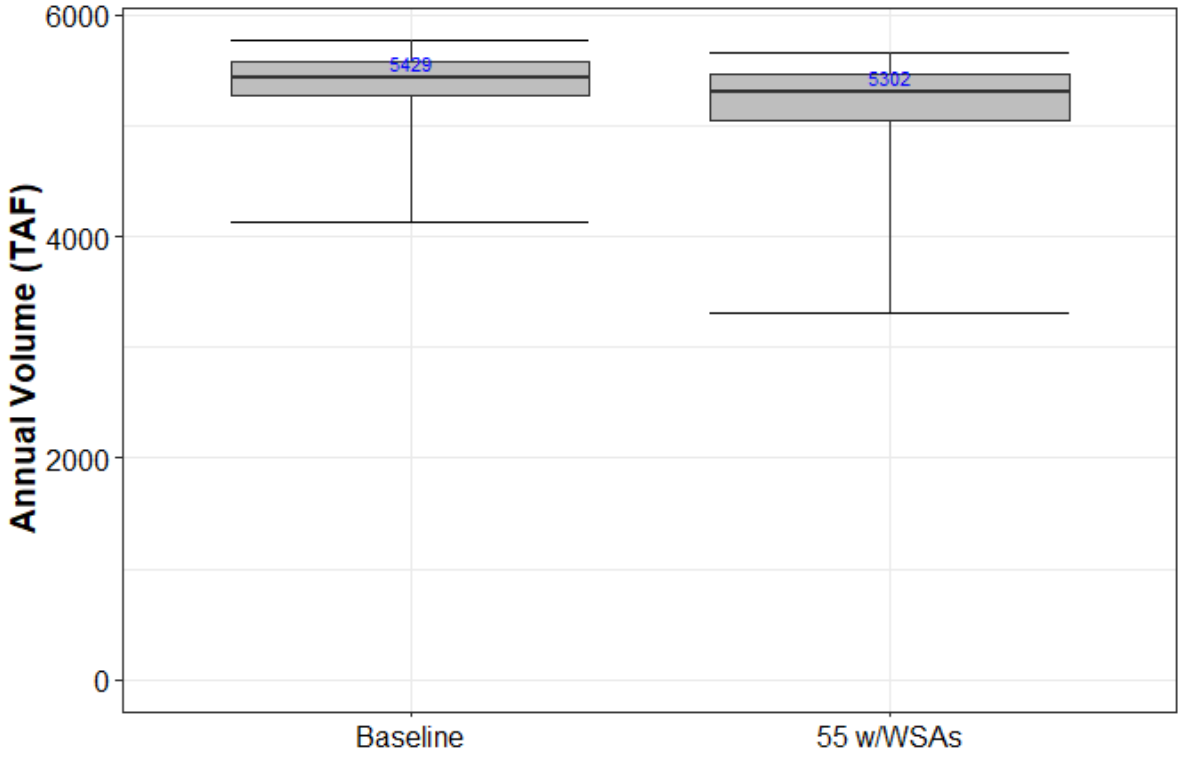


Figure 13.4-59. Annual Total Sacramento/Delta Supply to the Sacramento River Watershed for Baseline and 55 w/WSAs Scenarios

Table 13.4-107. Average Annual Total Sacramento/Delta Supply to the Sacramento River Watershed by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	4,913	-772
D	5,370	-201
BN	5,474	-115
AN	5,469	-68
W	5,497	-106
All	5,367	-232

As presented in the figure and table below, SacWAM results for average annual Sacramento/Delta water supply to agriculture in the Sacramento River watershed under the 55 w/WSAs scenario show reductions compared to baseline in all water year types. These reductions are less than under the 55 scenario and more similar to the Low Flow Alternative in all water year types. Under the 55 w/WSAs scenario, the reductions compared to baseline range from 708 TAF (17 percent) in critical years to 55 TAF (1 percent) in above normal years. The average annual water supply reduction from baseline across all water year types is 207 TAF (4 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-5 in Chapter 6, *Changes in Hydrology and Water Supply*).

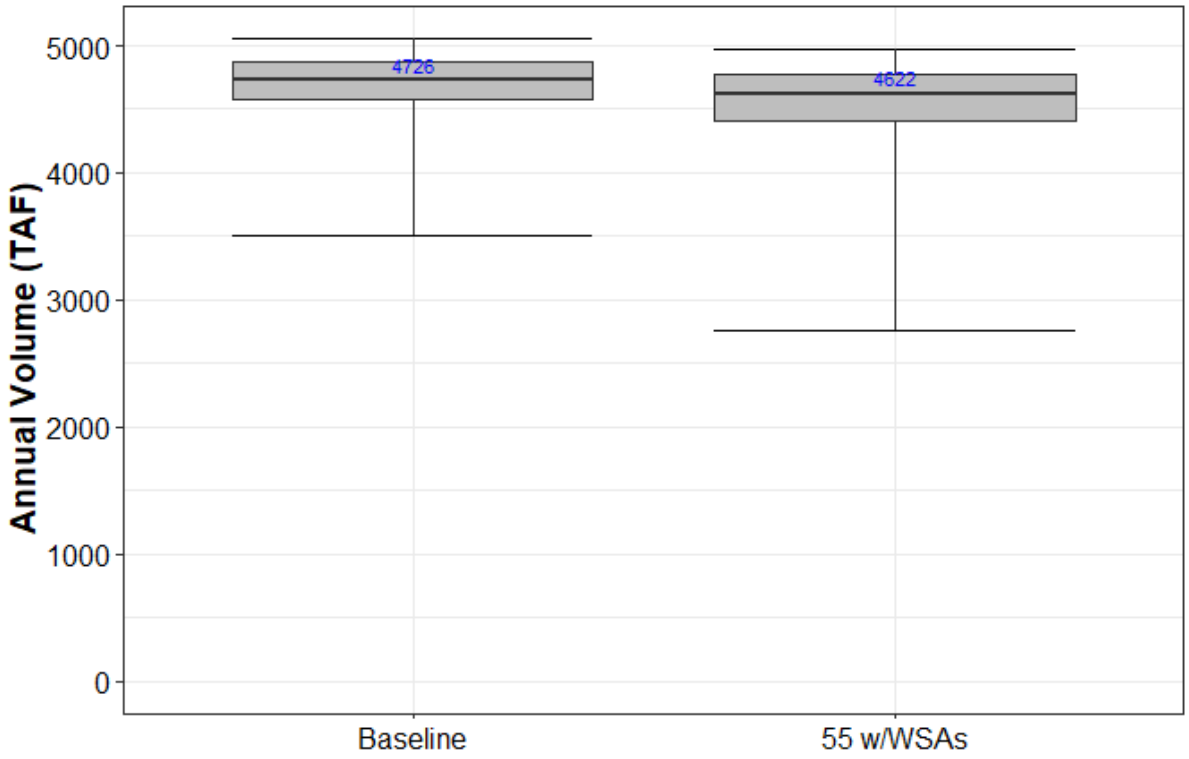


Figure 13.4-60. Annual Sacramento/Delta Supply to Agriculture in the Sacramento River Watershed for Baseline and 55 w/WSAs Scenarios

Table 13.4-108. Average Annual Sacramento/Delta Supply to Agriculture in the Sacramento River Watershed by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	4,255	-708
D	4,690	-169
BN	4,784	-102
AN	4,776	-55
W	4,796	-97
All	4,680	-207

As presented in the figure and table below, SacWAM results for average annual Sacramento/Delta water supply to municipal use in the Sacramento River watershed under the 55 w/WSAs scenario show reductions compared to baseline in all water year types. These reductions are less than those under the 55 scenario and more similar to reductions under the Low Flow Alternative in all water year types. Under the 55 w/WSAs scenario, reductions compared to baseline are greater in drier years, ranging from 64 TAF (14 percent) in critical years to 8 TAF (2 percent) in wet years. The average annual water supply reduction from baseline across all water year types is 24 TAF (5 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-6 in Chapter 6, *Changes in Hydrology and Water Supply*).

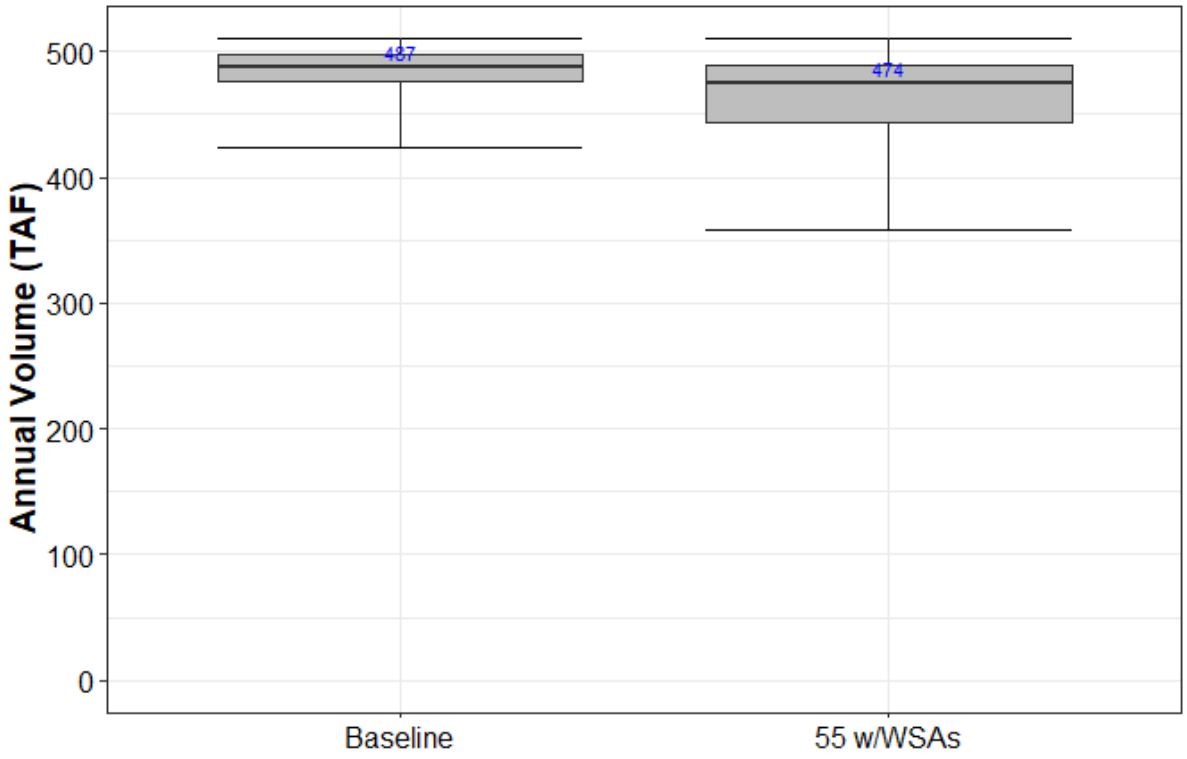


Figure 13.4-61. Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Sacramento River Watershed for Baseline and 55 w/WSAs Scenarios

Table 13.4-109. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Sacramento River Watershed by Water Year for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	458	-64
D	477	-32
BN	487	-13
AN	493	-11
W	500	-8
All	485	-24

As presented in the figure and table below, SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges in the Sacramento River watershed under the 55 w/WSAs scenario show limited changes for all water year types, with a very small reduction of 1 TAF (less than 1 percent) across all water year types that would be assumed to be negligible and within the expected precision of the model. These changes are very similar to those for the flow scenarios generated using SacWAM version 2025.08.28 and presented in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. These reductions are less than those generated using SacWAM version 2023.06.12 and evaluated in Chapter 6, *Changes in Hydrology and Water Supply,* for the flow scenarios, including the 55 scenario and Low Flow Alternative (see Table 6.4-7 in Chapter 6). However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past

practice of reducing water supplies to CVPIA wildlife refuges when it reduces allocations to Sacramento River Settlement Contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges could at times be larger than indicated by the modeling.

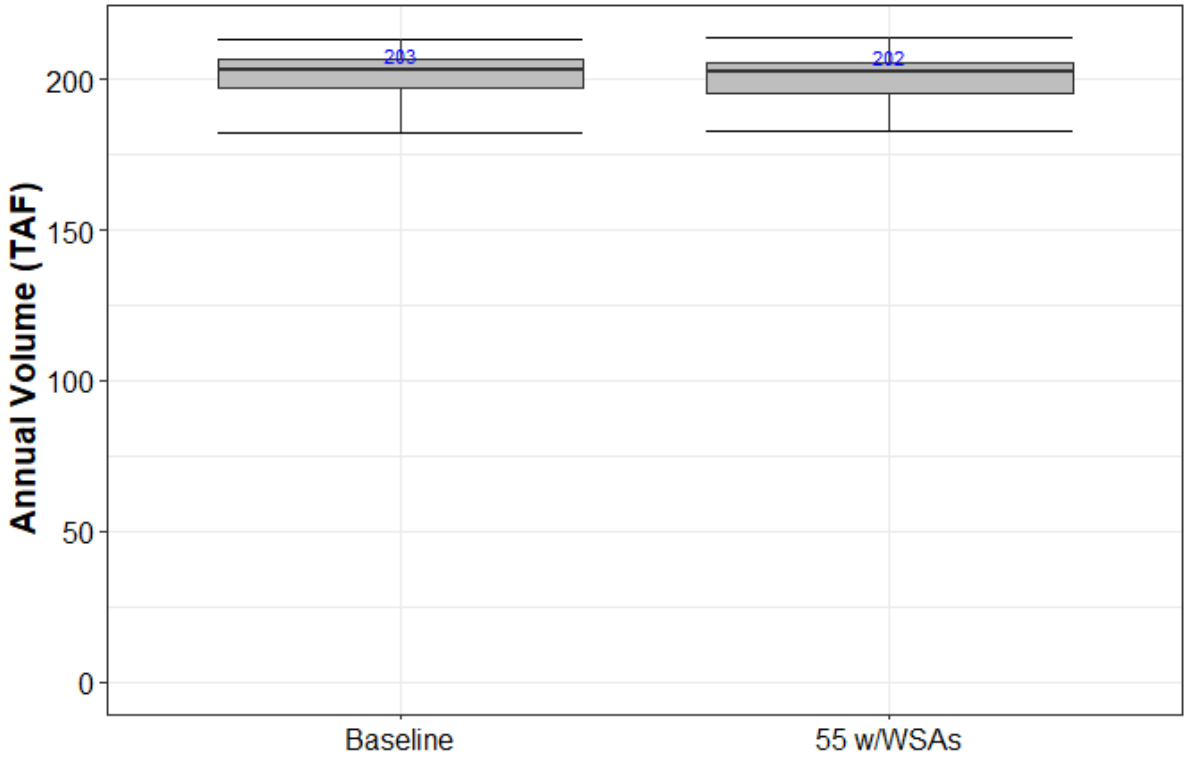


Figure 13.4-62. Annual Sacramento/Delta Supply to Wildlife Refuges in the Sacramento River Watershed for Baseline and 55 w/WSAs Scenarios

Table 13.4-110. Average Annual Sacramento/Delta Supply to Wildlife Refuges in the Sacramento River Watershed Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	200	0
D	203	-1
BN	203	0
AN	200	-2
W	201	-2
All	201	-1

Voluntary Agreement Pathway

Overall, the VA scenario would result in a reduction in Sacramento/Delta surface water supply within the Sacramento/Delta watershed. The VA scenario results presented below reflect the range of changes in Sacramento/Delta surface water supplies that could occur within the Sacramento River watershed under the VA pathway. In the below figures and tables, "VA" assumes that unspecified water purchases are provided entirely through reductions in Delta exports, and "VA Low Sac/Delta Supply" assumes that the unspecified water purchases are provided entirely from willing

sellers in the Sacramento River watershed and would affect agricultural uses. Because it is possible that unspecified water purchases would be provided through a combination of inflow sources within the Sacramento/Delta watershed and reductions in exports, the actual future condition could be between these two scenarios.

As presented in the figure and table below, SacWAM results for average annual total Sacramento/Delta water supply to the Sacramento River watershed under the VA scenario show reductions compared to baseline in all water year types, with larger reductions in Sacramento/Delta water supply in all water year types if it is assumed that unspecified water purchases are provided entirely from willing sellers in the Sacramento River watershed ("VA Low Sac/Delta Supply"). The average annual water supply reduction from baseline across all water year types is 110-223 TAF, about 2-4 percent, depending on the sources of the unspecified water purchases.

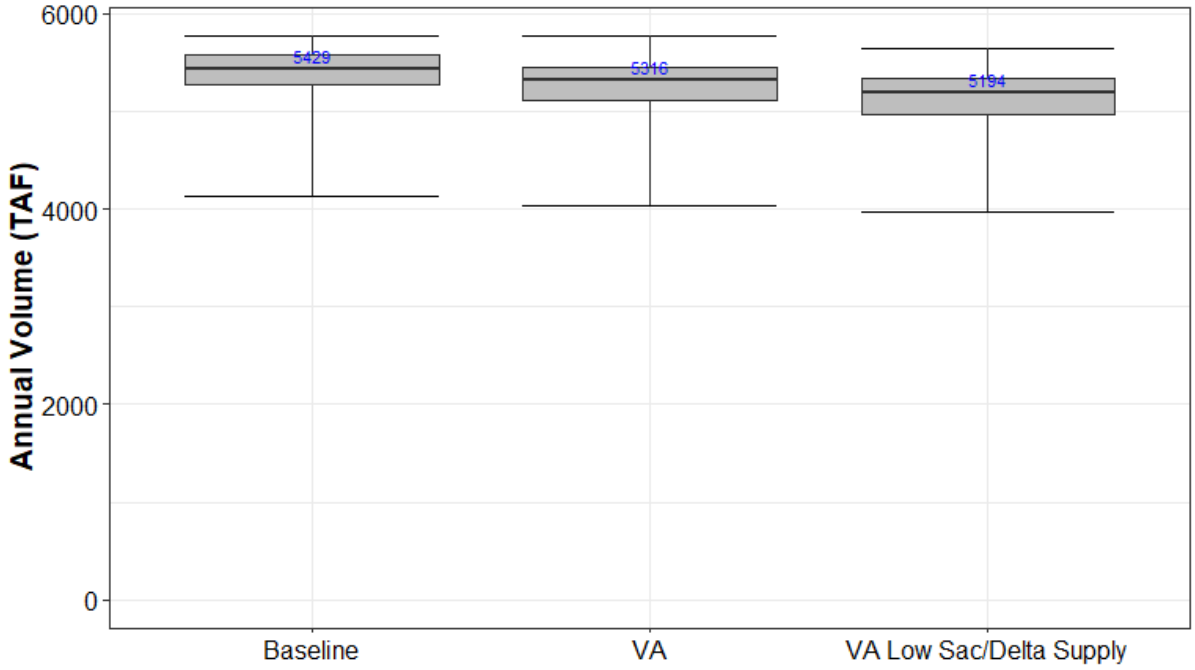


Figure 13.4-63. Annual Total Sacramento/Delta Supply to the Sacramento River Watershed for Baseline and VA Scenarios

Table 13.4-111. Average Annual Total Sacramento/Delta Supply to the Sacramento River Watershed by Water Year Type for the VA Scenarios

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)	VA Low Sac/Delta Supply: Change from Baseline (TAF/yr)
C	4,913	-26	-91
D	5,370	-210	-368
BN	5,474	-184	-254
AN	5,469	-183	-320
W	5,497	-5	-128
All	5,367	-110	-223

As presented in the figure and table below, SacWAM results for average annual Sacramento/Delta water supply to agriculture in the Sacramento River watershed under the VA scenario show reductions compared to baseline in all water year types, with larger reductions if it is assumed that unspecified water purchases are provided entirely from willing sellers in the Sacramento River watershed ("VA Low Sac/Delta Supply"). The average annual water supply reduction from baseline across all water year types is 98-211 TAF, about 2-4 percent, depending on the sources of the unspecified water purchases.

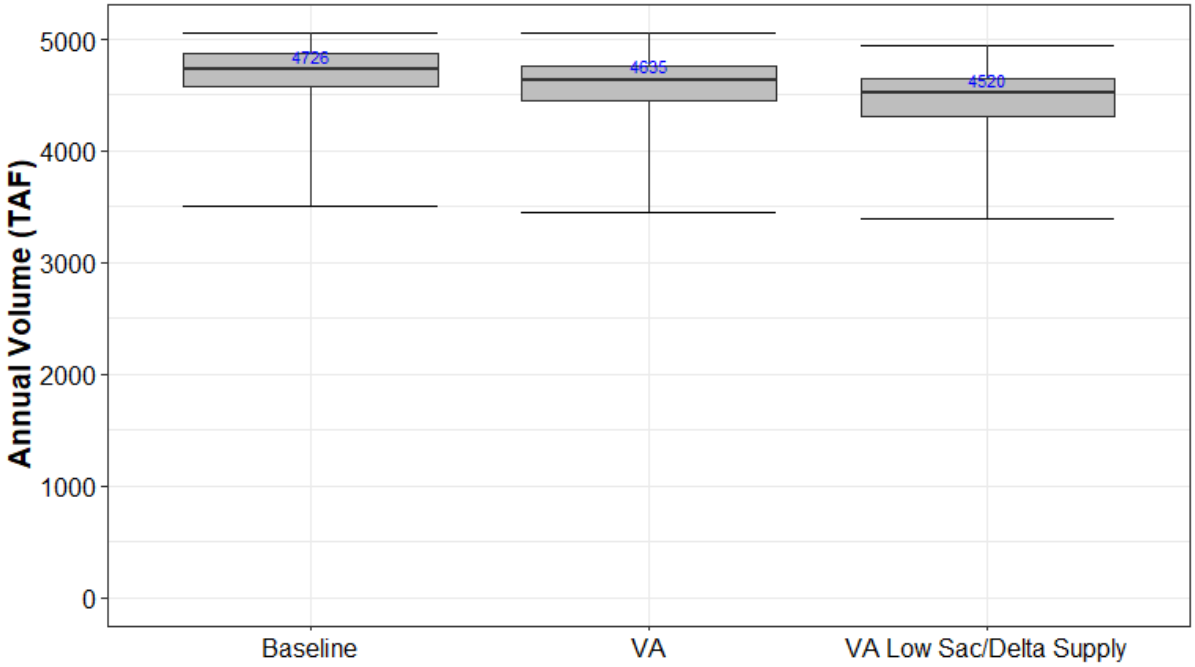


Figure 13.4-64. Annual Sacramento/Delta Supply to Agriculture in the Sacramento River Watershed for Baseline and VA Scenarios

Table 13.4-112. Average Annual Sacramento/Delta Supply to Agriculture in the Sacramento River Watershed by Water Year Type for the VA Scenarios

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)	VA Low Sac/Delta Supply: Change from Baseline (TAF/yr)
C	4,255	-6	-71
D	4,690	-179	-337
BN	4,784	-183	-253
AN	4,776	-179	-316
W	4,796	-3	-126
All	4,680	-98	-211

As presented in the figure and table below, SacWAM results for average annual Sacramento/Delta water supply to municipal use in the Sacramento River watershed show reductions compared to baseline in all water year types. Because it assumed that unspecified water purchases are provided entirely from willing sellers and would affect agricultural uses, the VA scenario results presented below do not distinguish between the "VA Low Sac/Delta Supply" and "VA" because the effect on

municipal supply would be the same. Under the VA scenario, reductions in annual average supplies compared to baseline are greater in the driest years, ranging from 31 TAF (7 percent) in dry years to 1 TAF (less than 1 percent) in below normal years. The average annual water supply reduction from baseline across all water year types is 11 TAF (2 percent) under the VA scenario.

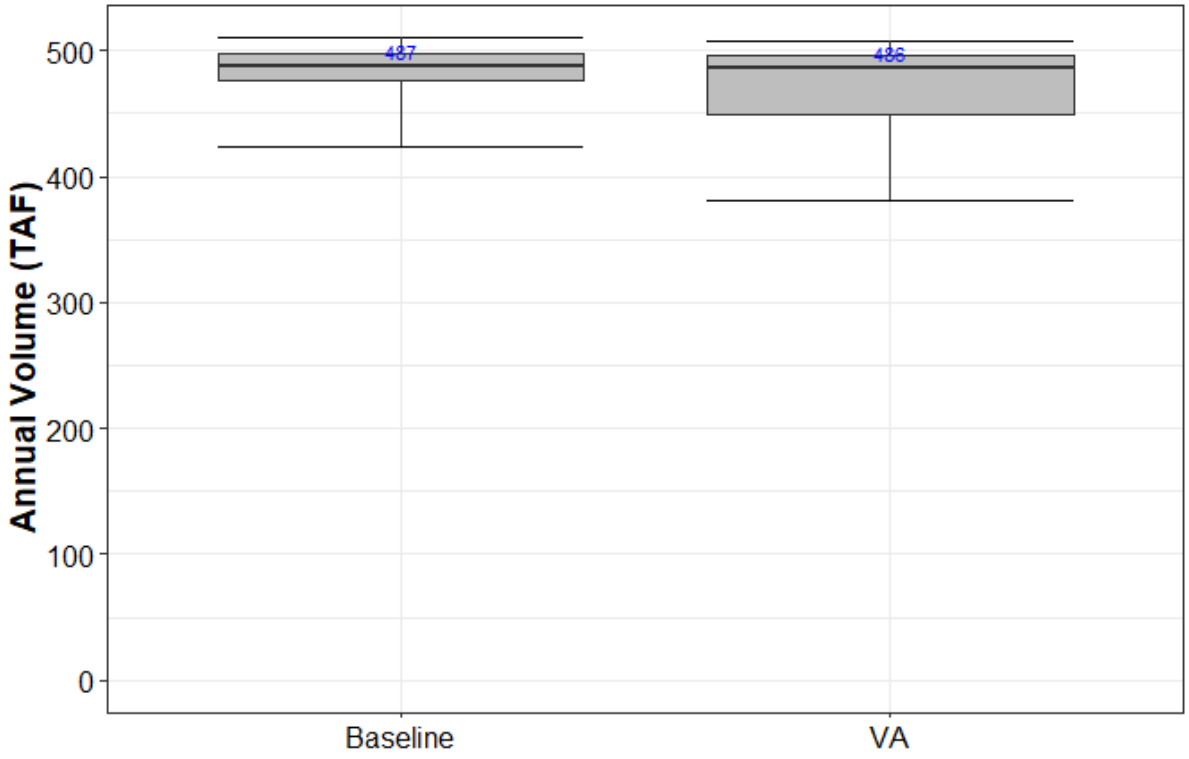


Figure 13.4-65. Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Sacramento River Watershed for Baseline and VA Scenarios

Table 13.4-113. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Sacramento River Watershed by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	458	-20
D	477	-31
BN	487	-1
AN	493	-3
W	500	-2
All	485	-11

As presented in the figure and table below, SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges in the Sacramento River watershed show that there would be no change from baseline under the VA scenario. Because it is assumed that unspecified water purchases are provided entirely from willing sellers and would affect agricultural uses, the VA scenario results presented below do not distinguish between the "VA Low Sac/Delta Supply" and "VA."

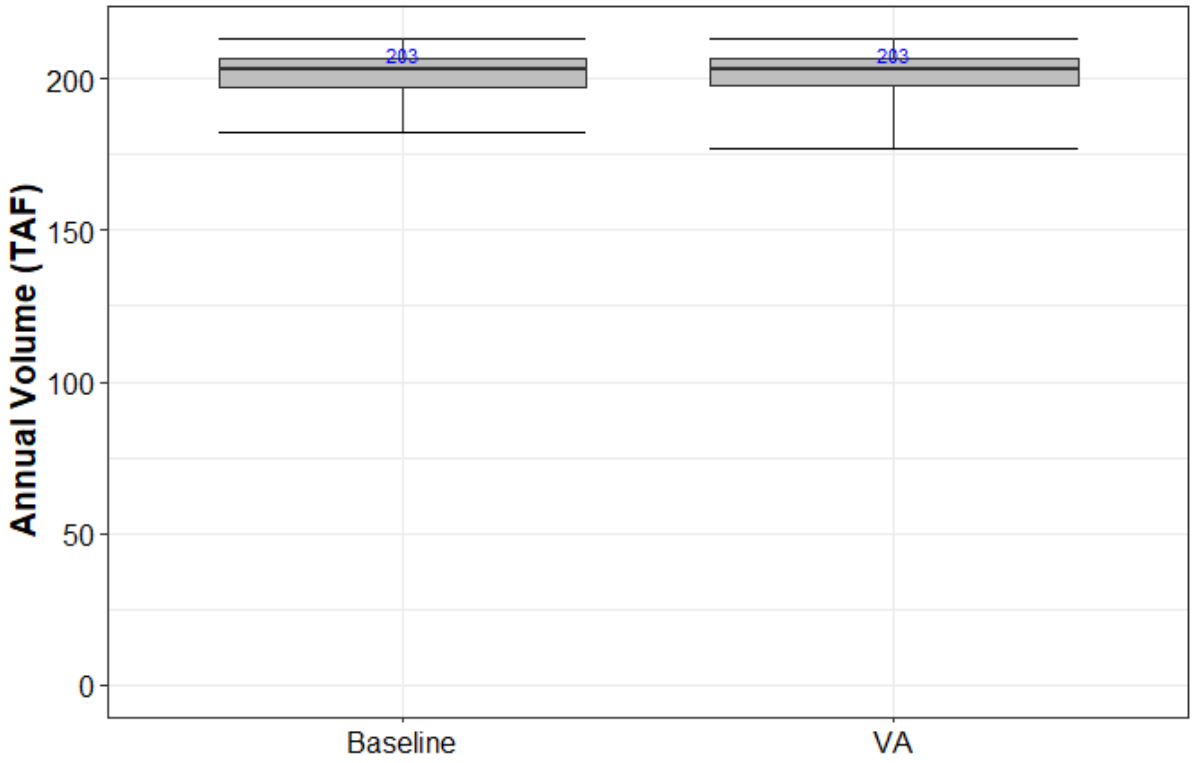


Figure 13.4-66. Annual Sacramento/Delta Supply to Wildlife Refuges in the Sacramento River Watershed for Baseline and VA Scenarios

Table 13.4-114. Average Annual Sacramento/Delta Supply to Wildlife Refuges in the Sacramento River Watershed by Water Year Type for VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	200	0
D	203	0
BN	203	0
AN	200	0
W	201	0
All	201	0

Sacramento/Delta Supply to the Delta Eastside Tributaries

The Delta eastside tributaries region includes the watersheds of the Cosumnes, Mokelumne, and Calaveras Rivers from the headwaters to the legal Delta boundary. With respect to the SacWAM domain, this includes WBAs 60N and 60S. See Section 6.4.4, *Sacramento/Delta Supply to the Delta Eastside Tributaries,* for additional contextual information.

Regulatory Pathway

As presented in the figure and table below, SacWAM results for average annual total Sacramento/Delta water supply to the Delta eastside tributaries region under the 55 w/WSAs scenario show reductions compared to baseline in all water year types. These reductions are less

than those under the 55 scenario and more similar to reductions under the Low Flow Alternative in all water year types. Under the 55 w/WSAs scenario, reductions compared to baseline are greater in drier years, ranging from 30 TAF (19 percent) in critical years to 17 TAF (8 percent) in wet years. The average annual water supply reduction from baseline across all water year types is 24 TAF (12 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-8 in Chapter 6, *Changes in Hydrology and Water Supply*).

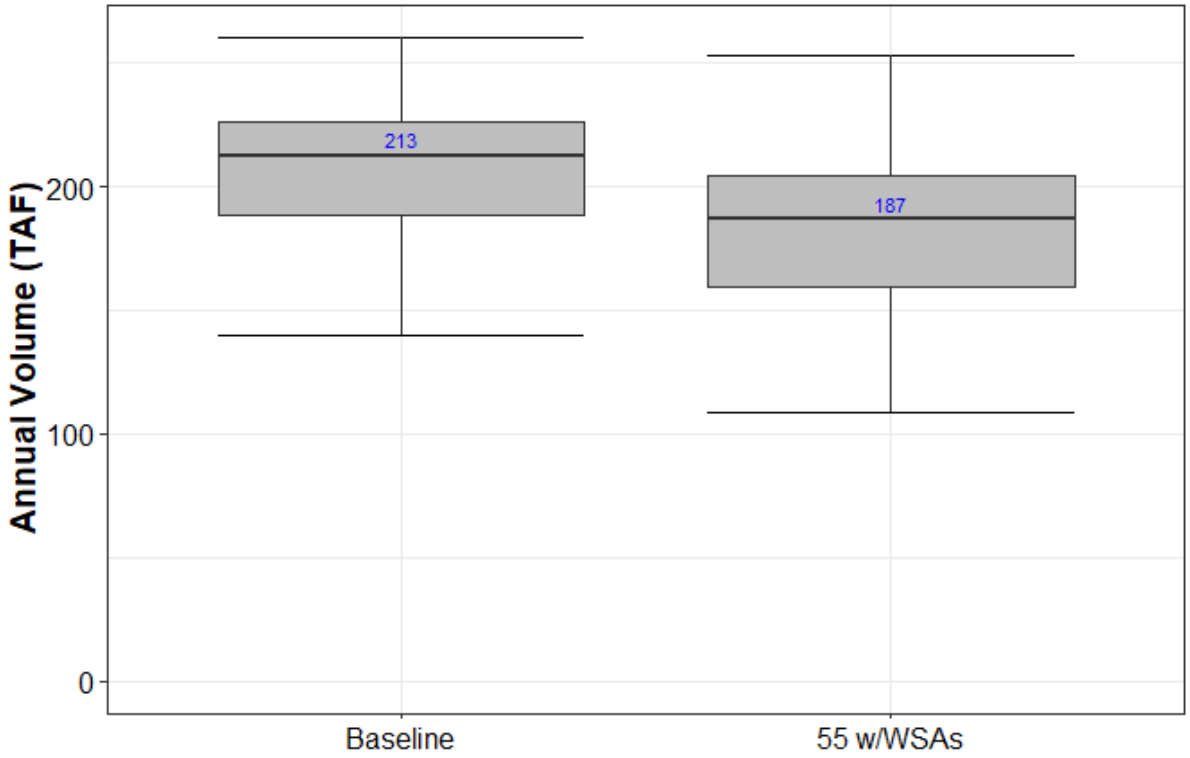


Figure 13.4-67. Annual Total Sacramento/Delta Supply to the Delta Eastside Tributaries Region for Baseline and 55 w/WSAs Scenarios

Table 13.4-115. Average Annual Total Sacramento/Delta Supply to the Delta Eastside Tributaries Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	158	-30
D	193	-25
BN	211	-27
AN	219	-23
W	232	-17
All	206	-24

As presented in the table below, SacWAM results for average annual Sacramento/Delta water supply to agriculture in the Delta eastside tributaries region under the 55 w/WSAs scenario show reductions compared to baseline in all water year types. These changes would be less than under the 55 scenario and more similar to the Low Flow Alternative in all water year types. Reductions from baseline range from 21 TAF (16 percent) in below normal years to 5 TAF (7 percent) in critical years. The average annual water supply reduction from baseline across all water year types is 14

TAF (11 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-9 in Chapter 6, *Changes in Hydrology and Water Supply*).

Table 13.4-116. Average Annual Sacramento/Delta Supply to Agriculture in the Delta Eastside Tributaries Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	78	-5
D	110	-9
BN	130	-21
AN	140	-20
W	153	-16
All	125	-14

As presented in the table below, SacWAM results for average annual Sacramento/Delta water supply to municipal use in the Delta eastside tributaries region under the 55 w/WSAs scenario show reductions compared to baseline in all water year types. These reductions are less than those under the 55 scenario and more similar to the Low Flow Alternative in all water year types. Under the 55 w/WSAs scenario, reductions compared to baseline are greater in drier years, ranging from 25 TAF (31 percent) in critical years to 2 TAF (3 percent) in wet years. The average annual water supply reduction from baseline across all water year types is 9 TAF (11 percent), under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-6 in Chapter 6, *Changes in Hydrology and Water Supply*).

Table 13.4-117. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Delta Eastside Tributaries Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	80	-25
D	83	-15
BN	81	-6
AN	79	-3
W	79	-2
All	81	-9

Voluntary Agreement Pathway

Overall, the VA scenario shows very limited changes in Sacramento/Delta surface water supply to the Delta eastside tributaries region, as presented in the figure and tables below, and these reductions are smaller than those under the 55 w/WSAs scenario. SacWAM results for average annual total Sacramento/Delta water supply to the Delta eastside tributaries region under the VA scenario are unchanged compared to baseline in wet, above normal, and below normal years, and show reductions of 1 TAF (less than 1 percent) in critical and dry years. The average annual water supply reduction from baseline across all water year types is 1 TAF (1 percent) under the VA scenario. Similarly, the results for Sacramento/Delta surface water supply to agriculture in the Delta eastside tributaries region under the VA scenario show that there would be no change from baseline for all water year types. Results for Sacramento/Delta surface water supply to municipal use in the Delta eastside tributaries region under the VA scenario show that any reductions would be minimal (0-1 TAF, depending on the water year type).

As discussed above, the results for the VA scenario consider changes in water supply as a result of flows that would be provided on tributaries with HRL commitments, CVP/SWP export reductions identified in the MOU proposing HRL commitments, and water purchase programs, including unspecified water purchases. The unspecified water purchases could be provided from willing sellers in the Sacramento/Delta watershed, or from export reductions. Unspecified water purchases could also be provided through a combination of willing sellers in the Sacramento/Delta watershed and from export reductions. The SacWAM modeling assumes that unspecified water purchases are provided from willing sellers in the Sacramento River watershed. The water supply results for the VA scenario presented below do not distinguish between the "VA Low Sac/Delta Supply" and "VA" because the effect on Sacramento/Delta water supply to the Delta eastside tributaries region for all sectors would be assumed to be the same under each scenario and, as such, are labeled as "VA."

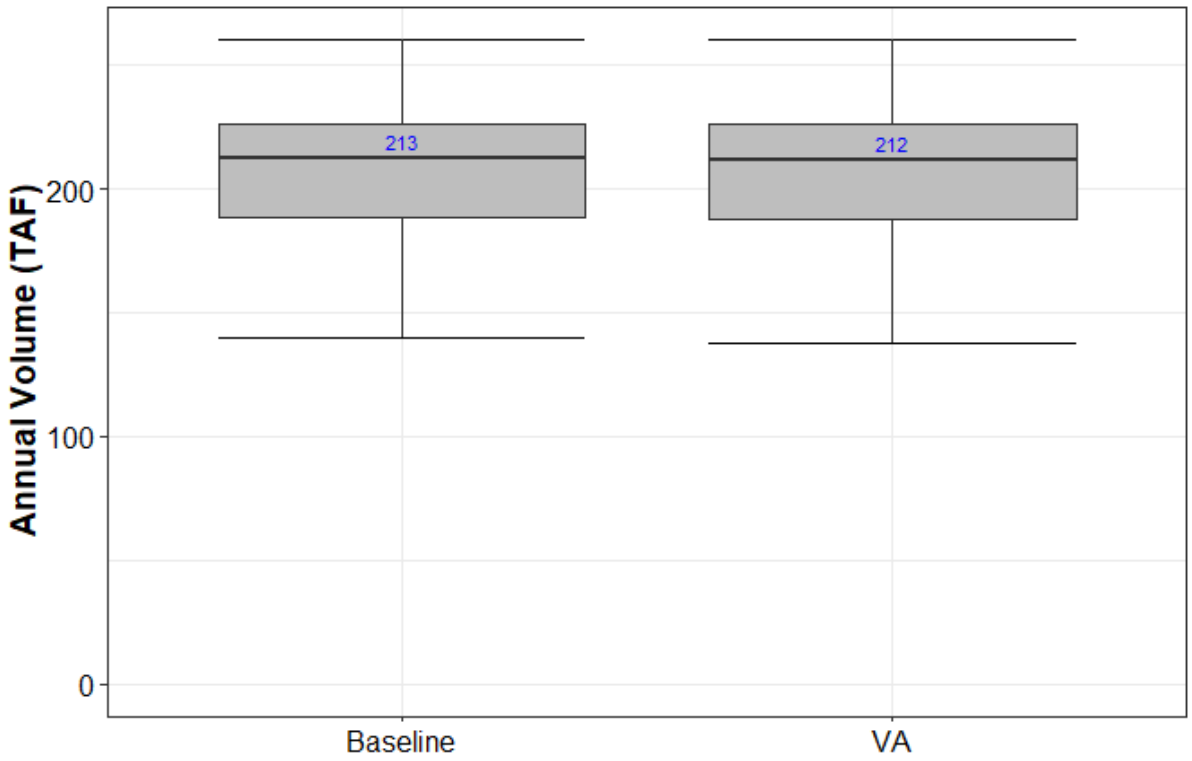


Figure 13.4-68. Annual Total Sacramento/Delta Supply to the Delta Eastside Tributaries Region for Baseline and VA Scenarios

Table 13.4-118. Average Annual Total Sacramento/Delta Supply to the Delta Eastside Tributaries Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	158	-1
D	193	-1
BN	211	0
AN	219	0
W	232	0
All	206	-1

Table 13.4-119. Average Annual Sacramento/Delta Supply to Agriculture in the Delta Eastside Tributaries Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	78	0
D	110	0
BN	130	0
AN	140	0
W	153	0
All	125	0

Table 13.4-120. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Delta Eastside Tributaries Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	80	-1
D	83	-1
BN	81	0
AN	79	0
W	79	0
All	81	0

Sacramento/Delta Supply to the Delta

The Delta includes the tidal portions of the Sacramento, San Joaquin, and Mokelumne Rivers and communities within the Legal Delta. Water supply in this region is used primarily for agricultural uses on Delta islands (modeled as Delta depletions); CVP deliveries to the City of Tracy, Banta-Carbona Irrigation District, Byron-Bethany Irrigation District, and Westside Irrigation District; and the City of Antioch in the western Delta. With respect to the SacWAM domain, this includes WBA 50, portions of CVP Upper Delta-Mendota Canal demands, and the demand unit for the City of Antioch. See Section 6.4.5, *Sacramento/Delta Supply to the Delta*, for additional contextual information.

Regulatory Pathway

Overall, changes in Sacramento/Delta water supplies to the Delta region are limited under the 55 w/WSAs scenario, as presented in the figure and tables below. These results are similar to those for the Low Flow Alternative presented in Chapter 6, *Changes in Hydrology and Water Supply,* which also show limited changes in Sacramento/Delta water supplies.

Section 6.4.5, *Sacramento/Delta Supply to the Delta*, discusses that the Sacramento/Delta water delivered to the Delta region does not significantly change in the SacWAM scenarios. Significant reductions are not modeled explicitly in the SacWAM scenarios due to the uncertainty in observed Delta depletions and how deletions may change if diversions were curtailed. SacWAM results show that the availability of water for diversion is reduced throughout the watershed. Therefore, it is likely that the frequency of insufficient natural and abandoned flows to meet Delta and other riparian diversions would increase. To the degree that such shortages occur, they would be represented in this analysis as a share of total agricultural water supply and overall cumulative changes in water supply (discussed above in Section 13.4.4.1, *Total Water Supply*). If Delta water

supply is reduced to help meet outflow requirements, there would be an increase in SWP and CVP reservoir storage or an increase in water supply to other regions.

In the baseline scenario, average annual total Sacramento/Delta water supply to the Delta region is highest in critical years (1,197 TAF) and lowest in wet years (1,108 TAF). Under the 55 w/WSAs scenario, the modeling shows that there could be a small increase of 1 TAF (less than 1 percent) from baseline across all water year types, which is similar to the Low Flow Alternative (see Table 6.4-11 in Chapter 6, *Changes in Hydrology and Water Supply*). Similar to these results for average annual total Sacramento/Delta water supply to the Delta region, SacWAM results for changes in Sacramento/Delta water supply to agriculture the Delta and to municipal uses in the Delta show only small changes from baseline under the 55 w/WSAs scenario.

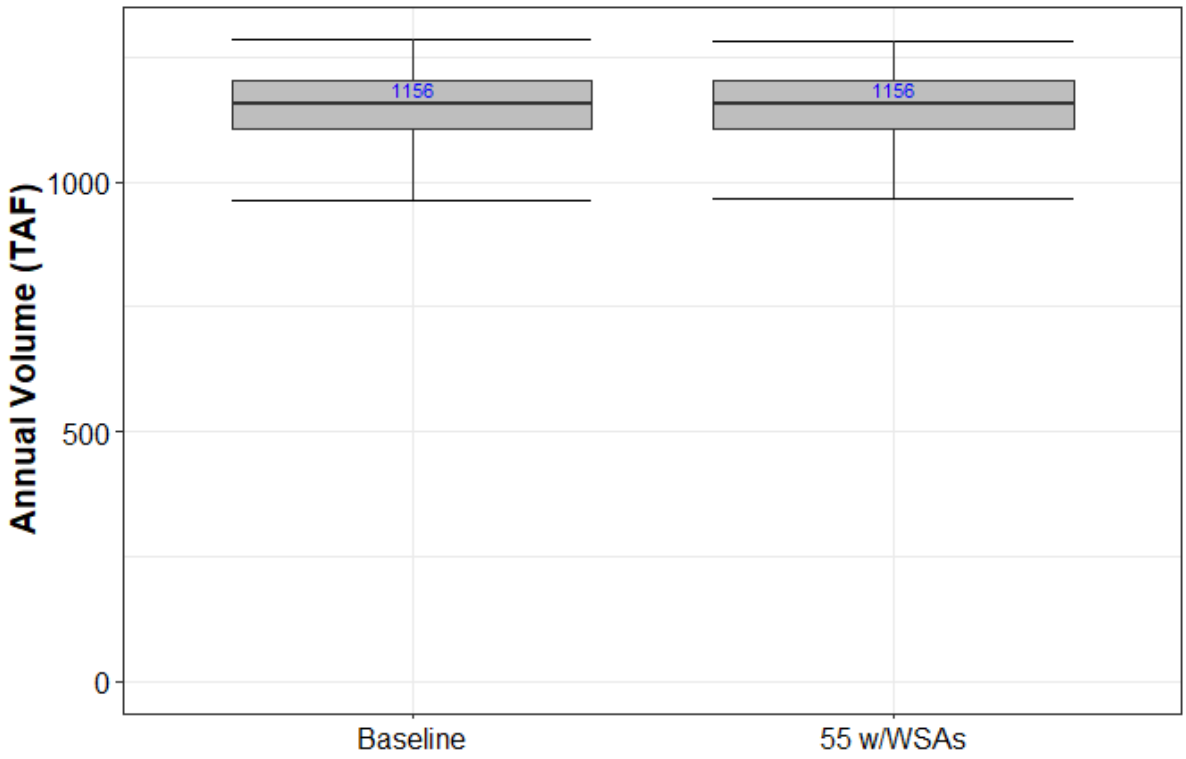


Figure 13.4-69. Annual Total Sacramento/Delta Supply to the Delta Region for Baseline and 55 w/WSAs Scenarios

Table 13.4-121. Average Annual Total Sacramento/Delta Supply to the Delta Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1,197	-5
D	1,184	0
BN	1,170	3
AN	1,125	5
W	1,108	2
All	1,153	1

Table 13.4-122. Average Annual Sacramento/Delta Supply to Agriculture in the Delta Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1,188	-4
D	1,169	0
BN	1,153	2
AN	1,104	4
W	1,083	1
All	1,135	0

Table 13.4-123. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Delta Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	9	-2
D	15	0
BN	18	2
AN	21	1
W	25	1
All	18	0

Voluntary Agreement Pathway

As presented in the figure and tables below, similar to the 55 w/WSAs scenario, modeled changed in Sacramento/Delta total water supply to the Delta region are limited under the VA scenario. Overall, the SacWAM results for Sacramento/Delta total water supply to the Delta show that there could be an overall increase of 1 TAF (less than 1 percent) from baseline across all water year types. Results shown below for Sacramento/Delta water supply to agriculture in the Delta and to municipal use in the Delta similarly show only small changes from baseline under the VA scenario for all water year types. Because it is assumed that unspecified water purchases would not be provided from willing sellers in the Delta, the water supply results for the VA scenario presented below are not reflected as a range.

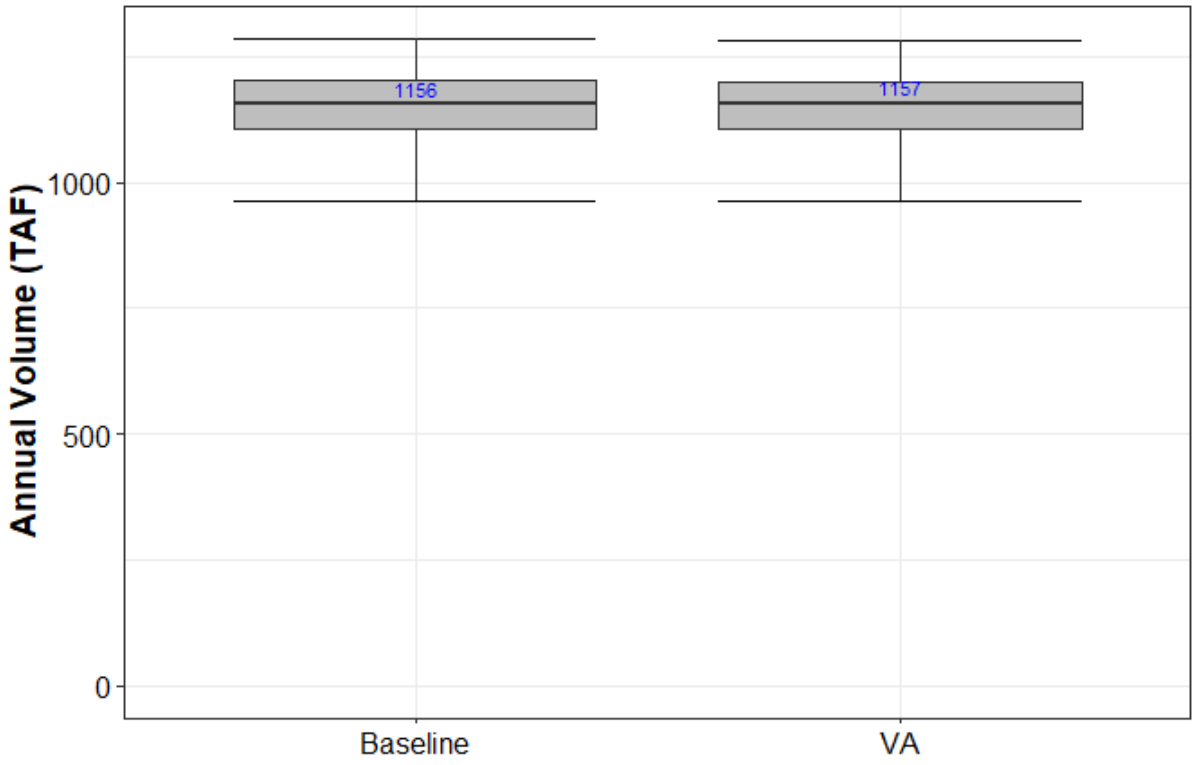


Figure 13.4-70. Annual Total Sacramento/Delta Supply to the Delta Region for Baseline and VA Scenarios

Table 13.4-124. Average Annual Total Sacramento/Delta Supply to the Delta Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	1,197	-1
D	1,184	0
BN	1,170	1
AN	1,125	0
W	1,108	2
All	1,153	1

Table 13.4-125. Average Annual Sacramento/Delta Supply to Agriculture in the Delta Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	1,188	-1
D	1,169	0
BN	1,153	0
AN	1,104	0
W	1,083	2
All	1,135	1

Table 13.4-126. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Delta Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	9	0
D	15	0
BN	18	1
AN	21	0
W	25	0
All	18	0

13.4.4.4 Sacramento/Delta Supply to the San Joaquin Valley

The San Joaquin Valley region includes the watershed of the San Joaquin River upstream of the Delta and the Tulare Lake Basin. With respect to the SacWAM domain, this includes WBA 61N and the primarily agricultural demands served by CVP and SWP deliveries to the San Joaquin Valley and Tulare Lake. WBA 61N is defined by the Stanislaus River to the south, and the boundaries of Oakdale Irrigation District and South San Joaquin Irrigation District to the north. Supplies to WBA 61N demands are from the Lower San Joaquin River and its tributaries and are unchanged in the modeled scenarios. As with other regions that receive some of their supply as exports from the Delta, the only portion of the supply that is analyzed here is the portion that was exported from the Delta. See Section 6.4.8, *Sacramento/Delta Supply to the San Joaquin Valley,* for additional contextual information.

Regulatory Pathway

Annual total Sacramento/Delta surface water supply to the San Joaquin Valley region for the baseline and 55 w/WSAs scenarios are presented in the figure and table below. SacWAM results for average annual total Sacramento/Delta water supply to the San Joaquin Valley region under the 55 w/WSAs scenario show reductions compared to baseline of 203 TAF (12 percent) in critical years, 229 TAF (9 percent) in dry years, and 41 TAF (1 percent) in below normal years, and increases compared to baseline of 70 TAF (2 percent) in above normal years and 32 TAF (1 percent) in wet years. Overall, across all water year types, changes in Sacramento/Delta supply to the San Joaquin Valley region would be less than the 55 scenario and more similar to the Low Flow Alternative. The average annual reduction in total Sacramento/Delta water supply to the San Joaquin Valley region under the 55 w/WSAs scenario is 73 TAF (3 percent), which is less than the reduction under the 55 scenario and more similar to the Low Flow Alternative (see Table 6.4-20 in Chapter 6, *Changes in Hydrology and Water Supply*).

As discussed in more detail in Section 6.4.8, *Sacramento/Delta Supply to the San Joaquin Valley*, SWP and CVP contractors have different contractual provisions governing their water supply deliveries. This can occur both among contractors with the same agency (SWP or CVP) and between contractors for the two different agencies, including under varying hydrologic conditions. Because water is supplied to users in the San Joaquin Valley region under a variety of SWP and CVP contracts, the effects of the 55 w/WSAs scenario may be dissimilar, and the effects of the new instream flow requirements are not uniform across the San Joaquin Valley region. Additionally, more frequent "calls on Friant" may occur by exchange contractors if the CVP supply from the Delta is reduced. In this circumstance, the exchange contractors would get water from Millerton Lake (the reservoir impounded by Friant Dam) and supplies to Friant contractors in the south side of the San Joaquin

Valley would be reduced. This would not change the results presented in this chapter, other than possibly an increase in seepage loss, because both the Friant contractors and the exchange contractors are within the San Joaquin Valley region.

In addition, under the 55 w/WSAs scenario, the inclusion of water supply adjustments would lessen water supply reductions compared to those under the 55 scenario to a greater extent for certain agricultural users in the San Joaquin Valley. Results for average south of Delta exports under the 55 w/WSAs scenario show increases from baseline in April and May due primarily to the difference in I:E assumptions between baseline and the 55 w/WSAs scenario discussed above under *Changes in Hydrology*, decreases from baseline in June through December, and minimal departures from baseline in January through June. The overall effect would be a reduction in supply to these users on an annual basis, but these increases in supply during April and May would reduce the water supply impacts to CVP south-of-Delta agricultural contractors. Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*, and Appendix H1a4, *Sacramento Water Allocation Model Results for CVP Export Constraint Sensitivity Analysis*, provide more detailed results for changes in water supply to CVP contractors.

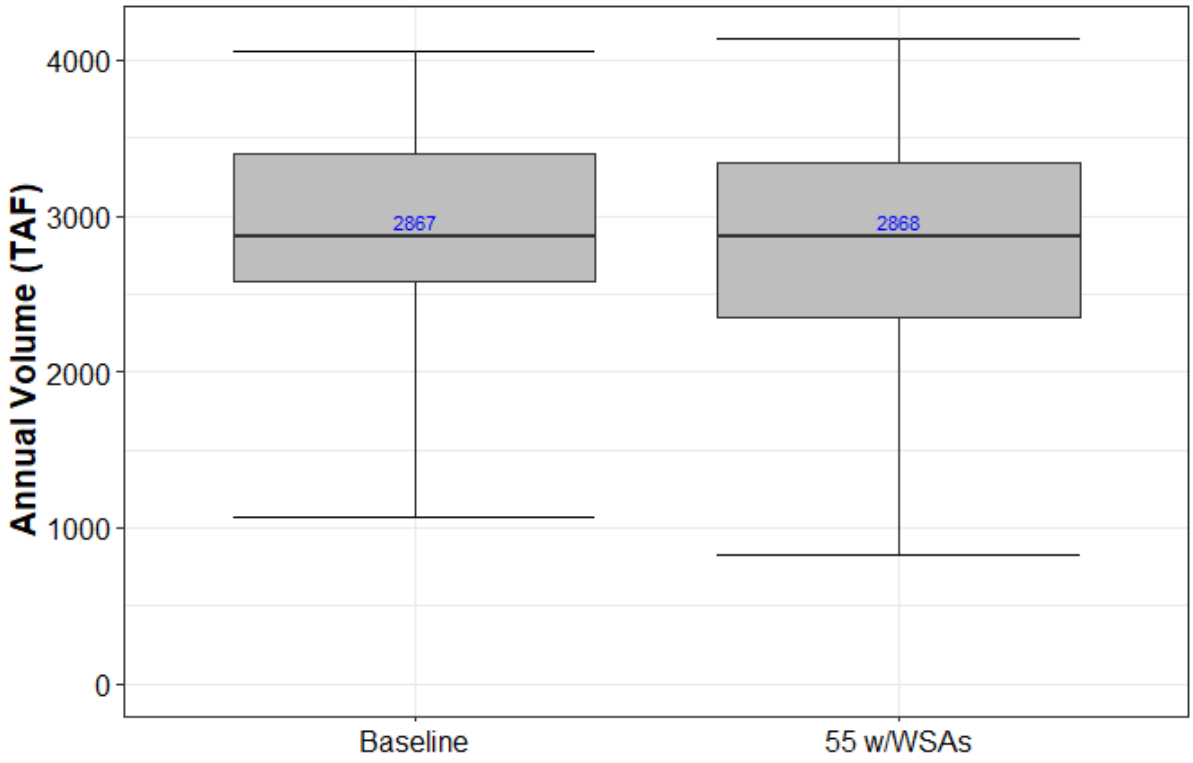


Figure 13.4-71. Annual Total Sacramento/Delta Supply to the San Joaquin Valley Region for Baseline and 55 w/WSAs Scenarios

Table 13.4-127. Average Annual Total Sacramento/Delta Supply to the San Joaquin Valley Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1,762	-203
D	2,640	-229
BN	2,821	-41
AN	2,960	70
W	3,541	32
All	2,845	-73

Agriculture is the dominant use type in this region and drives the pattern described above. Annual Sacramento/Delta supply to agriculture in San Joaquin Valley region for the baseline and 55 w/WSAs scenarios are presented in the figure and table below. Under the 55 w/WSAs scenario, average annual Sacramento/Delta supply to agriculture in the San Joaquin Valley increases by 36 TAF (1 percent) in wet years and 81 TAF (3 percent) in above normal years, and decreases by 25 TAF (1 percent) in below normal years, 201 TAF (9 TAF) in dry years, and 192 TAF (13 percent) in critical years. In below normal, dry, and critical water years, these reductions are less than under the 55 scenario and are more similar to the Low Flow Alternative. In wet and above normal water years, these results differ from those under the flow scenarios, which show reductions in water supply instead of increases in supply. Across all water year types, the average annual water supply reduction from baseline under the 55 w/WSAs scenario is 60 TAF (2 percent) which is less than the reduction under the 55 w/WSAs scenario and more similar to the Low Flow Alternative (see Table 6.4-21 in Chapter 6, *Changes in Hydrology and Water Supply*).

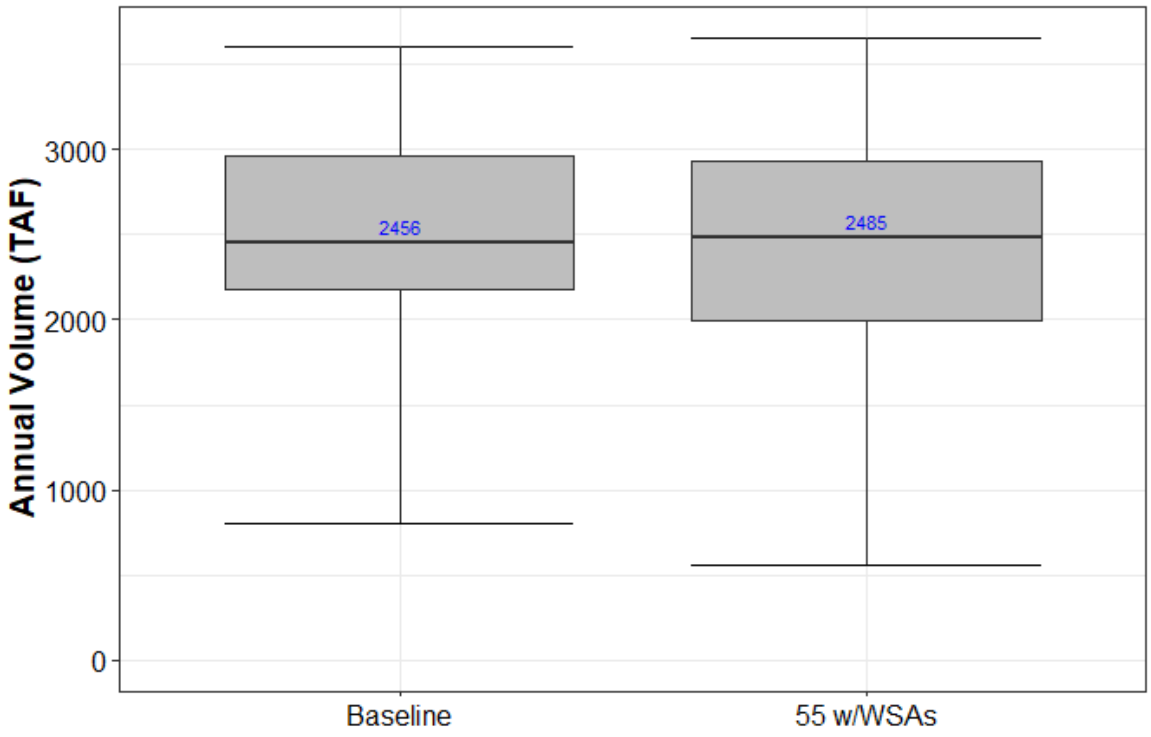


Figure 13.4-72. Annual Sacramento/Delta Supply to Agriculture in the San Joaquin Valley Region for Baseline and 55 w/WSAs Scenarios

Table 13.4-128. Average Annual Sacramento/Delta Supply to Agriculture in the San Joaquin Valley Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	1,443	-192
D	2,249	-201
BN	2,414	-25
AN	2,550	81
W	3,101	36
All	2,445	-60

SacWAM results for average annual Sacramento/Delta water supply to municipal use in the San Joaquin Valley region under the 55 w/WSAs scenario show reductions from baseline in all water year types, as presented in the figure and table below. Overall, these reductions would be less than under the 55 scenario and more similar to the Low Flow Alternative in all water year types. Under the 55 w/WSAs scenario, reductions compared to baseline would range from 28 TAF (32 percent) in dry years to 3 TAF (3 percent) in wet years. The average annual Sacramento/Delta supply to San Joaquin Valley region municipal use across all water year types would decrease from baseline by 13 TAF (13 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-22 in Chapter 6, *Changes in Hydrology and Water Supply*).

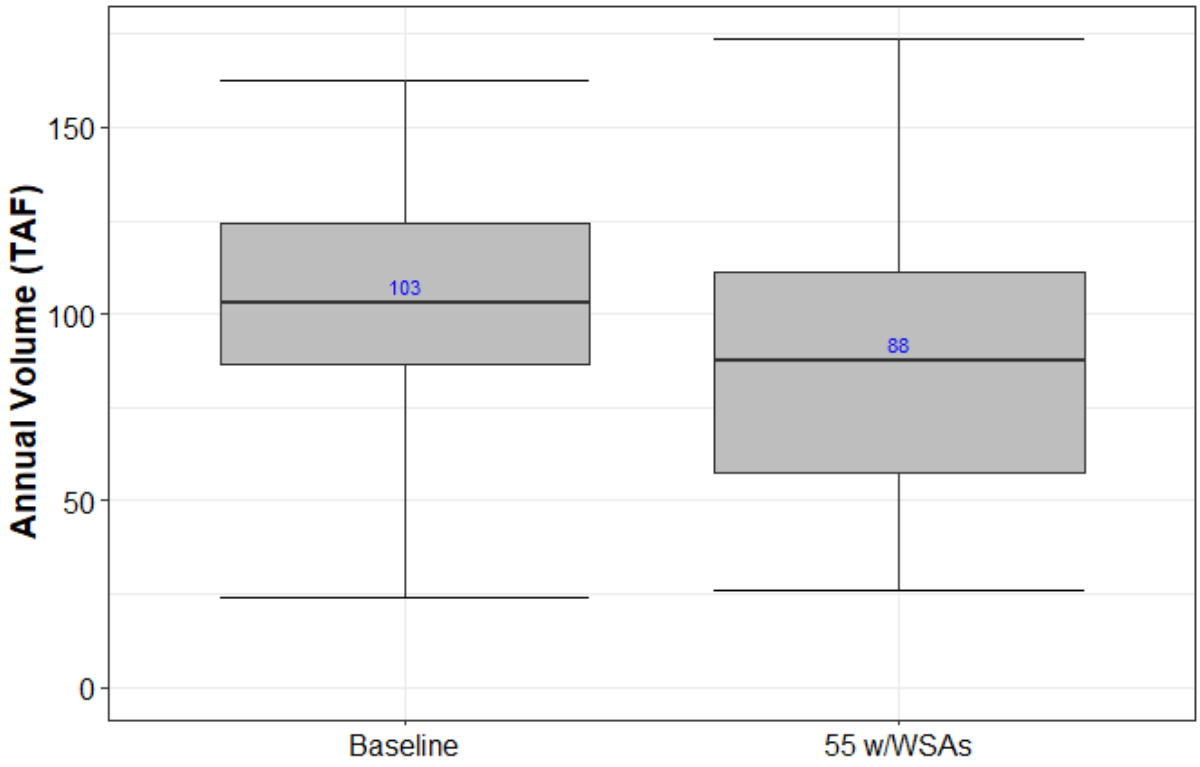


Figure 13.4-73. Annual Sacramento/Delta Supply to Municipal and Industrial Use in the San Joaquin Valley Region for Baseline and 55 w/WSAs Scenarios

Table 13.4-129. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the San Joaquin Valley Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	48	-5
D	89	-28
BN	102	-16
AN	108	-11
W	132	-3
All	100	-13

As presented in the figure and table below, SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges in the San Joaquin Valley under the 55 w/WSAs scenario show limited changes for all water year types, with a small reduction of 1 TAF (less than 1 percent) across all water year types that would be assumed to be negligible and within the expected precision of the model. These changes are very similar to those for the flow scenarios generated using SacWAM version 2025.08.28, which are presented in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. These reductions are less than those generated using SacWAM version 2023.06.12 and evaluated in Chapter 6, *Changes in Hydrology and Water Supply,* for the flow scenarios, including the 55 scenario and Low Flow Alternative (see Table 6.4-22 in Chapter 6). However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past practice of reducing water supplies to CVPIA wildlife refuges when it reduces allocations to San Joaquin River Exchange Contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges could at times be larger than indicated by the modeling.

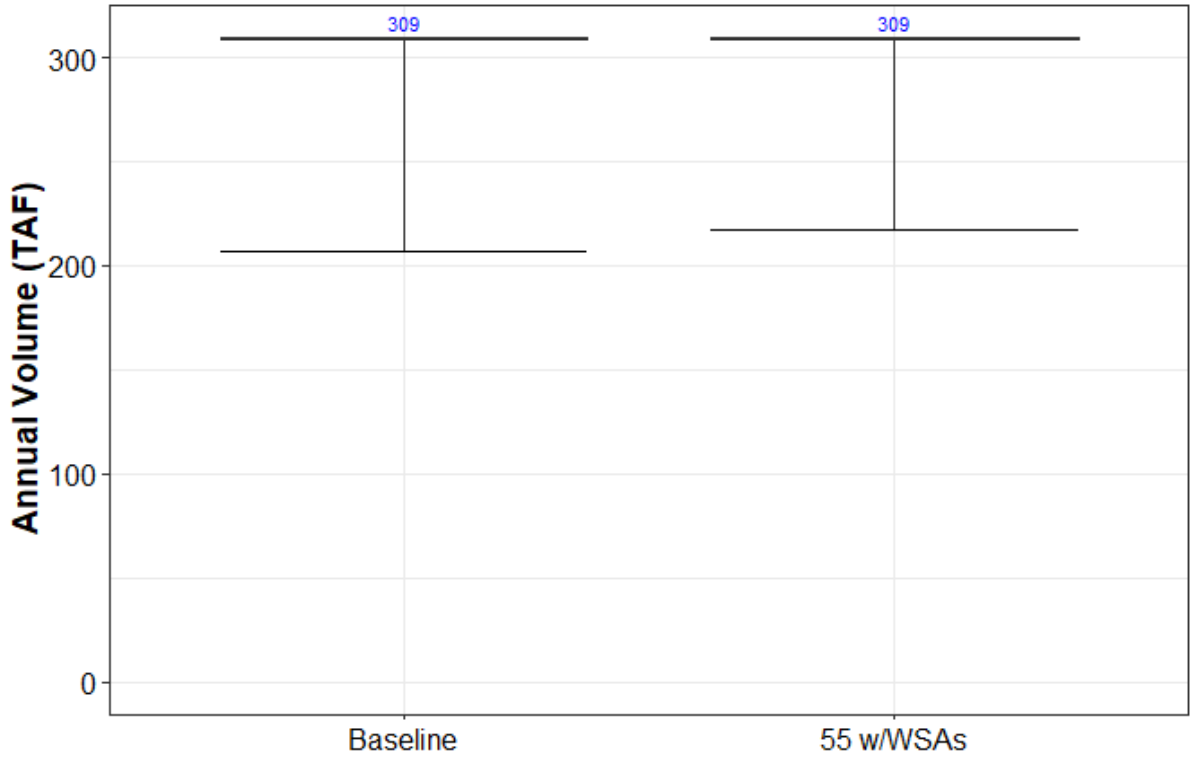


Figure 13.4-74. Annual Sacramento/Delta Supply to Wildlife Refuges in the San Joaquin Valley Region for Baseline and 55 w/WSAs Scenarios

Table 13.4-130. Average Annual Sacramento/Delta Supply to Wildlife Refuges in the San Joaquin Valley Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	271	-6
D	303	0
BN	305	0
AN	302	0
W	308	0
All	300	-1

Voluntary Agreement Pathway

Overall, these results show that the VA scenario could result in a change in total Sacramento/Delta supplies to the San Joaquin Valley region, as shown in the figure and table below. The overall effect would be dependent on the sources of the unspecified water purchases, which are not fully known at this time. In the results presented in this section, "VA" assumes that unspecified water purchases are provided entirely from willing sellers in the Sacramento/Delta watershed, and "VA High Export Cuts" assumes that the unspecified water purchases are provided entirely through reductions in Delta exports to agricultural use in the San Joaquin Valley. Because it is possible that unspecified water purchases would be provided through a combination of inflow sources within the Sacramento/Delta watershed and reductions in exports, the actual future condition could be between these two scenarios. Under the VA scenario and across all water year types, the change in Sacramento/Delta supplies to the San Joaquin Valley region could range from an average annual increase of up to 51 TAF (2 percent) to an average annual decrease of up to 62 TAF (2 percent) depending on the sources of unspecified water purchases. Any decreases in Sacramento/Delta supplies to the San Joaquin Valley region would be less than or similar to those under the Low Flow Alternative.

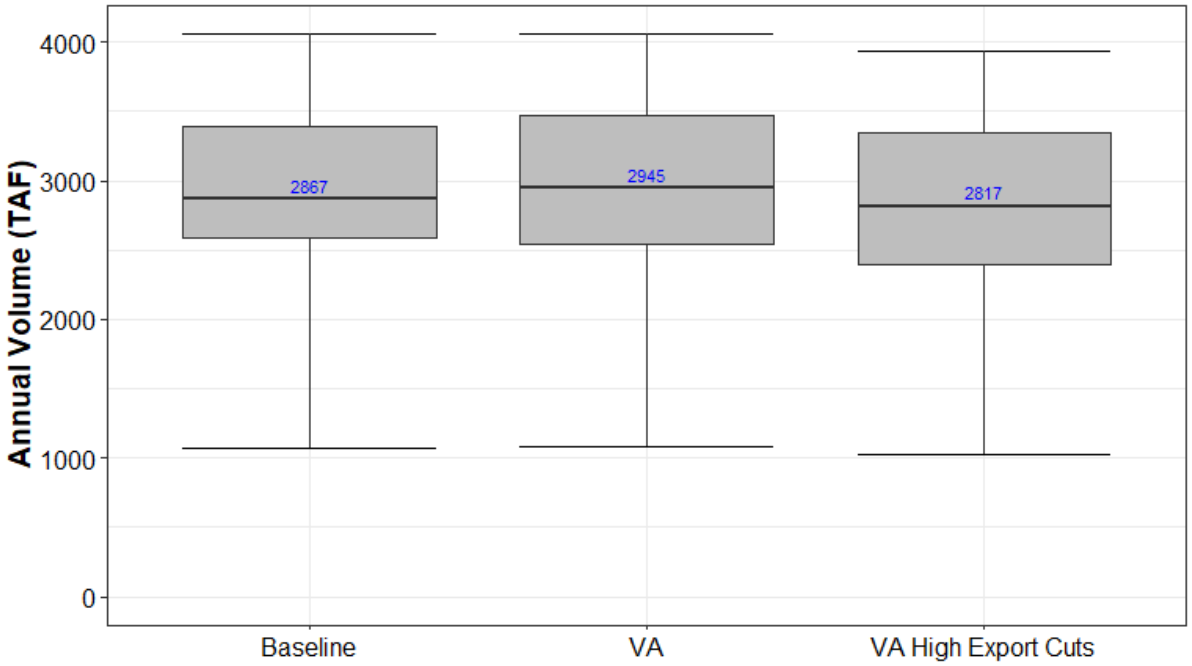


Figure 13.4-75. Annual Total Sacramento/Delta Supply to the San Joaquin Valley Region for Baseline and VA Scenarios

Table 13.4-131. Average Annual Total Sacramento/Delta Supply to the San Joaquin Valley Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)	VA High Export Cuts: Change from Baseline (TAF/yr)
C	1,762	-8	-73
D	2,640	26	-132
BN	2,821	50	-20
AN	2,960	48	-89
W	3,541	102	-21
All	2,845	51	-62

Similarly, as presented in the figure and table below, the SacWAM results show that the VA scenario could result in a change in average annual Sacramento/Delta supply to agriculture in the San Joaquin Valley region, and the overall effect would be dependent on the sources of the unspecified water purchases, which are not fully known at this time but would be provided from willing sellers. Under the VA scenario, changes in Sacramento/Delta supplies to agriculture in the San Joaquin Valley region could range from an average annual increase of 48 TAF (2 percent) to an average annual decrease of 65 TAF (3 percent). Any decreases in Sacramento/Delta supplies to agriculture in the San Joaquin Valley region would be less than or similar to those under the Low Flow Alternative.

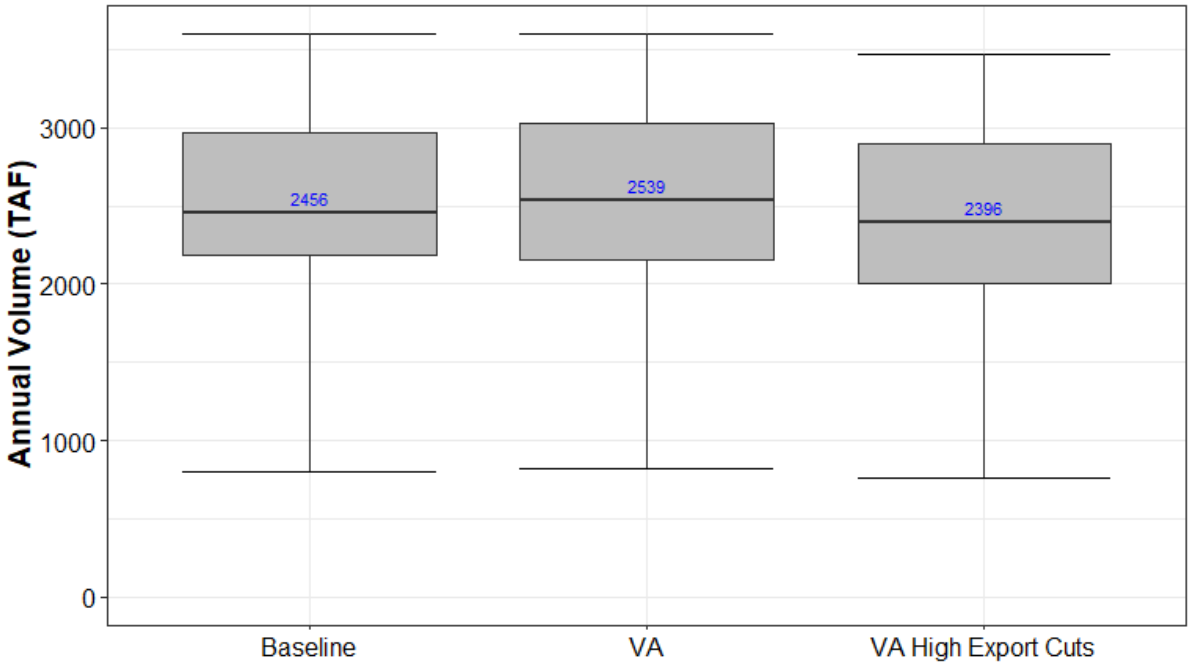


Figure 13.4-76. Annual Sacramento/Delta Supply to Agriculture in the San Joaquin Valley Region for Baseline and VA Scenarios

Table 13.4-132. Average Annual Sacramento/Delta Supply to Agriculture in the San Joaquin Valley Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)	VA High Export Cuts: Change from Baseline (TAF/yr)
C	1,443	-9	-74
D	2,249	22	-136
BN	2,414	47	-23
AN	2,550	45	-92
W	3,101	98	-25
All	2,445	48	-65

SacWAM results for average annual Sacramento/Delta water supply to municipal use in the San Joaquin Valley region would be limited under the VA scenario, as presented in the figure and table below. Because it assumed that unspecified water purchases are provided entirely from willing sellers and would affect agricultural uses, the VA scenario results presented below do not distinguish between "VA" and "VA High Export Cuts" because the effect on municipal supply would be the same. Model results for the VA scenario show small increases from baseline in all water year types, ranging from 1 TAF (2 percent) in critical years to 4 TAF (3 percent) in wet years. The average annual Sacramento/Delta supply to San Joaquin Valley region municipal use across all water year types would increase from baseline by 3 TAF (3 percent) under the VA scenario.

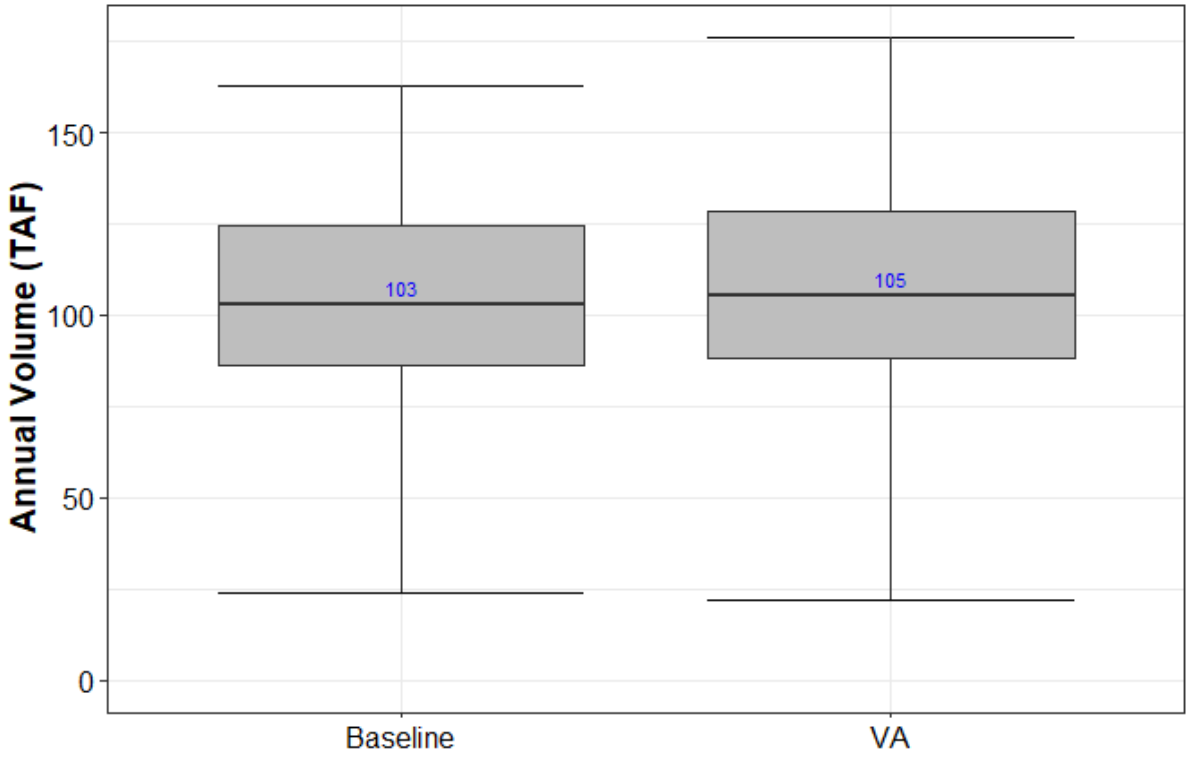


Figure 13.4-77. Annual Sacramento/Delta Supply to Municipal and Industrial Use in the San Joaquin Valley Region for Baseline and VA Scenarios

Table 13.4-133. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the San Joaquin Valley Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	48	1
D	89	3
BN	102	3
AN	108	3
W	132	4
All	100	3

As presented in the figure and table below, SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges in the San Joaquin Valley region show that there would be no reduction under the VA scenario. Because it is assumed that unspecified water purchases are provided entirely from willing sellers and would affect agricultural uses, the VA scenario results presented below do not distinguish between "VA" and "VA High Export Cuts" because the effect on refuge water supply would be the same. Under the VA scenario, annual average Sacramento/Delta water supply to wildlife refuges in the San Joaquin Valley would remain unchanged from baseline in all water year types, except for dry years when supplies could increase by 1 TAF (less than 1 percent).

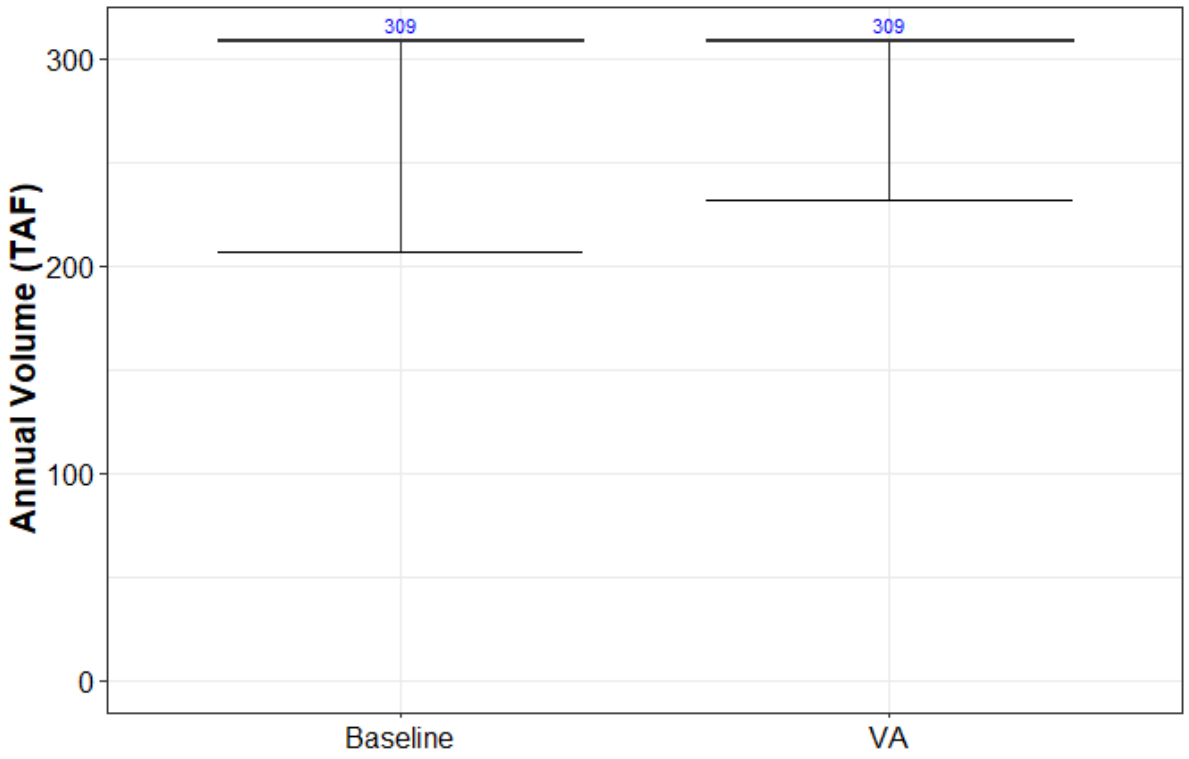


Figure 13.4-78. Annual Sacramento/Delta Supply to Wildlife Refuges in the San Joaquin Valley Region for Baseline and VA Scenarios

Table 13.4-134. Average Annual Sacramento/Delta Supply to Wildlife Refuges in the San Joaquin Valley Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	271	0
D	303	1
BN	305	0
AN	302	0
W	308	0
All	300	0

13.4.4.5 Sacramento/Delta Supply to the San Francisco Bay Area, Central Coast, and Southern California

This section summarizes SacWAM results for changes in Sacramento/Delta surface water supply to the San Francisco Bay Area, Central Coast, and Southern California under the 55 w/WSAs scenario and VA scenario. For each region, model results are presented for changes in total Sacramento/Delta supply, and by sector (agriculture and municipal use). Sacramento/Delta surface water is not supplied to wildlife refuges in these regions.

As discussed above, the HRL proposals include flows that would be provided through water purchases programs. The sources for the PWA Water Purchased Fixed Price Program are identified and as such are modeled. However, the unspecified water purchases (PWA Water Purchase Market

Price Program and permanent state water purchases) would be from unspecified willing sellers, which could include inflow sources within the Sacramento/Delta watershed or reductions in exports, both of which could result in additional Delta outflows. Because it is assumed that unspecified water purchases would not be provided from users in these regions, results presented for changes in water supply to the San Francisco Bay Area, Central Coast, and Southern California are the same under "VA" and "VA High Export Cuts" and results for the VA scenario for these regions are not presented as a range.

Sacramento/Delta Supply to the San Francisco Bay Area

The Bay Area region includes communities that receive Sacramento/Delta supply via the Putah South Canal, North Bay Aqueduct, Contra Costa Canal, Mokelumne Aqueduct, and South Bay Aqueduct, and diversions from the western Delta by Contra Costa Water District (CCWD). These communities include the North Bay (Fairfield, Suisun City, Travis Air Force Base, Napa, Benicia, Vallejo), East Bay (CCWD and EBMUD), South Bay (portions of Santa Clara Valley Water District [Valley Water], Zone 7 Water District [Zone 7], and Alameda County Water District), and communities within the Delta that are served by CCWD, including Bay Point, Pittsburg, Antioch, Oakley, Cypress Corridor, Hotchkiss Tract, Summer Lakes, Bethel Island, Knightsen, and Brentwood. Water supplies to the Bay Area from other sources outside the Sacramento River watershed, Delta eastside tributaries, and Delta regions (e.g., San Francisco Public Utilities Commission service areas from the Hetch Hetchy Project) are not included in these results because they will not be affected by the revised proposed Plan amendments. The vast majority of water supply to the Bay Area region goes to municipal and industrial demands, although one agricultural demand unit corresponding to a portion of Solano Irrigation District near Fairfield is included in the Bay Area region. Zone 7 also provides water for agricultural irrigation. See Section 6.4.6, *Sacramento/Delta Supply to the San Francisco Bay Area*, for additional contextual information.

Regulatory Pathway

SacWAM results for average annual total Sacramento/Delta water supply to the San Francisco Bay Area under the 55 w/WSAs scenario show reductions compared to baseline in all water year types, as presented in the figure and tables below. Overall, these reductions would be less than under the Low Flow Alternative in all water year types. Under the 55 w/WSAs scenario, reductions compared to baseline are greater in drier year types, ranging from 85 TAF (12 percent) in dry years to 20 TAF (3 percent) in wet years. The average annual water supply reduction from baseline across all water year types is 48 TAF (7 percent) under the 55 w/WSAs scenario, which is a smaller reduction than under the Low Flow Alternative (see Table 6.4-14 in Chapter 6, *Changes in Hydrology and Water Supply*).

Similarly, under the 55 w/WSAs scenario, SacWAM results for Sacramento/Delta supply to agriculture in the San Francisco Bay Area show reductions for all water year types. These reductions are less than those under the Low Flow Alternative in all water year types, except for wet years when reductions under the 55 w/WSAs scenario are similar to the Low Flow Alternative. Under the 55 w/WSAs scenario, reductions in annual average Sacramento/Delta supplies to agriculture compared to baseline range from 5 TAF (19 percent) in below normal years to 2 TAF (7 percent) in wet years. The average annual water supply reduction from baseline across all water year types is 3 TAF (11 percent) under the 55 w/WSAs scenario, which is a smaller reduction than under the Low Flow Alternative (see Table 6.4-15 in Chapter 6, *Changes in Hydrology and Water Supply*).

Reductions in Sacramento/Delta supply to municipal uses in the San Francisco Bay Area under the 55 w/WSAs scenario also occur for all water year types. These reductions are less than those under the 55 scenario and the Low Flow Alternative in all water year types. Under the 55 w/WSAs scenario, reductions in annual average Sacramento/Delta supplies to municipal use compared to baseline range from 81 TAF (12 percent) in dry years to 18 TAF (3 percent) in wet years. The average annual reduction in Sacramento/Delta supply to municipal use across all water year types is 45 TAF (7 percent) under the 55 w/WSAs scenario, which is a smaller reduction than under the Low Flow Alternative (see Table 6.4-16 in Chapter 6, *Changes in Hydrology and Water Supply*).

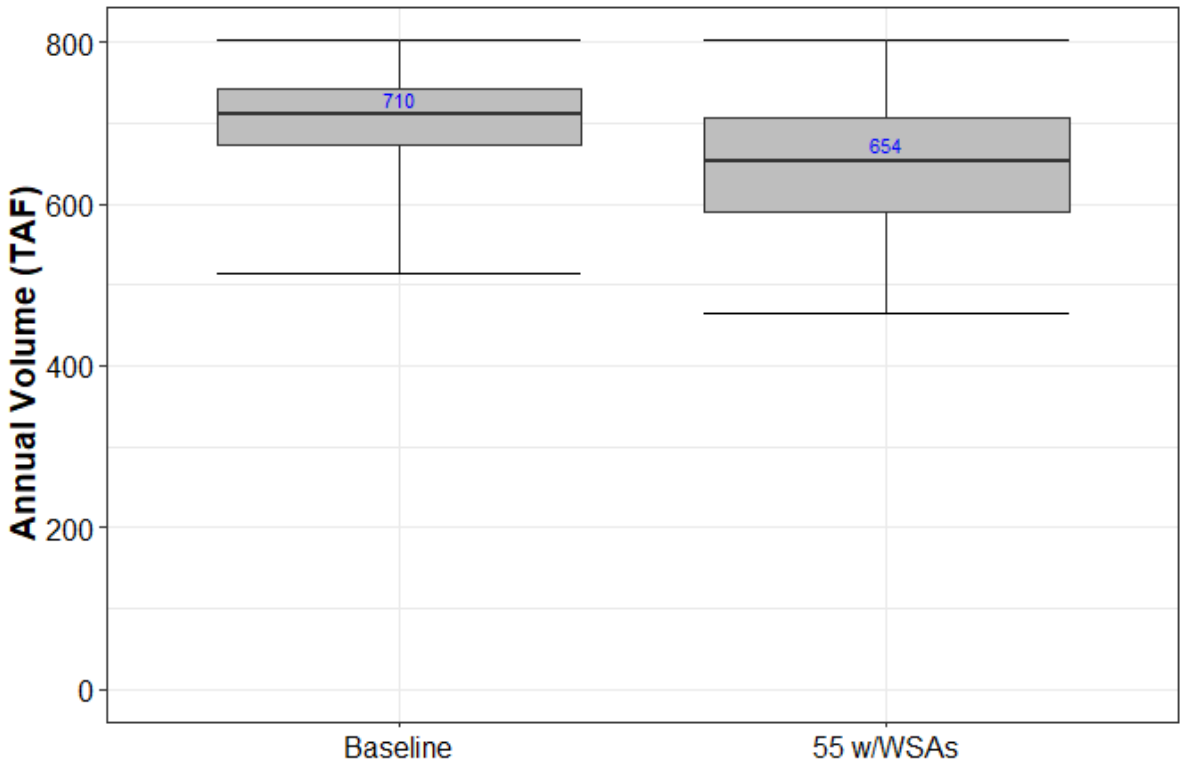


Figure 13.4-79. Annual Total Sacramento/Delta Supply to the San Francisco Bay Area Region for Baseline and 55 w/WSAs Scenarios

Table 13.4-135. Average Annual Total Sacramento/Delta Supply to the San Francisco Bay Area Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	597	-56
D	679	-85
BN	705	-53
AN	707	-29
W	752	-20
All	696	-48

Table 13.4-136. Average Annual Sacramento/Delta Supply to Agriculture in the San Francisco Bay Area Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	23	-3
D	27	-3
BN	28	-5
AN	28	-4
W	29	-2
All	27	-3

Table 13.4-137. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the San Francisco Bay Area Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	574	-53
D	652	-81
BN	677	-48
AN	679	-26
W	723	-18
All	669	-45

Voluntary Agreement Pathway

SacWAM results for average annual total Sacramento/Delta water supply to the San Francisco Bay Area under the VA scenario show limited changes compared to baseline in all water year types, as presented in the figure and tables below. The SacWAM results suggest that the Sacramento/Delta supply to this region could increase slightly under the VA scenario. Across all water year types, this increase in average annual total Sacramento/Delta water supply could be 3 TAF (less than 1 percent). The SacWAM results also show that there would be no discernable change in Sacramento/Delta surface water supply to agriculture in the San Francisco Bay Area. There could be a small increase in Sacramento/Delta surface water supply to municipal use in all water year types, which would range from 1 TAF (less than 1 percent) in critical years to 6 TAF (1 percent) in wet years. The average annual increase in Sacramento/Delta supply to municipal uses in the San Francisco Bay Area is 3 TAF (less than 1 percent).

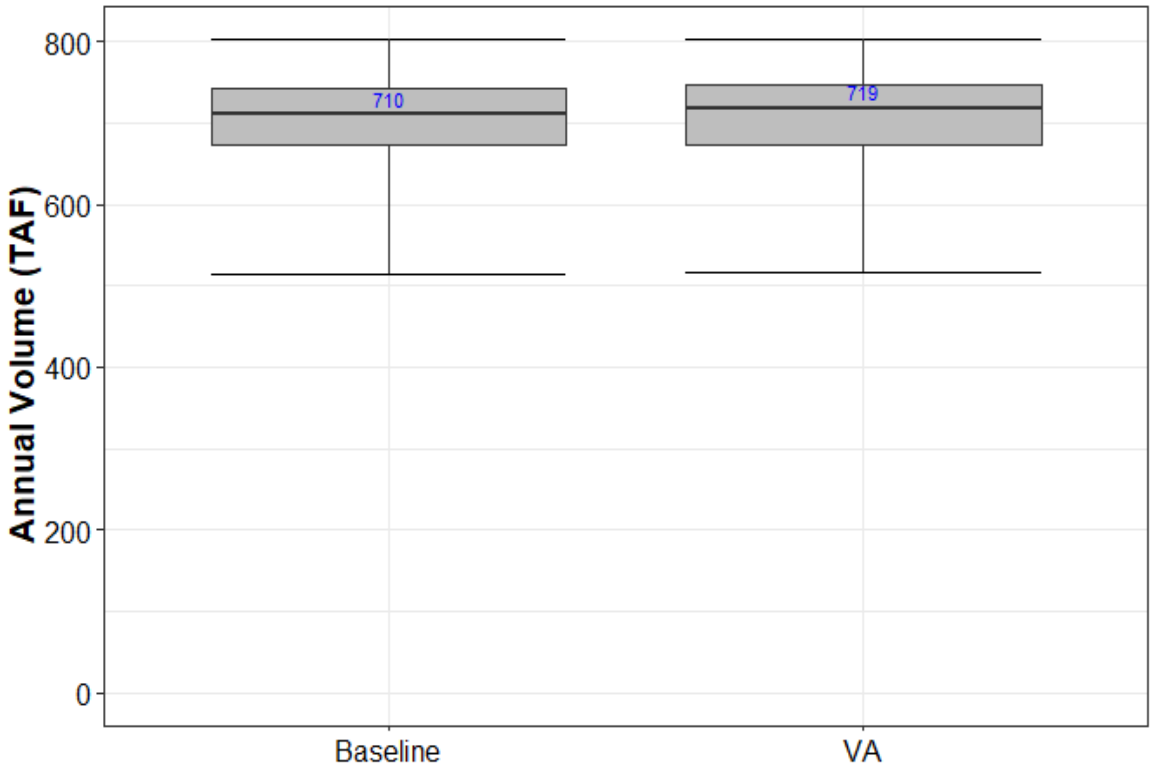


Figure 13.4-80. Annual Total Sacramento/Delta Supply to the San Francisco Bay Area Region for Baseline and VA Scenarios

Table 13.4-138. Average Annual Total Sacramento/Delta Supply to the San Francisco Bay Area Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	597	1
D	679	1
BN	705	4
AN	707	6
W	752	6
All	696	3

Table 13.4-139. Average Annual Sacramento/Delta Supply to Agriculture in the San Francisco Bay Area Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	23	0
D	27	0
BN	28	0
AN	28	0
W	29	0
All	27	0

Table 13.4-140. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the San Francisco Bay Area Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	574	1
D	652	1
BN	677	4
AN	679	6
W	723	6
All	669	3

Sacramento/Delta Supply to the Central Coast

The Sacramento/Delta water supplied to the Central Coast region discussed in this section represents a relatively small amount of Sacramento/Delta water that includes SWP and CVP deliveries for agriculture and urban uses. See Section 6.4.7, *Sacramento/Delta Supply to Central Coast*, for additional contextual information.

Regulatory Pathway

The figure and table below present annual total Sacramento/Delta surface water supply to the Central Coast region for the baseline and 55 w/WSAs scenarios. SacWAM results for average annual total Sacramento/Delta water supply to the Central Coast region under the 55 w/WSAs scenario show reductions compared to baseline in all water year types, except for wet years when there is no change. Overall, these reductions are less than under the 55 scenario and more similar to the Low Flow Alternative across all water year types. Under the 55 w/WSAs scenario, reductions compared to baseline are greater in drier year types, ranging from 15 TAF 19 percent) in dry years to 0 TAF (0 percent) in wet years. The average annual water supply reduction from baseline across all water year types is 5 TAF (6 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-17 in Chapter 6, *Changes in Hydrology and Water Supply*).

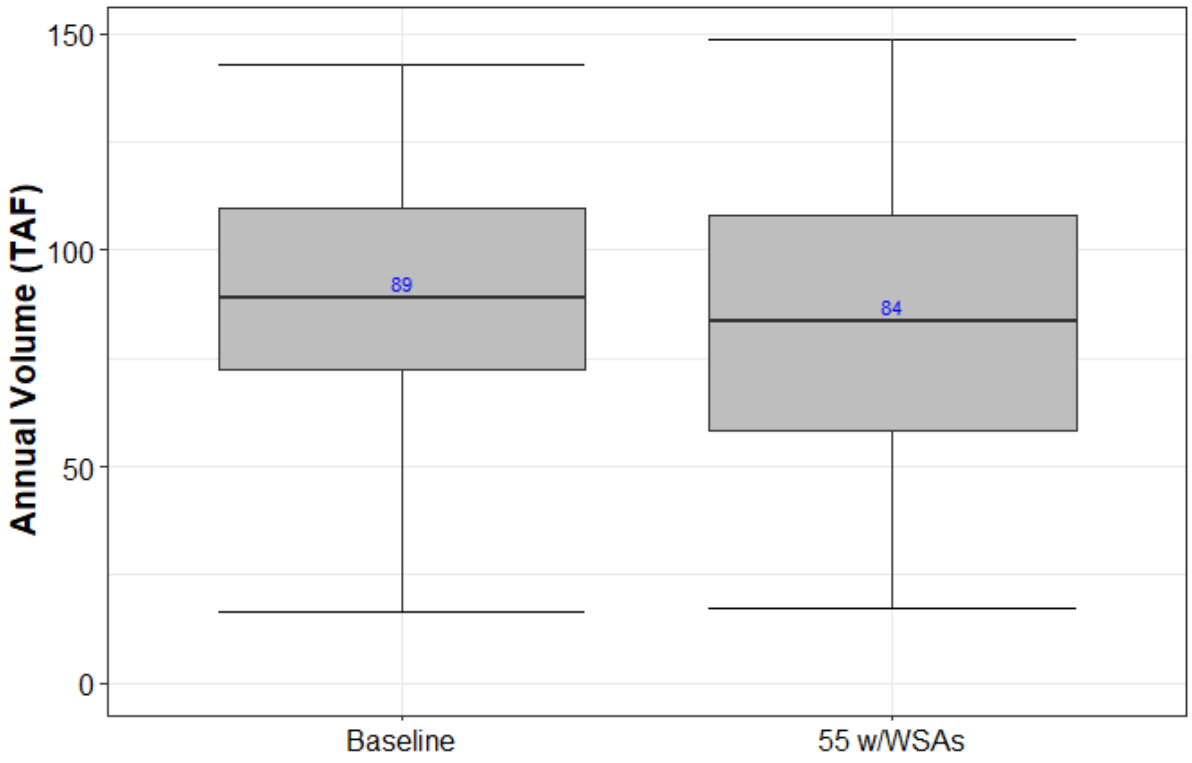


Figure 13.4-81. Annual Total Sacramento/Delta Supply to the Central Coast Region for Baseline and 55 w/WSAs Scenarios

Table 13.4-141. Average Annual Total Sacramento/Delta Supply to the Central Coast Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	42	-5
D	76	-15
BN	86	-5
AN	91	-1
W	118	0
All	87	-5

As shown in the table below, SacWAM results for annual average Sacramento/Delta water supply to agriculture in the Central Coast region under the 55 w/WSAs scenario show reductions compared to baseline in critical years (3 TAF or 16 percent), no discernable change from baseline in dry years (less than 1 TAF or 1 percent), and small increases compared to baseline in below normal (3 TAF or 10 percent), above normal (5 TAF or 14 percent), and wet (2 TAF or 5 percent) water years. Overall, the average annual change in Sacramento/Delta surface water supply across all water year types is an increase from baseline of 1 TAF (4 percent) under the 55 w/WSAs scenario. This differs from the estimated changes under the Low Flow Alternative and 55 scenario, which show reductions in water supply across all water year types (see Table 6.4-18 in Chapter 6, *Changes in Hydrology and Water Supply*).

Table 13.4-142. Average Annual Sacramento/Delta Supply to Agriculture in the Central Coast Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	19	-3
D	33	0
BN	35	3
AN	37	5
W	52	2
All	37	1

As shown in the table below, SacWAM results for average annual Sacramento/Delta water supply to municipal use in the Central Coast region under the 55 w/WSAs scenario show reductions compared to baseline in all water year types. Overall, these reductions would be less than under the 55 scenario and more similar to the Low Flow Alternative in all water year types. Under the 55 w/WSAs scenario, the reductions range from 15 TAF (34 percent) in dry years to 2 TAF (3 percent) in wet years and 2 TAF (9 percent) in critical years. The average annual water supply reduction from baseline across all water year types is 7 TAF (13 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-19 in Chapter 6, *Changes in Hydrology and Water Supply*).

Table 13.4-143. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Central Coast Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	23	-2
D	44	-15
BN	50	-9
AN	54	-6
W	66	-2
All	49	-7

Voluntary Agreement Pathway

SacWAM results for average total annual Sacramento/Delta water supply to the Central Coast region under the VA scenario show limited changes compared to baseline in all water year types. The SacWAM results suggest that the total Sacramento/Delta supply to this region could increase slightly under the VA scenario, as shown in the figure and tables below. The total Sacramento/Delta supply to the Central Coast is unchanged compared to baseline in critical years and increases compared to baseline in all other water year types, with the largest change (5 TAF or 4 percent) in wet years. Across all water year types, total Sacramento/Delta supply would increase from baseline by 2 TAF (3 percent) under the VA scenario. Across all water year types, Sacramento/Delta supply to agriculture in the Central Coast would increase by 1 TAF (2 percent) and Sacramento/Delta supply to municipal use in the Central Coast would increase by 1 TAF (3 percent) under the VA scenario.

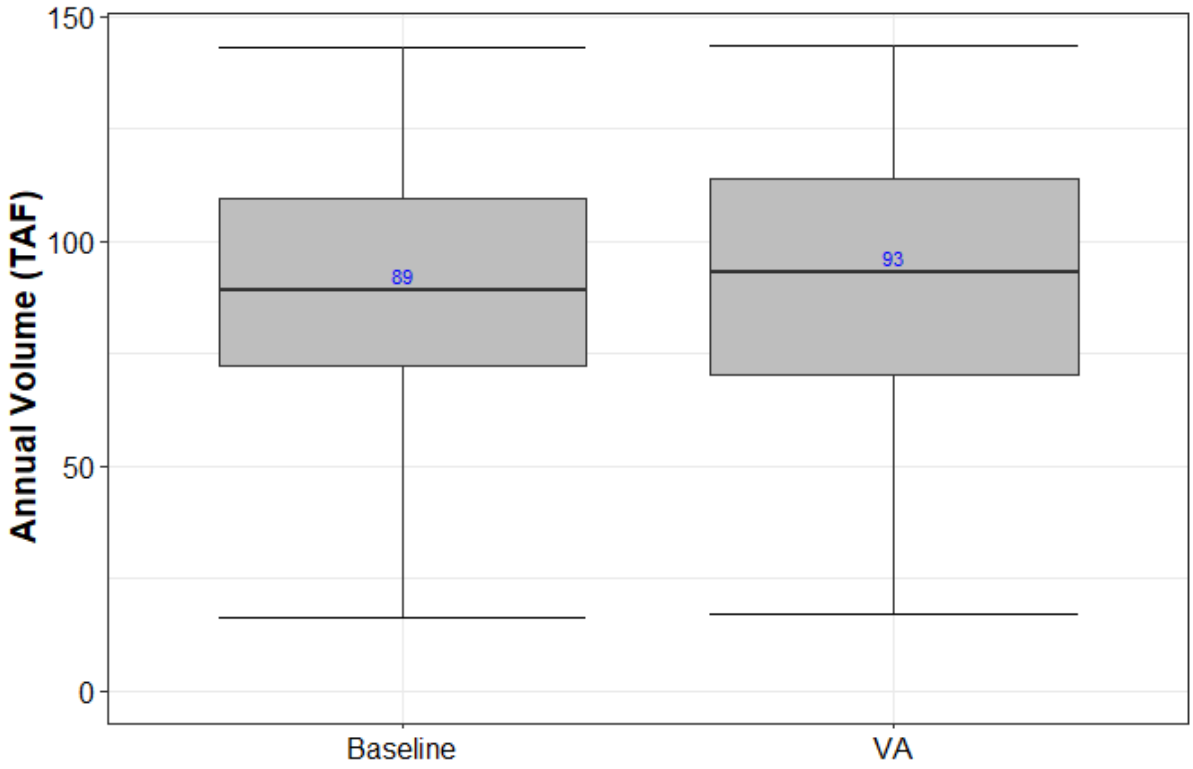


Figure 13.4-82. Annual Total Sacramento/Delta Supply to the Central Coast Region for Baseline and VA Scenarios

Table 13.4-144. Average Annual Total Sacramento/Delta Supply to the Central Coast Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	42	0
D	76	1
BN	86	3
AN	91	3
W	118	5
All	87	2

Table 13.4-145. Average Annual Sacramento/Delta Supply to Agriculture in the Central Coast Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	19	-1
D	33	-1
BN	35	1
AN	37	1
W	52	2
All	37	1

Table 13.4-146. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Central Coast Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	23	1
D	44	1
BN	50	1
AN	54	1
W	66	2
All	49	1

Sacramento/Delta Supply to Southern California

The Southern California region is comprised of the South Coast, Colorado River, and Lahontan Hydrologic Regions. The Sacramento/Delta supplies included in this analysis include only the Sacramento/Delta SWP supplies imported via the California Aqueduct. Other supplies, such as from the Owens Valley and the Colorado River, are not analyzed here. See Section 6.4.9, *Sacramento/Delta Supply to Southern California,* for additional contextual information.

Regulatory Pathway

Overall, the 55 w/WSAs scenario would result in a reduction in total Sacramento/Delta surface water supply to Southern California, as shown in the figure and table below. SacWAM results for average annual total Sacramento/Delta water supply to the Southern California region under the 55 w/WSAs scenario show reductions from baseline in all water year types. These reductions are less than under the 55 scenario and are more similar to the high end of the Low Flow Alternative (45 scenario) in all water year types. Under the 55 w/WSAs scenario, reductions in annual average supplies compared to baseline range from 515 TAF (35 percent) in dry years to 95 TAF (12 percent) in critical years. The average annual water supply reduction across all water year types is 276 TAF (16 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-24 in Chapter 6, *Changes in Hydrology and Water Supply*).

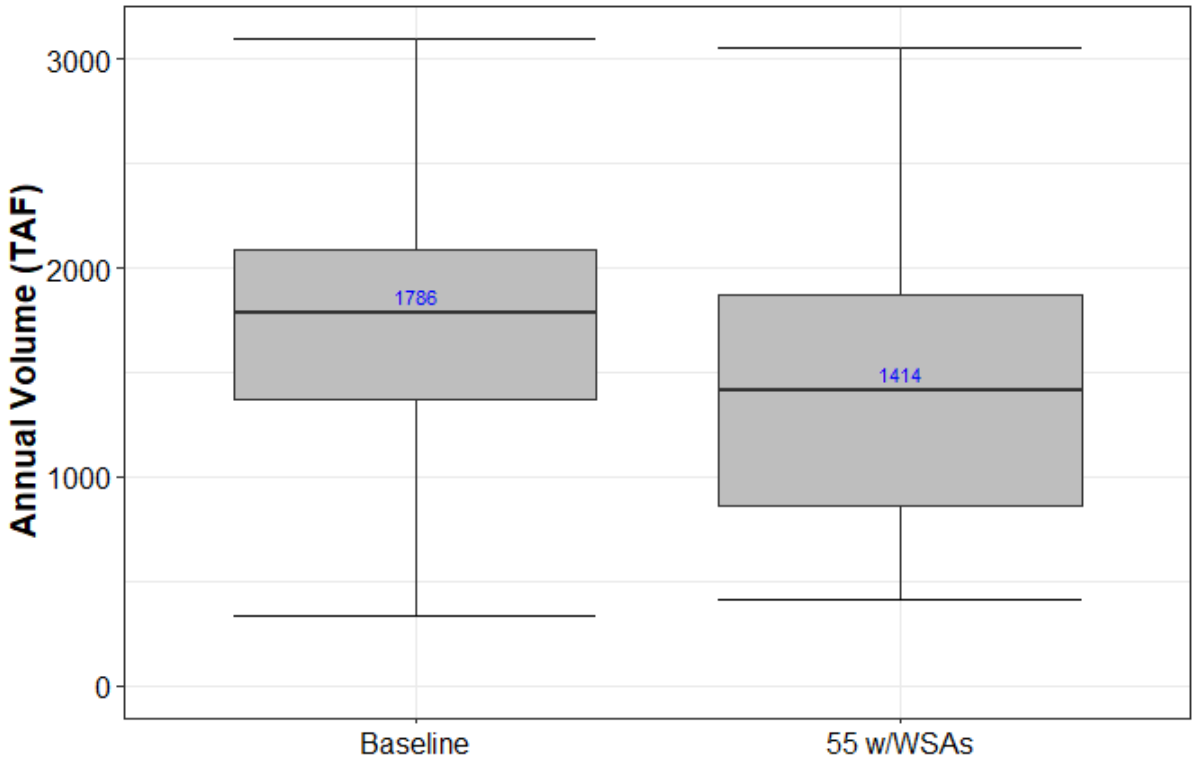


Figure 13.4-83. Annual Total Sacramento/Delta Supply to the Southern California Region for Baseline and 55 w/WSAs Scenarios

Table 13.4-147. Average Annual Total Sacramento/Delta Supply to the Southern California Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	773	-95
D	1,452	-515
BN	1,722	-355
AN	1,840	-225
W	2,266	-167
All	1,688	-276

As shown in the table below, under the 55 w/WSAs scenario, average annual Sacramento/Delta supply to agriculture in Southern California decreases from baseline in all water year types. These changes are less than under the 55 scenario and are more similar to the Low Flow Alternative in all water year types. Under the 55 w/WSAs scenario, reductions in average annual Sacramento/Delta supplies compared to baseline are greatest in dry years (4 TAF or about 35 percent) and smallest in wet years (1 TAF or 7 percent) and critical years (1 TAF or about 12 percent). The average annual water supply reduction across all water year types is 2 TAF (about 16 percent) under the 55 w/WSAs scenario, which is similar to the Low Flow Alternative (see Table 6.4-25 in Chapter 6, *Changes in Hydrology and Water Supply*).

Table 13.4-148. Average Annual Sacramento/Delta Supply to Agriculture in the Southern California Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	7	-1
D	13	-4
BN	15	-3
AN	16	-2
W	20	-1
All	15	-2

As shown in the table below, overall, the 55 w/WSAs scenario would result in a reduction in Sacramento/Delta surface water supplies to municipal use within the Southern California Region. SacWAM results for average annual total Sacramento/Delta supply to the Southern California region under the 55 w/WSAs scenario show reductions compared to baseline in all water year types. Overall, these reductions are less than under the 55 scenario and more similar to the high end of the Low Flow Alternative (45 scenario). Under the 55 w/WSAs scenario, reductions in average annual Sacramento/Delta supplies compared to baseline range from 510 TAF (35 percent) in dry years to 94 TAF (12 percent) in critical years. The average annual water supply reduction across all water year types is 273 TAF (16 percent) which is similar to the high end of the Low Flow Alternative (45 scenario) (see Table 6.4-26 in Chapter 6, *Changes in Hydrology and Water Supply*).

Table 13.4-149. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Southern California Region by Water Year Type for the 55 w/WSAs Scenario

Water Year Type	Baseline (TAF/yr)	55 w/WSAs: Change from Baseline (TAF/yr)
C	766	-94
D	1,439	-510
BN	1,707	-352
AN	1,824	-223
W	2,247	-165
All	1,673	-273

Voluntary Agreement Pathway

SacWAM results for average annual total Sacramento/Delta water supply to Southern California under the VA scenario show limited changes compared to baseline in all water year types. The SacWAM results suggest that the total Sacramento/Delta supply to this region could increase slightly under the VA scenario, as shown in the figure and tables below. SacWAM results for average annual total Sacramento/Delta water supply to the Southern California region under the VA scenario show that supplies could increases from baseline in all water year types, ranging from an increase of 6 TAF (1 percent) in critical years to 49 TAF (3 percent) in above normal years. Across all water year types, the increase in total Sacramento/Delta supply to Southern California could be 29 TAF (2 percent), under the VA scenario. The SacWAM results also show that there would be no change in Sacramento/Delta supplies to agriculture in Southern California, and that there could be a slight increase in Sacramento/Delta supplies to municipal uses in Southern California for all water year types. Across all water year types, Sacramento/Delta supply to municipal use could increase by 29 TAF (2 percent) under the VA scenario.

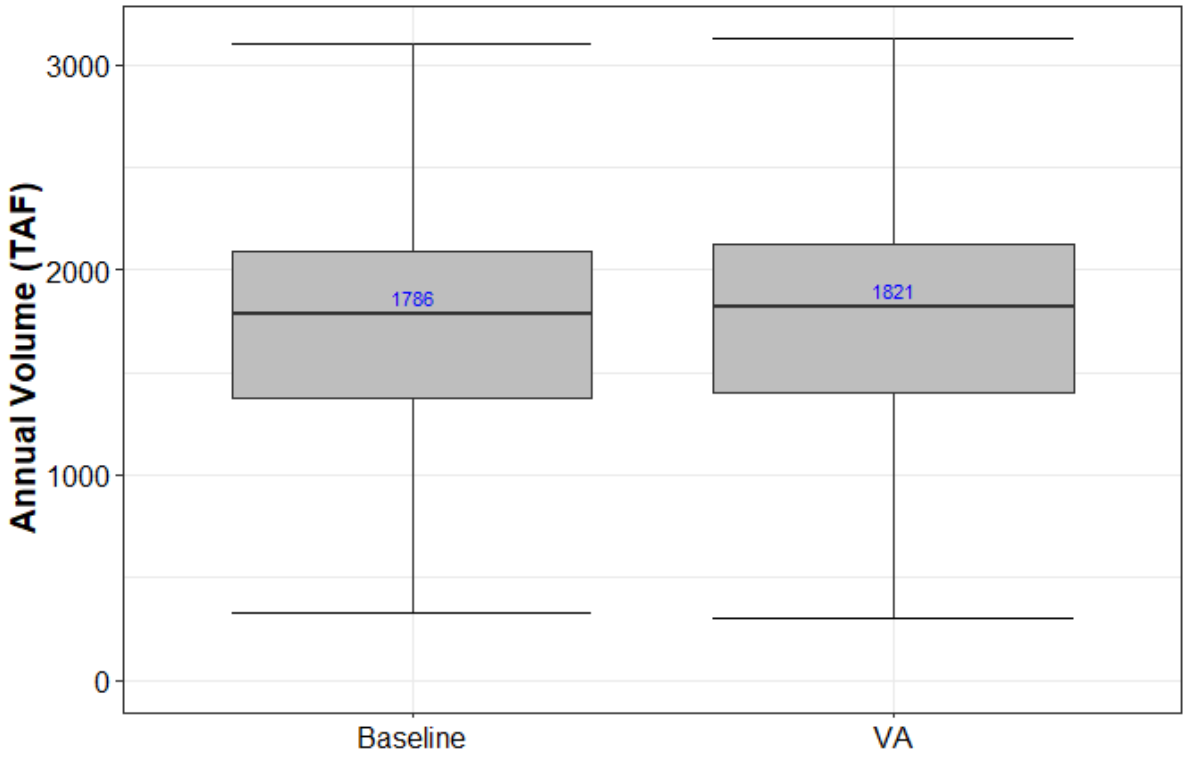


Figure 13.4-84. Annual Total Sacramento/Delta Supply to the Southern California Region for Baseline and VA Scenarios

Table 13.4-150. Average Annual Total Sacramento/Delta Supply to the Southern California Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	773	6
D	1,452	27
BN	1,722	32
AN	1,840	49
W	2,266	33
All	1,688	29

Table 13.4-151. Average Annual Sacramento/Delta Supply to Agriculture in the Southern California Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	7	0
D	13	0
BN	15	0
AN	16	0
W	20	0
All	15	0

Table 13.4-152. Average Annual Sacramento/Delta Supply to Municipal and Industrial Use in the Southern California Region by Water Year Type for the VA Scenario

Water Year Type	Baseline (TAF/yr)	VA: Change from Baseline (TAF/yr)
C	766	5
D	1,439	27
BN	1,707	32
AN	1,824	48
W	2,247	33
All	1,673	29

13.4.4.6 Summary of Changes in Surface Water Supply

Regulatory Pathway

Overall, changes in flow requirements could result in reductions in Sacramento/Delta supply to all regions under the starting point for the regulatory pathway (55 w/WSAs). These reductions in supply would be lower compared to results for the 55 flow scenario presented in Chapter 6, *Changes in Hydrology and Water Supply*. Based on the SacWAM results presented above and in Chapter 6, reductions in total Sacramento/Delta water supply under the 55 w/WSAs scenario would be more similar to those under the Low Flow Alternative (35 and 45 scenarios). Results for specific regions and uses of water vary somewhat from this general trend. For example, Sacramento/Delta surface water supplied to wildlife refuges in the Sacramento River watershed and San Joaquin Valley under the 55 w/WSAs scenario show very limited changes compared to baseline conditions, although it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges could at times be larger than indicated by the modeling. Additionally, some regions show only small changes in Sacramento/Delta supplies under the 55 w/WSAs scenario, such as the Central Coast which shows an average annual reduction of 5 TAF across all water year types. Results specific to each region are discussed in more detail in the prior sections.

Voluntary Agreement Pathway

The VA pathway would also result in a total average annual reduction in Sacramento/Delta surface water supply for the term of the VA pathway as shown above in this section, although the effects of these changes would vary by region. The total reduction in Sacramento/Delta surface water supplies under the VA pathway would also be less compared to the 55 w/WSAs scenario, for the term of the VA pathway. Under the VA pathway, most of the reductions in Sacramento/Delta surface water supplies would occur within the Sacramento/Delta watershed. For the Sacramento River watershed and San Joaquin Valley regions, results for changes in Sacramento/Delta surface water supplies under the VA pathway are presented as a range representing the possible change in Sacramento/Delta water supply from baseline to reflect the potential sources of water provided through unspecified water purchases. For these regions, the actual change from baseline would be within the range presented.

13.4.5 Changes in Groundwater Supply

This section includes a short discussion of groundwater in the SacWAM domain that characterizes groundwater use in the study area as well as a more qualitative description of changes that could

occur to groundwater supply with the implementation of the revised proposed Plan amendments. SacWAM includes a model representation of groundwater pumping, incidental recharge from deep percolation and conveyance losses, and stream-groundwater interactions for the Sacramento River watershed and the Delta eastside tributaries regions. SacWAM does not include simulation of these groundwater flows in the Delta, south of the Delta, or in the Bay Area. As discussed in Section 6.2, *SacWAM Model Assumptions*, groundwater pumping in the unimpaired flow scenarios was constrained to be no greater than the corresponding monthly value of groundwater pumping from the baseline scenario.[5] Groundwater pumping in the VA scenario is not limited by results from the baseline scenario, but due to the nature of HRL commitments, changes in groundwater are generally small and localized in that scenario.

SacWAM groundwater results for groundwater pumping, groundwater recharge, stream-groundwater flux, and groundwater storage for SacWAM version 2025.08.28 are presented for the VA scenario and starting point for the regulatory pathway (55 w/WSAs scenario) in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*. SacWAM groundwater results for groundwater pumping, groundwater recharge, stream-groundwater flux, and groundwater storage are presented for the 35, 45, 55, and 65 scenarios in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*. Note that the results for the 55 w/WSAs and 35, 45, 55, and 65 scenarios reflect limits on replacement groundwater pumping as described above.

Historical water deliveries data is used to provide estimates of the 2005 to 2015 average annual total groundwater use in the study area (Section 2.8, *Existing Water Supply*). Analysis of that data finds that approximately 17.3 MAF of groundwater is used annually within the study area, or roughly 42 percent of total use from all sources of supply (Table 13.4-153 and Table 2.8-1 in Chapter 2, *Hydrology and Water Supply*). Groundwater accounts for approximately 43 percent of the total supplies to agriculture, 41 percent to municipal water uses, and 23 percent of the total supplies to managed wetlands.

Table 13.4-153. Average Annual Groundwater Use by Geographic Region and Sector, 2005–2015 (thousand acre-feet)

	Sector			
Geographic Region	Agriculture	Municipal	Managed Wetlands	Total Groundwater Use
Sacramento River watershed	2,272	387	20	2,679
Delta eastside tributaries	545	53	0	597
Delta	34	40	0	74
San Francisco Bay Area	80	184	0	264
San Joaquin Valley	9,034	823	251	10,107
Central Coast	968	196	0	1,164
Southern California	792	1,590	0	2,382
Total	13,725	3,272	271	17,267

Source: Table 2.8-2, Chapter 2, *Hydrology and Water Supply*.

[5] The allowance of pumping 0.1 percent greater than baseline was included to ensure numerical stability of the model. See Appendix A1, *Sacramento Water Allocation Model Methods and Results*, for further explanation.

Section 13.4.4, *Changes in Surface Water Supply*, provides SacWAM results for changes in Sacramento/Delta surface water supply under the VA pathway and starting point for the regulatory pathway (55 w/WSAs scenario). As discussed in Section 6.5, *Changes in Groundwater Supply*, historically, in areas with adequate groundwater, the local response to decreased surface water availability has been to use more groundwater. Irrigation districts serving multiple farms may have their own wells with water that is pumped directly into distribution systems. Municipalities generally rely on multiple sources of water to provide protection against shortages and unanticipated failures in parts of the delivery systems. Municipal wholesalers who rely on surface water often have one or more groundwater wells that may serve as supplemental or backup supplies. In both the Sacramento River and San Joaquin River Valleys, many communities rely solely on groundwater.

The revised proposed Plan amendments have the potential to affect groundwater levels due to potential changes in groundwater pumping and changes in managed and incidental recharge. There is uncertainty regarding areal recharge rates, stream-groundwater interactions, and groundwater pumping in many parts of the study area. Precisely how these physical processes may change, and how users may respond to reduced surface water availability are difficult to determine based on other regulatory requirements and groundwater availability. The changes in groundwater supply would largely be dependent on other regulatory requirements, such as SGMA.

The following subsections provide additional information on changes in groundwater supply under the regulatory pathway and VA pathway.

13.4.5.1 Regulatory Pathway

SacWAM groundwater results for groundwater pumping, groundwater recharge, stream-groundwater flux, and groundwater storage are presented for the starting point for the regulatory pathway (55 w/WSAs scenario) in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments.* As discussed above, changes in hydrology and water supply under the 55 w/WSAs scenario would be expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. SacWAM results for average annual Sacramento/Delta water supply under the 55 w/WSAs scenario show reductions compared to baseline in all water year types that are more similar to the Low Flow Alternative than to the 55 scenario in all water year types. Accordingly, potential changes in groundwater recharge and groundwater levels resulting from substitute groundwater pumping to replace Sacramento/Delta surface water supplies or from reduced incidental recharge under the starting point for the regulatory pathway for the revised proposed Plan amendments (55 w/WSAs scenario) would be less than those under the 55 scenario and more similar to the Low Flow Alternative. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, changes could also be as high as those identified in Chapter 6, *Changes in Hydrology and Water Supply,* and Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*.

13.4.5.2 Voluntary Agreement Pathway

SacWAM groundwater results for groundwater pumping, groundwater recharge, stream-groundwater flux, and groundwater storage are presented for the VA scenario in Appendix H1a2,

Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments. Changes in hydrology and water supply with implementation of the VA pathway could result in small changes in streamflow and changes in water supply, similar to the effects described in Chapter 9, *Proposed Voluntary Agreements*. Changes with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

The HRL proposals identify that some flow contributions could be provided through groundwater substitution, including in basins subject to the Sustainable Groundwater Management Act (SGMA) where that is consistent with local management under SGMA. The SacWAM modeling considers that some flows could be provided through groundwater substitution in the American River watershed consistent with the HRL documents. Flows in other watersheds could also be provided through groundwater substitution, but sufficient information is not available at this time to include additional groundwater substitution in the modeling. If additional flows are made available through groundwater substitution, water supply reductions for the Sacramento/Delta watershed would be less than indicated by the results, and associated effects such as land fallowing would be reduced.

13.4.6 Sensitivity Analysis for 2025 Record of Decision and 2025 Incidental Take Permit

On December 4, 2025, pursuant to direction included in Action 5 of federal Executive Order 14181, Reclamation modified operational constraints included in the ROD for the LTO of the CVP and SWP. These modifications included adding flexibility to reduce OMR reverse flow restrictions and elimination of fall X2 requirements. In addition to the 2025 ROD changes, two amendments to the CDFW ITP issued for SWP operations pursuant to the CESA were approved by CDFW in 2025 to change requirements for SWP operations, including: 1) a one-year modification to remove the requirements for fall X2 in exchange for a summer food and habitat action, and 2) flexibility to reduce OMR flow restrictions at certain times. DWR has also submitted a 2026 ITP amendment request to CDFW to permanently remove the requirements for fall X2. In July 2026, CDFW approved an additional one-year modification to the ITP. CDFW is continuing to process the request for a permanent amendment to the ITP and expects to make its decision on the request by December 2026.

While the 2025 ROD and 2025 CDFW ITP (collectively, 2025 ROD/ITP) are actions taken by other agencies outside of the Bay-Delta Plan, these actions could interact with changes in hydrology and water supply under the revised proposed Plan amendments because the baseline for this project reflects conditions as they have largely existed for the majority of this planning process prior to the late 2024 and late 2025 changes to CVP and SWP operational constraints. The changes in CVP and SWP operational constraints affect the modeling and analyses even though these effects are not the result of this project. Changes in CVP and SWP operational constraints under the 2025 ROD/ITP are described in more detail below. This section also presents SacWAM modeling and postprocessing results for changes in hydrology (including changes in Delta inflow, south of Delta exports, and Delta outflow) and changes in water supply for the 55 w/WSAs + 2025 ROD/ITP and the VA + 2025 ROD/ITP scenarios. In addition, detailed SacWAM methods and results are presented in Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*, and

Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*.

Several modifications under the 2025 ROD/ITP may result in changes to Project operations. "Storm flex" operations allow the Projects to reduce OMR flows to capture peak flows during storm-related events after a real-time assessment of risk to managed species. From the start of the OMR management season[6] until the larval and juvenile Delta Smelt Protection Action is triggered, the 2024 ROD and 2024 ITP permitted Reclamation and DWR to operate to OMR no more negative than -6,250 cfs when specified hydrologic conditions are satisfied. The 2025 ROD increased the magnitude of the allowable negative OMR for Reclamation to -6,500 cfs and modified provisions regarding the hydrologic conditions and governance for the action. The storm flex provisions of the amended ITP remain consistent with the 2024 ROD and 2024 ITP.

The 2025 ROD/ITP also includes changes to OMR management actions. When the first flush action is triggered per provisions of the 2025 ITP amendments, DWR may provide an assessment to CDFW demonstrating that OMR more negative than -2,000 cfs would provide equal protection for fish species. If CDFW's Director agrees, DWR may operate to OMR flows as negative as -5,000 cfs. The 2025 ROD provides that based on Reclamation's assessment, Reclamation may initiate an early first flush action, or may postpone or reduce the duration and magnitude of the action if Reclamation concludes that it is not warranted to avoid exceeding incidental take of Delta smelt. During the remainder of the OMR management season, the 2025 ROD/ITP provides for increased flexibility in the management of negative OMR flows for both Projects. Under the 2025 ITP amendments, DWR may submit assessments for approval by CDFW's Director supporting alternative operations for OMR actions to prevent entrainment of Delta smelt when the default OMR limit would be -3,500 cfs, provided that no other action limiting OMR is triggered. The 2025 ROD provides Reclamation broader discretion to select an OMR limit as negative as -5,000 cfs at any time during the OMR management season based on a real-time assessment.

The September 2025 and July 2026 ITP amendments waived fall X2 requirements for 2025 and 2026, but did not specify whether they will remain in place during future years. In lieu of meeting fall X2, both amendments required additional operations of the Suisun Marsh Salinity Control Gates beyond those required by D-1641. Also, in lieu of implementing the fall X2 actions from the 2024 ITP, DWR committed to undertake a Delta Smelt Food Enhancement Habitat Action to supplement cultured zooplankton between June and October in the Suisun Marsh Region, remove invasive species within the North Delta Arc region, and add site-specific monitoring.

Overall, the changes under the 2025 ROD/ITP identified above could result in changes in hydrology and changes in water supply, including increased south of Delta exports and changes in Delta inflow and Delta outflow at times under certain conditions. These changes are evaluated in this section by comparing SacWAM results for changes in hydrology under the starting point for the regulatory pathway and under the VA pathway in combination with the 2025 ROD/ITP (55 w/WSAs + 2025 ROD/ITP and VA + 2025 ROD/ITP scenarios) with results for the 55 w/WSAs scenario and VA scenario and baseline.

The SacWAM results presented in this section include postprocessing of additional CVP export effects associated with the 2025 ROD that were not explicitly modeled. As discussed in Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*, efforts

[6] The first flush action can occur as early as December 1st through the end of February, and by default limits OMR to -2,000 cfs for 14 days under specified flow and turbidity conditions.

to model the combined effects of the 2025 ROD and 2025 ITP amendments are complicated by inconsistent constraints on export operations between the CVP and SWP. Because the export operations of the two Projects are intertwined via shared responsibilities for meeting regulatory requirements and the Coordinated Operations Agreement (COA) that governs the sharing of that responsibility, inconsistent values of other operational constraints such as OMR reverse flow limits can introduce the possibility that the modeled operations of one Project may benefit collaterally from relaxations to the other Project's constraints. Initial attempts to model such scenarios generally resulted in a collateral benefit to SWP exports during the OMR management season that were inconsistent with the provisions of the ITP, likely overestimating the combined effects of the 2025 ROD and ITP amendments on Project exports and Delta outflow. Attempts to prevent such modeled operations resulted in over-constrained SWP exports, likely underestimating the combined effects of the 2025 ROD and ITP amendments. Although it is in principle possible to formulate model constraints to overcome both challenges, there is currently no publicly available operations model that has been confirmed to effectively model such operations, and SacWAM modelers have been unable to formulate such constraints to date. Accordingly, Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments,* describes a postprocessing approach to represent the combined effects of the 2025 ROD/ITP adequately for the purposes of analyzing the sensitivity of both the VA and regulatory pathways to those changes.

As described in Section 13.4.2.1, *Sacramento Water Allocation Model (SacWAM) General Updates*, SacWAM version 2026.05.29 was used to model the 55 w/WSAs + 2025 ROD/ITP scenario and the VA + 2025 ROD/ITP scenario. To facilitate comparison with the baseline, 55 w/WSAs, and VA scenarios, the SacWAM results presented in this section and in Appendices H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendment*, and H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*, also present SacWAM results for the baseline, 55 w/WSAs, and VA scenarios alone using SacWAM version 2026.05.29.

There is some uncertainty in how the 2025 ROD/ITP will be implemented, and the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results. Modeled scenarios include dynamic modeling of changes to fall X2 and the first flush OMR requirement for the 2025 ROD/ITP but rely on postprocessing to estimate additional CVP export effects associated with the 2025 ROD that are discussed in more detail in Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*. The results presented in Appendix H1a6 do not include postprocessing of the additional CVP export effects associated with the 2025 ROD. In addition to these specific uncertainties, Section 6.1.1, *Presentation of Results*, provides information on the appropriate use of model results. As discussed in Section 6.1.1, because it simulates hypothetical conditions, SacWAM is not intended to be used in a real-time predictive manner. SacWAM results are intended to be used in a comparative manner, which allows for assessing the changes in system operations and resulting incremental effects between scenarios.

The HRL flows are intended to be additive to required flows under D-1641 and resulting flows under the 2024 LTO ROD and 2024 NMFS and USFWS BiOps rather than the 2025 ROD/ITP. As such, because changes under the 2025 ROD/ITP could reduce the base upon which the HRL flow commitments are intended to be added, the revised proposed Plan amendments include a new LTO base flow balancing provision that is discussed in more detail in Section 13.3, *Revised Proposed Plan Amendments*. The provision requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA

pathway. The modeling results presented below show the effects of not having the LTO base flow balancing provision. However, the LTO base flow balancing provision would be expected to prevent reductions in Delta outflows under the VA pathway.

The LTO base flow balancing provision would not apply under the regulatory pathway because the regulatory pathway flow requirements are not built on base flows but instead are requirements for tributary and Delta outflow levels based on unimpaired flows. However, increases in Delta outflows under the regulatory pathway could also be reduced due to the 2025 ROD/ITP at times when the prior fall X2 and OMR flow restrictions that were modified in the 2025 ROD/ITP would have controlled Delta outflows or otherwise resulted in greater Delta outflows than those required under the regulatory pathway. This is more likely with WSAs than without WSAs, but could occur in either case, particularly in the fall. Chapter 13, *Revised Proposed Plan Amendments*, has been updated to evaluate these possible effects of changes to other regulatory requirements on the expected outcomes of the Bay-Delta Plan under the regulatory pathway. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the new narrative interior Delta flow objective that is described in Section 13.3.6, *Interior Delta Flows*. While the narrative objective is expected to be met through implementation of CESA and ESA requirements and compliance with the existing numeric interior Delta flow objectives in the Plan, as appropriate, during annual or periodic reviews of the Bay-Delta Plan and its implementation, the State Water Board will evaluate the effectiveness of the interior Delta flow objectives and implementation actions and assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

13.4.6.1 Changes in Hydrology

This section provides SacWAM results for changes in Delta inflow, south of Delta exports, and Delta outflow for the baseline, VA, VA + 2025 ROD/ITP, 55 w/WSAs, and 55 w/WSAs + 2025 ROD/ITP scenarios using SacWAM version 2026.05.29. Detailed SacWAM results for changes in hydrology under the VA + 2025 ROD/ITP and 55 w/WSAs + 2025 ROD/ITP scenarios are presented in Appendices H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*, and H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*, including changes in tributary streamflows, Delta inflows, Delta exports, interior Delta flows, Delta outflows, and changes in reservoir storage and elevation.

Overall, changes in hydrology under the 2025 ROD/ITP would be expected to primarily affect flows on Project tributaries (including the American River, Feather River, and mainstem Sacramento River), and in the Delta (including Delta inflows, south of Delta exports, and Delta outflows). As shown in Appendices H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*, and H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*, Project reservoirs (Folsom, Oroville, and Shasta Reservoirs) show increased end of September reservoir storage levels under wetter hydrologic conditions, which is due to the removal of the fall X2 requirement in above normal and wet water year types.

The 2025 ROD/ITP would not be expected to have direct effects on streamflows or reservoir storage and elevations on non-Project tributaries. The modeling results presented in Appendices H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*, and H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit*

Amendments, show that there would generally not be changes in streamflows or reservoir storage and elevation on non-Project tributaries between the 55 w/WSAs + 2025 ROD/ITP scenario and the 55 w/WSAs scenario alone, or between the VA + 2025 ROD/ITP scenario and the VA scenario alone. Any differences in model results on non-Project tributaries between scenarios with and without the 2025 ROD/ITP are small. Statistical summaries such as boxplots, exceedance plots, and cumulative frequency distributions supporting this conclusion can be found in Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*.

Delta Inflow

Delta inflow is the sum of tributary inflows, as well as local runoff to the Delta.

Under the VA + 2025 ROD/ITP scenario, average total January through June Delta inflow is greater for all water year types compared to the VA scenario alone (Table 13.4-154). Similarly, under the 55 w/WSAs + 2025 ROD/ITP scenario, average total January through June Delta inflow is greater for all water year types compared to the 55 w/WSAs scenario alone; these changes occur primarily in above normal and wet water year types (Table 13.4-154). These increases are largely the result of increased reservoir spill during the winter months due to the removal of the fall X2 requirement that applies in above normal and wet water years, which would result in increased end of September reservoir storage on Project tributaries in above normal and wet water years.

Under the VA + 2025 ROD/ITP scenario, average total July through December Delta inflow is reduced across all water year types compared to the VA scenario alone (Table 13.4-155). These changes vary by water year type; reductions occur in above normal and wet water year types, increases occur in dry and below normal water year types, and flows are very similar between the two modeled scenarios for critical water year types. Under the 55 w/WSAs +_2025 ROD/ITP scenario, average total July through December Delta inflow is reduced across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-155). These changes vary by water year type; reductions occur in above normal and wet years, and increases occur in critically dry, dry, and below normal water year types. These changes result primarily from the removal of the fall X2 requirement that applies in above normal and wet water years.

Under the VA + 2025 ROD/ITP scenario, average total annual Delta inflow is reduced very slightly across all water year types compared to the VA scenario alone (Table 13.4-156). These changes vary by water year type; reductions occur in above normal and wet water year types, and increases occur in critical, dry, and below normal water year types. Similarly, under the 55 w/WSAs + 2025 ROD/ITP scenario, average total annual Delta inflow is reduced very slightly across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-156). These changes vary by water year type; reductions occur in above normal and wet water year types, and increases occur in critical, dry, and below normal water year types.

Actual changes in Delta inflow resulting from the 2025 ROD/ITP could differ somewhat from the modeling results. Without the fall X2 requirement that applies during the fall of wet and above normal water year types, it is possible that water that was stored in reservoirs and used to meet the fall X2 requirement could at times be released from storage earlier in the year and could provide for increased Delta inflows under certain conditions (e.g., to support potential increases in exports, as discussed in *South of Delta Exports*, below). However, these possible additional changes associated with the removal of the fall X2 would primarily occur under wetter hydrologic conditions.

Table 13.4-154. Average Total January–June Delta Inflow Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	5,259	-17	37	95	97
D	7,032	324	400	647	660
BN	10,101	281	355	1,105	1,107
AN	16,197	236	331	982	1,051
W	25,324	12	48	364	415
All	13,988	155	218	601	628

Table 13.4-155. Average Total July–December Delta Inflow Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	4,454	-18	-17	-284	-275
D	6,028	-30	73	-611	-539
BN	6,815	-161	-138	-587	-573
AN	8,202	-110	-598	-555	-831
W	10,783	-65	-187	-166	-257
All	7,629	-74	-142	-412	-453

Table 13.4-156. Average Total Annual Delta Inflow Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	9,712	-35	20	-188	-178
D	13,059	294	473	36	121
BN	16,916	119	218	518	534
AN	24,399	127	-268	428	220
W	36,107	-53	-139	198	158
All	21,617	82	76	189	175

South of Delta Exports

Under existing conditions, between approximately one-third and half of the Sacramento/Delta water supplied is to south of Delta users via South Delta pumping facilities, with higher export rates in wetter years. The tables below present SacWAM results for average south of Delta exports for the baseline, VA, VA + 2025 ROD/ITP, 55 w/WSAs, and 55 w/WSAs + 2025 ROD/ITP scenarios.

Under the VA + 2025 ROD/ITP scenario, average total January through June CVP south of Delta exports increase across all water year types compared to the VA scenario alone (Table 13.4-157). These changes vary by water year type; increases occur in all water year types except in critical water years when the results are similar under the two scenarios. Similarly, under the 55 w/WSAs + 2025 ROD/ITP scenario, average total January through June CVP exports increase across all water

year types compared to the 55 w/WSAs scenario alone (Table 13.4-157). These changes vary by water year type; increases occur in all water year types except in critical water years when average total January through June CVP Delta exports are the same as compared to the 55 scenario alone.

Under the VA + 2025 ROD/ITP scenario, average total July through December south of Delta CVP exports show no change across all water year types compared to the VA scenario alone but the results vary by water year type; no change occurs in dry water years, slight reductions occur in critical and below normal water years, and increases occur in above normal and wet water years (Table 13.4-158). Under the 55 w/WSAs + 2025 ROD/ITP scenario, there is a slight reduction in average total July through December south of Delta CVP exports across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-158). These changes vary by water year type; increases occur in average total July through December south of Delta exports in above normal and below normal water years, and reductions occur in wet, dry, and critical water years.

Overall, under the VA + 2025 ROD/ITP scenario, average total annual CVP south of Delta exports increase across all water year types compared to the VA scenario alone (Table 13.4-159). These changes vary by water year type; increases occur in all water year types except for critical water years, with the largest increase occurring in above normal water years. Similarly, under the 55 w/WSAs + 2025 ROD/ITP scenario, average total south of Delta CVP exports increase across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-159). These changes vary by water year type; increases occur in all water year types except for critical years.

Under the VA + 2025 ROD/ITP scenario, average total January through June SWP south of Delta exports are very similar across all water year types compared to the VA scenario alone (Table 13.4-160). These changes vary by water year type; no change occurs in dry water years, slight increases occur in critical, above normal, and wet water years, and reductions occur in below normal water years. Likewise, under the 55 w/WSAs + 2025 ROD/ITP scenario, total January through June SWP south of Delta exports are very similar across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-160). These changes vary by water year type; reductions occur in critical, dry, and below normal water years, while increases occur in above normal and wet water years.

Under the VA + 2025 ROD/ITP scenario, there are increases in average total July through December SWP south of Delta exports across all water year types compared to the VA scenario alone (Table 13.4-161). These changes vary by water year type: increases occur in all water year types except for above normal water years when slight reductions occur. The largest increase occurs in dry water years. Under the 55 w/WSAs + 2025 ROD/ITP, average total July through December SWP south of Delta exports are greater for every water year type compared to the 55 w/WSAs scenario alone, with the largest increase occurring in dry water years (Table 13.4-161).

Overall, average annual total SWP south of Delta exports are greater under the VA + 2025 ROD/ITP scenario for every water year type compared to the VA scenario alone, with the largest increase in dry water years (Table 13.4-162). Likewise, under the 55 w/WSAs + 2025 ROD/ITP scenario, average total SWP south of Delta exports are greater for every water year type compared to the 55 w/WSAs scenario alone, with the largest increase in dry water years (Table 13.4-162).

Actual changes in CVP and SWP south of Delta exports resulting from the 2025 ROD/ITP could differ somewhat from the modeling results. Without the fall X2 requirement that applies during the fall of wet and above normal water year types, it is possible that water stored in reservoirs that would have been released to meet the fall X2 requirement under baseline conditions could at times be released from storage earlier in the year and could provide for increased south of Delta exports

under certain conditions. However, these possible additional changes associated with the removal of the fall X2 would primarily occur under wetter hydrologic conditions.

Table 13.4-157. Average Total January–June CVP South of Delta Exports Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios (Including Postprocessing of Additional CVP Export Effects Associated with 2025 ROD)

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	757	-55	-58	-123	-123
D	962	35	87	12	67
BN	981	130	212	217	308
AN	1,040	128	199	287	357
W	1,254	105	127	124	140
All	1,030	71	113	97	140

Table 13.4-158. Average Total July–December CVP South of Delta Exports Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	984	-29	-37	-117	-153
D	1,385	-32	-32	-109	-120
BN	1,389	-99	-117	-100	-99
AN	1,438	-77	-49	-130	-99
W	1,520	-10	-6	-19	-21
All	1,368	-43	-43	-84	-89

Table 13.4-159. Average Total Annual CVP South of Delta Exports Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios (Including Postprocessing of Additional CVP Export Effects Associated with 2025 ROD)

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	1,741	-84	-94	-240	-276
D	2,347	4	54	-96	-53
BN	2,370	32	95	116	209
AN	2,478	52	150	157	259
W	2,774	95	121	106	119
All	2,398	29	70	13	51

Table 13.4-160. Average Total January–June SWP South of Delta Exports Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	476	24	28	40	36
D	609	79	79	-73	-75
BN	713	116	100	-42	-57
AN	878	96	106	-39	-34
W	1,501	104	105	-35	-26
All	910	87	86	-33	-34

Table 13.4-161. Average Total July–December SWP South of Delta Exports Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	800	7	12	-179	-137
D	1,602	-50	27	-587	-498
BN	2,068	-30	-14	-462	-438
AN	2,129	9	7	-332	-283
W	2,224	-32	1	-201	-171
All	1,814	-24	6	-349	-303

Table 13.4-162. Average Total Annual SWP South of Delta Exports Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	1,275	31	40	-138	-101
D	2,211	30	106	-660	-573
BN	2,782	85	86	-504	-495
AN	3,007	105	112	-371	-317
W	3,725	72	105	-236	-197
All	2,724	62	92	-382	-337

Delta Outflow

This section provides SacWAM results for Delta outflow under the VA + 2025 ROD/ITP scenario and 55 w/WSAs + 2025 ROD/ITP scenario.

Under the VA + 2025 ROD/ITP scenario, average total January through June Delta outflow increases across all water year types compared to the VA scenario alone (Table 13.4-163). Increases occur in all water year types, with the largest increase occurring in critical years. Under the 55 w/WSAs + 2025 ROD/ITP scenario, average total January through June Delta outflow is reduced across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-163). These changes vary

by water year type; increases occur in critical and wet years, and decreases occur in all other water year types with the greatest decrease occurring in below normal water years.

Under the VA + 2025 ROD/ITP scenario, average total July through December Delta outflow is reduced across all water year types compared to the VA scenario alone (Table 13.4-164). The changes vary by water year type: increases occur in critical, dry, and below normal water years, and reductions occur in above normal and wet water years with the largest reduction occurring in above normal water years. Under the 55 w/WSAs + 2025 ROD/ITP scenario, average total July through December Delta outflow is reduced across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-164). These changes vary by water year type; reductions occur in all water year types except critical years when there is a slight increase in flow, with the largest reduction occurring in above normal water years.

Overall, under the VA + 2025 ROD/ITP scenario, average total annual Delta outflow is reduced across all water year types compared to the VA scenario alone (Table 13.4-165). The changes vary by water year type; reductions occur in above normal and wet water years with the greatest reduction occurring in above normal water years, and increases occur in critical, dry, and below normal water years. Under the 55 w/WSAs + 2025 ROD/ITP scenario, average total annual Delta outflow is reduced across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-165). These changes vary by water year type: reductions occur in all water year types except in critical water years when there would be a slight increase in Delta outflow. The greatest reduction occurs in above normal water years.

Actual changes in Delta outflow associated with the 2025 ROD/ITP could differ somewhat from the modeling results. There are several areas of uncertainty associated with the operation of the 2025 ROD/ITP. For example, the modeling results presented in this section include postprocessing of additional CVP export effects associated with the 2025 ROD, but the actual effects could differ to some extent. For example, as described above, it is also possible that water that would have been released to meet fall X2 requirements under baseline conditions could be released to support exports earlier in the season. Such operations would diminish the magnitude of reservoir spill that contributes to modeled increases in Delta inflow and Delta outflow during January through June. As discussed above, under the VA pathway, the LTO baseflow balancing provision would be expected to prevent reductions in Delta outflows. Under the regulatory pathway, changes to reservoir spill dynamics could reduce the magnitude of increases in Delta outflows, but substantial net increases would still be expected.

Table 13.4-163. Average Total January–June Delta Outflow Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios (Including Postprocessing of Additional CVP Export Effects Associated with 2025 ROD)

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	3,554	87	140	184	190
D	5,028	389	415	703	662
BN	8,056	124	132	923	847
AN	14,071	163	176	724	717
W	22,452	-68	-55	273	300
All	11,747	123	145	534	518

Table 13.4-164. Average Total July–December Delta Outflow Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	1,889	4	7	24	26
D	2,293	52	80	92	88
BN	2,603	-32	-6	-22	-33
AN	3,913	-41	-556	-80	-436
W	6,392	-23	-181	59	-60
All	3,726	-6	-104	28	-54

Table 13.4-165. Average Total Annual Delta Outflow Baseline and Change from Baseline (TAF) by Water Year Type for 2025 ROD/ITP Scenarios (Including Postprocessing of Additional CVP Export Effects Associated with 2025 ROD)

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	5,443	91	147	208	216
D	7,321	441	495	796	750
BN	10,659	92	126	901	814
AN	17,984	122	-380	644	282
W	28,844	-92	-236	332	240
All	15,473	117	40	562	465

13.4.6.2 Changes In Water Supply

This section provides SacWAM results for changes in water supply under the VA + 2025 ROD/ITP scenario and 55 w/WSAs + 2025 ROD/ITP scenario using SacWAM version 2026.05.29. Detailed SacWAM results for changes in water supply are presented in Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*, for water supply by sector and region, and Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*, for water supply by SacWAM water budget area (WBA) and other logical grouping of demand sites.

Under the VA + 2025 ROD/ITP scenario, average annual total Sacramento/Delta supply increases across all water year types compared to the VA scenario alone (Table 13.4-166). The changes vary by water year type; slight decreases occur in above normal years and increases occur in all other water year types, with the greatest increase in dry water years. Similarly, under the 55 w/WSAs + 2025 ROD/ITP scenario, average annual total Sacramento/Delta supply increases across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-166). These changes vary by water year type; there is no change between the two scenarios for above normal years, and increases occur in all other water year types, with the largest increase in dry water years. Overall, these results show that the 2025 ROD/ITP would be expected to lessen the water supply reductions that would occur under the starting point for the regulatory pathway and under the VA pathway.

Under the VA + 2025 ROD/ITP scenario, average annual total Sacramento/Delta supply to agriculture increases slightly across all water year types compared to the VA scenario alone (Table 13.4-167). These changes vary by water year type; increases occur in critical, dry and wet water

years and reductions occur in below normal and above normal water years. Under the 55 w/WSAs + 2025 ROD/ITP scenario, the total Sacramento/Delta supply to agriculture is greater for all water year types compared to the 55 w/WSAs scenario alone, with the largest increase occurring in critical water years (Table 13.4-167). Overall, these results show that the 2025 ROD/ITP would be expected to lessen the water supply reductions that would occur under the starting point for the regulatory pathway and under the VA pathway.

Under the VA + 2025 ROD/ITP scenario, the average annual total Sacramento/Delta supply to municipal use increases compared to the VA scenario across all water year types (Table 13.4-168). These changes vary by water year type; increases occur in every water year type except for above normal water years when a reduction occurs. Similarly, under the 55 w/WSAs + 2025 ROD/ITP scenario, average total Sacramento/Delta supply to municipal use increases across all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-168). These changes vary by water year type; increases occur in every water year type except in above normal years when there is a slight decrease compared to the 55 w/WSAs scenario alone. Overall, these results show that the 2025 ROD/ITP would be expected to lessen the water supply reductions that would occur under the starting point for the regulatory pathway and under the VA pathway.

Under the VA + 2025 ROD/ITP scenario, the average annual total Sacramento/Delta supply to wildlife refuges for all water year types are similar compared to the VA scenario alone (Table 13.4-169). Likewise, under the 55 w/WSAs + 2025 ROD/ITP scenario, the average annual total Sacramento/Delta supply to wildlife refuges is similar for all water year types compared to the 55 w/WSAs scenario alone (Table 13.4-169). Overall, the modeling results estimate that the 2025 ROD/ITP would have minimal changes on Sacramento/Delta supply to wildlife refuges.

Table 13.4-166. Average Annual Total Sacramento/Delta Supply by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	9,423	-79	-49	-1,174	-1,083
D	11,605	-337	-240	-1,083	-981
BN	12,188	-145	-143	-587	-531
AN	12,418	-213	-246	-249	-249
W	13,515	20	57	-278	-237
All	12,042	-135	-101	-657	-597

Table 13.4-167. Average Annual Total Sacramento/Delta Supply to Agriculture by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	7,005	-16	3	-928	-880
D	8,293	-160	-136	-390	-362
BN	8,559	-120	-140	-148	-130
AN	8,658	-133	-154	12	14
W	9,232	103	106	-67	-56
All	8,465	-46	-43	-284	-263

Table 13.4-168. Average Annual Total Sacramento/Delta Supply to Municipal and Industrial Use by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	1,946	3	15	-237	-192
D	2,806	-19	53	-691	-617
BN	3,121	45	67	-437	-400
AN	3,258	58	46	-259	-261
W	3,775	40	73	-208	-180
All	3,076	24	55	-370	-331

Table 13.4-169. Average Annual Total Sacramento/Delta Supply to Wildlife Refuges by Water Year Type for 2025 ROD/ITP Scenarios

Water Year Type	Baseline	VA	VA + 2025 ROD/ITP	55 w/WSAs	55 w/WSAs + 2025 ROD/ITP
C	472	-1	-2	-9	-10
D	507	0	0	-2	-2
BN	508	0	0	-1	-1
AN	502	-1	-1	-2	-2
W	508	0	1	-2	-1
All	501	0	0	-3	-3

13.5 Beneficial Environmental Effects

13.5.1 Introduction

To support the Sacramento/Delta Update to the Bay-Delta Plan, a Scientific Basis Report was finalized in 2017 pursuant to the requirements of California Public Health and Safety Code section 57004.[1] The 2017 Scientific Basis Report reviews and summarizes the best available science supporting potential changes to the Bay-Delta Plan's flow and water project operational requirements, building on science in the Delta Flow Criteria Report and other analyses. The 2017 Scientific Basis Report also provides a summary of the science on other non-flow stressors and proposed actions to address those stressors in concert with flow actions.

Following receipt of the memorandum of understanding (MOU) for the HRL commitments in 2022, the State Water Board, California Department of Water Resources (DWR), and California Department of Fish and Wildlife (CDFW) prepared a Scientific Basis Report Supplement to document the science supporting the HRL commitments (Appendix G2, *Final Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan*). The Scientific Basis Report Supplement builds on the 2017 Scientific Basis Report, particularly through providing additional scientific information supporting specific HRL commitments to provide flow and non-flow physical habitat restoration actions in the tributaries, flood bypasses, and Delta. On October 25, 2023, the final draft Scientific Basis Report Supplement was submitted for peer review, and on February 21, 2024, peer review reports were submitted to the State Water Board. Staff from the State Water Board, DWR, and CDFW are working on revising the report in response to the peer reviewer comments.

As described further in the 2017 Scientific Basis Report and the Scientific Basis Report Supplement, native aquatic species have been declining in tributaries and the Bay-Delta due to anthropogenic stressors, including degradation of habitat and changes in flows.

Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, and the 2017 Scientific Basis Report include an analysis of the benefits of the 35 through 75 flow scenarios and other components of the proposed Plan amendments described in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*. Chapter 9, *Proposed Voluntary Agreements*, and the Scientific Basis Report Supplement include an analysis of the benefits of the HRL commitments. While the changes in hydrology and thus the expected benefits of the starting point for the regulatory pathway (55 w/WSAs scenario) generally fall between those of the Low Flow Alternative (35 and 45 scenarios) and the 55 scenario that were evaluated in Chapter 3 and the 2017 Scientific Basis Report, this section (13.5, *Beneficial Environmental Effects*) presents updated modeling and results for the benefits of the 55 w/WSAs scenario in addition to benefits of the VA pathway (VA scenario) compared to baseline. During the term of the VA pathway, changes in hydrology and associated benefits would be expected to be similar to those under the VA pathway alone, even with

[1] Section 57004 requires that the scientific basis of any statewide plan, basin plan, plan amendment, guideline, policy, or regulation undergo external scientific peer review before adoption.

the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

13.5.2 Methods

The benefit analyses in this section were conducted using the analytical methods developed in the 2017 Scientific Basis Report and the Scientific Basis Report Supplement. The 2017 Scientific Basis Report and the Scientific Basis Report Supplement evaluate potential benefits of the flow scenarios and HRL commitments relative to the 2008–2009 BiOps condition, which is referred to as the "reference condition" in the Scientific Basis Report Supplement. The analysis presented in this section (13.5, *Beneficial Environmental Effects*) evaluates benefits relative to the Staff Report baseline. Section 6.2.1, *Baseline Assumptions*, defines the baseline assumptions and Section 9.3.6, *Points of Comparison for VA Flow Assets*, describes the difference between the baseline and the 2008–2009 BiOps condition.

The analysis presented in this section includes scenarios representative of the regulatory pathway (55 w/WSAs) and the VA pathway ("VA scenario"). To represent additional Delta outflows from the lower San Joaquin River watershed from possible scenarios that could occur from implementation of the Tuolumne River HRL commitments or the Lower San Joaquin River flow objectives in the 2018 Bay-Delta Plan, this section also presents results for the regulatory and VA pathways in combination with the aforementioned processes which are identified as "…w/Tuol" and "…w/40uf," respectively (see Section 13.4, *Changes in Hydrology and Water Supply*).

In addition to the quantitative methods described in the following sections, a qualitative literature review was conducted to evaluate possible benefits of the regulatory and VA pathways (see Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations,* and Chapter 4, *Other Aquatic Ecosystem Stressors*, and the Scientific Basis Report Supplement).

13.5.2.1 Tributary Habitat Analysis

To evaluate potential changes in salmonid habitat area, the tributary habitat analysis methods from the Scientific Basis Report Supplement were applied (See Section 5.1, *Tributary Habitat Analysis*, of the Scientific Basis Report Supplement [Appendix G2, *Final Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan*] for a full description of the methods, and Appendix H1c, *Beneficial Environmental Effects*, for a description of additional steps taken for the application of the methodology). Briefly, habitat suitability criteria for velocity and depth were empirically derived for each tributary by associating fish presence with depth and velocity values. These criteria were paired with hydraulic model outputs of depth and velocity and assumptions of cover and substrate suitability to weight habitat areas for each flow level, resulting in relationships between flow and suitable habitat area. These flow-suitable habitat area relationships were mostly compiled within the DSMHabitat R package (Rodriguez et al. 2023) and are documented in Appendix H1c, *Beneficial Environmental Effects*. Flow-suitable habitat area relationships for tributaries included in the HRL commitments initially were developed using data from DSMHabitat and were then iteratively updated with input from watershed representatives to reflect the most up-to-date quantities of habitat suitable by depth, velocity, substrate (for spawning habitat), and cover (for rearing habitat) criteria. Existing habitat (excluding HRL contributions) was used for the 55 w/WSAs scenario. SacWAM-modeled flows for each flow scenario then were applied to these flow-suitable habitat area relationships to estimate the area of suitable habitat for

spawning, instream rearing, and floodplain rearing. Temperature criteria then were applied to filter out habitat area where temperatures would be unsuitable as defined by temperatures above 13°C for spawning and 18°C for rearing, using 7-day average daily maxima. These analyses were applied within appropriate seasons for each salmon run and habitat type: fall-run rearing (February through June), fall-run spawning (October through December), spring-run rearing (November through May), and spring-run spawning (March through October).

To further evaluate the quality of floodplain habitat under each scenario in terms of the duration, frequency, and timing of floodplain inundation at different magnitudes of suitable floodplain area inundation, the Meaningful Floodplain Event (MFE) analysis from the Scientific Basis Report Supplement was applied. This MFE approach evaluates the proportion of years in which floodplain inundation events of a given magnitude (suitable habitat area) occur for at least 2 months during the rearing period and for 2 out of every 3 years (i.e., did inundation events occur in at least 2 years out of the current year and the year before and after). The MFE frequency was estimated for a range of magnitudes, representing 25, 50, 75, and 100 percent of the area estimated to support offspring of the doubling goal population at the fry stage. If a doubling goal population was not available, the percentages were applied to the maximum habitat area. Methods are described in Section 5.1.3.4, *Floodplain Habitat Evaluation*, of the Scientific Basis Report Supplement (Appendix G2, *Final Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan*) and Appendix H1c, *Beneficial Environmental Effects*.

Most analyses were focused on fall-run Chinook salmon, but some were focused on spring run. Results are differentiated between fall-run and spring-run only for tributaries for which spring run were evaluated; results for all other tributaries represent only fall-run results.

As part of the process to revise the final draft Scientific Basis Report Supplement in response to public and peer reviewer comments, some data sources were updated for the tributary habitat analyses that are reflected in the results in this section. The flow habitat relationships for the American and Yuba Rivers have been updated after receipt of updated habitat data from the Sacramento Water Forum and the Yuba Water Agency. In addition, temperature data for the Yuba River are now derived from the Yuba River temperature model as described in Appendix H1b, *Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, American, and Yuba Rivers*. Information on the habitat data sources is available in Appendix H1c, *Beneficial Environmental Effects*.

13.5.2.2 Estuarine Habitat Analysis

To evaluate potential changes in estuarine habitat, the estuarine habitat methods from the Scientific Basis Report Supplement were applied. The area of suitable pelagic and wetland habitat was evaluated for Delta smelt larvae and juveniles, longfin smelt larvae and juveniles, and salmonid rearing. Suitability was defined by salinity, temperature, and turbidity criteria and evaluated using statistical relationships of Delta outflow and total exports with the habitat area meeting suitability criteria for each species and life stage under existing habitat conditions or with expected HRL habitat contributions. Existing habitat was used for the baseline and 55 w/WSAs scenario, and HRL habitat was used for the VA scenario. SacWAM results for each scenario were applied to these statistical relationships to calculate the area of suitable habitat for each species and life stage. The methods for this analysis can be found in Section 5.3, *Bay-Delta Two-Dimensional Hydrodynamic Analysis*, of the Scientific Basis Report Supplement (Appendix G2, *Final Scientific Basis Report*

Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan).

13.5.2.3 Flow Threshold Analysis

The 2017 Scientific Basis Report includes quantitative evaluations of the frequency of exceeding ecological flow thresholds for native species. The background and rationale for each threshold is described in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*. Each flow threshold was chosen to represent flows at which benefits to species were achieved, generally to support the needs of specific species, but some represented key X2 thresholds known to be beneficial for native species. Following the receipt of public comments on the 2023 draft Staff Report, new scientific information was evaluated to identify new flow thresholds for the protection of native fish species. Additional flow thresholds were incorporated into the analysis based on consideration of the following: 1) whether new studies relied upon peer-reviewed robust scientific methods to evaluate flow benefits for native species in the Sacramento/Delta watershed; 2) whether the studies evaluated new statistical relationships compared to what was evaluated in the 2017 Scientific Basis Report; 3) whether the new studies quantified flow benefits for native fish species at locations not evaluated in the 2017 Scientific Basis Report; and 4) whether the new studies analyzed flow thresholds for species or salmon runs for which flow thresholds were not identified in the 2017 Scientific Basis Report. Five new thresholds were added as described below.

Two studies demonstrated a positive statistical relationship between flows in the interior Delta and survival of late fall-run and winter-run out-migrating Chinook salmon. These studies supplemented the analysis of the lower Sacramento River, in reaches that are tidally influenced. Perry et al. (2018) demonstrated that through the lower Sacramento River, Sutter and Steamboat Slough, and Georgiana Slough, late fall-run (as surrogate for winter-run) probability of outmigration survival increased with flows up to approximately 35,315 cubic feet per second (cfs) at Freeport from December through March. Hance et al. (2022) analyzed survival for winter-run Chinook salmon in the same reaches and found that survival probability increased when daily flows increased up to 35,315 cfs at Freeport from February to mid-May. Therefore, a new flow threshold is incorporated for 35,300 cfs at Freeport during December through May for the outmigration survival of late-fall and winter-run Chinook salmon.

Michel et al. (2021) modeled flow and outmigration survival for all runs (but predominantly fall-run) at Wilkins Slough. The flow-survival relationship was best depicted as a step function. During mid-March to mid-June survival increased markedly when daily mean flows exceeded 10,712 cfs. For the purposes of the ecological flow threshold benefits analysis, this conclusion was translated into a new threshold of 10,700 cfs at Wilkins Slough during March through June for the outmigration survival of Chinook salmon.

Munsch et al. (2020) modeled the effects of flow on the presence and catch (given presence) of fall, winter, and spring run Chinook salmon fry. Fry presence in the Sacramento River and Delta decreased considerably when the 30-day mean flow at Freeport was less than 17,657 cfs. Fry catch, given presence, in the Sacramento River and Delta decreased considerably when flow was less than 26,486 cfs. Based on this information, new flow thresholds were incorporated for winter, spring, and fall run fry presence and abundance at Freeport flows of 17,700 and 26,500 cfs, respectively.

Polansky et al. (2024) used life cycle modeling to quantify the effects of habitat metrics (e.g., flow, food, temperature) on the population growth of Delta smelt. The authors found that Delta outflow during the summer had the largest effect on population growth, and there was a 50 percent probability of positive population growth when mean daily outflow exceeded approximately 10,200 cfs during June through August. Therefore, a new flow threshold is incorporated for 10,200 cfs Delta outflow during June through August for the protection of Delta smelt.

These new flow thresholds were added to the flow threshold analysis presented in this section. The full list of flow thresholds is provided in Table 13.5-1. Overall, these additional thresholds demonstrate that higher flows than those originally described in the 2023 draft Staff Report confer benefits for outmigration survival or population growth rates.

Table 13.5-1. Ecological Flow Thresholds used to Evaluate Benefits to Native Indicator Aquatic Species Populations

Threshold	Months	Analytical timestep[1]	Location	Flow (cfs)
Georgiana Slough flow reversal low	November – May	Month	Freeport	17,000
Georgiana Slough flow reversal high	November – May	Month	Freeport	20,000
Fall-run outmigration Rio Vista	April – June	Season	Rio Vista	20,000
Winter-run outmigration Rio Vista	February – April	Season	Rio Vista	20,000
Late-fall and winter-run outmigration Freeport	December – May	Month	Freeport	35,300
Fall, winter, and spring run outmigration Wilkins Slough	March – June	Month	Wilkins Slough	10,700
Fall, winter, and spring run fry presence	December – June	Month	Freeport	17,700
Fall, winter, and spring run fry abundance	December – June	Month	Freeport	26,500
Bay shrimp low	March – May	Season	Net Delta Outflow	20,000
Bay shrimp high	March – May	Season	Net Delta Outflow	25,000
Longfin smelt	January – June	Season	Net Delta Outflow	43,000
Delta smelt	June – August	Season	Net Delta Outflow	10,200
Sacramento splittail low	February – May	Season	Net Delta Outflow	30,000
Sacramento splittail high	February – May	Season	Net Delta Outflow	47,000
Starry flounder	March – June	Season	Net Delta Outflow	21,000
Green and white sturgeon	March – July	Season	Net Delta Outflow	37,000
Collinsville	January – June	Season	Net Delta Outflow	7,100
Chipps Island	January – June	Season	Net Delta Outflow	11,400
Port Chicago	January – June	Season	Net Delta Outflow	29,200

cfs = cubic feet per second

[1]This represents the timestep used to analyze the frequency of achieving the flow threshold. For "Season," flows were averaged over the indicated months and the frequency of that seasonal average achieving the flow threshold over the years in the SacWAM timeseries was evaluated. For "Month," the frequency of achieving the flow threshold in all indicated months in all years in the SacWAM timeseries was evaluated.

13.5.2.4 Flow-Abundance Analysis

To evaluate potential increases in abundance indices for native estuarine species, the flow-abundance analysis methods from the 2017 Scientific Basis Report and the Scientific Basis Report Supplement were applied. Statistical models of the abundance indices of four estuarine species (California bay shrimp [*Crangon franciscorum*], Sacramento splittail [*Pogonichthys macrolepidotus*], longfin smelt [*Spirinchus thaleichthys*], and starry flounder [*Platichthys stellatus*]) with Delta outflow were applied to SacWAM results for each scenario to estimate abundance indices. The percent change of the resulting abundance indices for the scenarios from the resulting abundance index for baseline were then calculated, along with an estimate of uncertainty. The methods for this analysis can be found in the 2017 Scientific Basis Report (Appendix B, *Scientific Basis Report in Support of New and Modified Requirements for Inflows from the Sacramento River and its Tributaries and Eastside Tributaries to the Delta, Delta Outflows, Cold Water Habitat, and Interior Delta Flows (2017)*) and Section 5.2, *Bay-Delta Flow-Abundance Relationships*, of the Scientific Basis Report Supplement (Appendix G2, *Final Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan*).

13.5.3 Regulatory Pathway

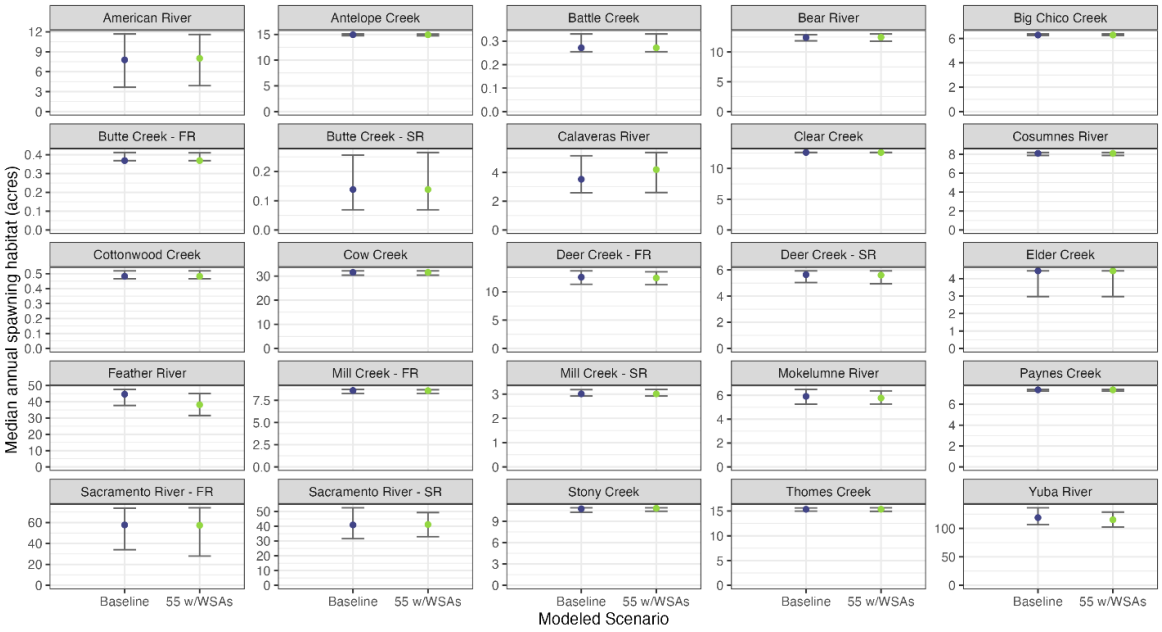
The regulatory pathway of the revised proposed Plan amendments is expected to provide benefits similar to those presented in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, and the 2017 Scientific Basis Report (Appendix B, *Scientific Basis Report in Support of New and Modified Requirements for Inflows from the Sacramento River and its Tributaries and Eastside Tributaries to the Delta, Delta Outflows, Cold Water Habitat, and Interior Delta Flows (2017)),* including through: increases in tributary and estuarine habitat; increases in the duration, frequency, and timing of floodplain inundation; increases in the frequency of meeting flow thresholds; and increases in the abundance indices of estuarine species. However, the benefits for 55 w/WSAs would be expected to be less than the 55 scenario as presented in Chapter 3 and closer to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. Since water supply adjustments could be modified after initial implementation, flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and such benefits would be more similar to those presented in Chapter 3.

13.5.3.1 Tributaries

For the results presented below, fall-run and spring-run results were differentiated only for tributaries for which spring run were evaluated; results for all other tributaries represent only fall-run results.

Spawning Habitat

Results for most tributaries show no difference in suitable spawning habitat area between the 55 w/WSAs scenario and baseline (Figure 13.5-1 and Table 13.5-2). The 55 w/WSAs scenario could result in reduced median spawning habitat on the Feather River, Sacramento River (spring-run), and Yuba River, but increased median spawning habitat in Stony Creek.



FR = fall-run; SR = spring-run.

Figure 13.5-1. Median (across All Years Modeled) Spawning Habitat (acres)

Table 13.5-2. Change in Median (across All Years Modeled) Spawning Habitat from Baseline

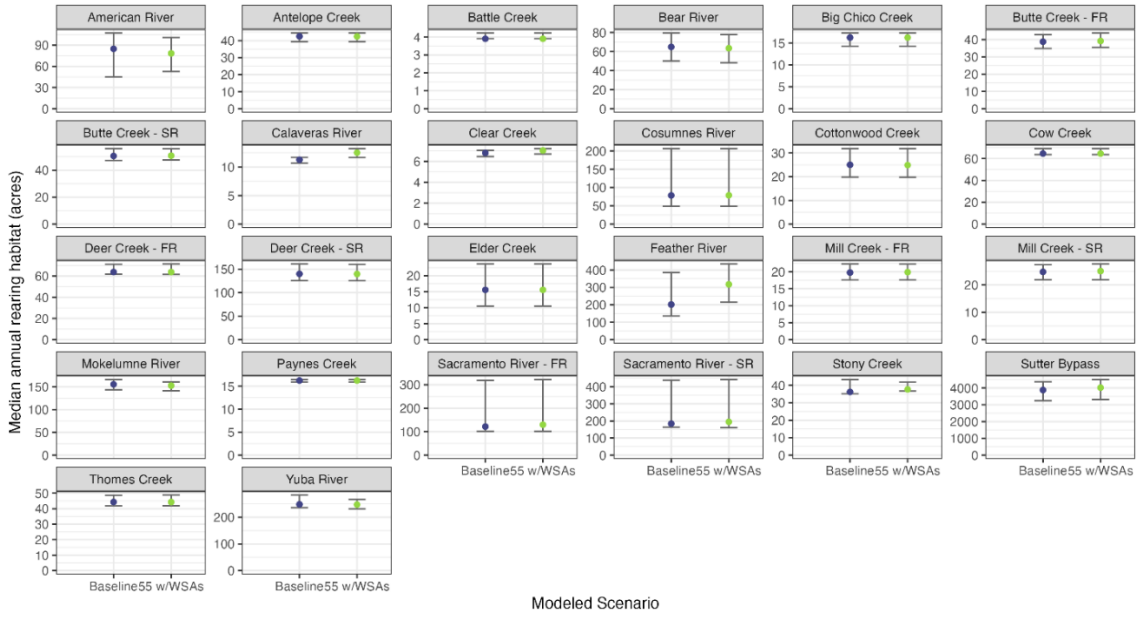
Watershed	55 w/WSAs
American River	0% (0)
Antelope Creek	0% (0)
Battle Creek	0% (0)
Bear River	0% (0)
Big Chico Creek	0% (0)
Butte Creek - FR	0% (0)
Butte Creek - SR	0% (0)
Calaveras River	0% (0)
Clear Creek	0% (0)
Cosumnes River	0% (0)
Cottonwood Creek	0% (0)
Cow Creek	0% (0)
Deer Creek - FR	0% (0)
Deer Creek - SR	0% (0)
Elder Creek	0% (0)
Feather River	-7% (-3)
Mill Creek - FR	0% (0)
Mill Creek - SR	0% (0)
Mokelumne River	0% (0)
Paynes Creek	0% (0)
Sacramento River - FR	0% (0)

Watershed	55 w/WSAs
Sacramento River - SR	-3% (-1)
Stony Creek	1% (0)
Thomes Creek	0% (0)
Yuba River	-3% (-3)

FR = fall-run; SR = spring-run.
Results are presented as percent change with the difference in acres in parentheses, both rounded to the nearest whole number.

Rearing Habitat

Results for most tributaries show no difference in suitable instream and floodplain rearing habitat area between the 55 w/WSAs scenario and baseline (Figure 13.5-2 and Table 13.5-3). The 55 w/WSAs scenario would be expected to result in increased rearing habitat on the Calaveras River, Clear Creek, Feather River, Stony Creek, and the Sutter Bypass, with the largest increase on the Feather River. The 55 w/WSAs scenario could result in decreased rearing habitat on the Bear River, Sacramento River (fall-run and spring-run), and Yuba River. Results for instream habitat alone can be found in Appendix H1c, *Beneficial Environmental Effects*.



FR = fall-run; SR = spring-run.

Figure 13.5-2. Median (across All Years Modeled) Rearing Habitat (acres)

Table 13.5-3. Change in Median (across All Years Modeled) Rearing Habitat from Baseline

Watershed	55 w/WSAs
American River	0% (0)
Antelope Creek	0% (0)
Battle Creek	0% (0)
Bear River	-1% (-1)
Big Chico Creek	0% (0)

Watershed	55 w/WSAs
Butte Creek - FR	0% (0)
Butte Creek - SR	0% (0)
Calaveras River	11% (1)
Clear Creek	3% (0)
Cosumnes River	0% (0)
Cottonwood Creek	0% (0)
Cow Creek	0% (0)
Deer Creek - FR	0% (0)
Deer Creek - SR	0% (0)
Elder Creek	0% (0)
Feather River	22% (42)
Mill Creek - FR	0% (0)
Mill Creek - SR	0% (0)
Mokelumne River	0% (0)
Paynes Creek	0% (0)
Sacramento River - FR	0% (-1)
Sacramento River - SR	-1% (-3)
Stony Creek	3% (1)
Sutter Bypass	2% (75)
Thomes Creek	0% (0)
Yuba River	-2% (-4)

FR = fall-run; SR = spring-run.
Results are presented as percent change with the difference in acres in parentheses, both rounded to the nearest whole number.

Floodplain Inundation

MFE results in Table 13.5-4 are presented for 25 percent of the doubling goal habitat area (or 25 percent of the maximum habitat area if no doubling goal was available). Results show that in most tributaries there are no differences between the 55 w/WSAs scenario and baseline. In some cases, the lack of a difference between the 55 w/WSAs scenario and baseline is due to the assumption that flows greater than a certain value do not create additional suitable floodplain rearing habitat area. This assumption is reflected in the flow-to-floodplain area curves used to perform the MFE analyses. Results are described in more detail below only for tributaries with notable results; full results (for all habitat area magnitudes) are available in Appendix H1c, *Beneficial Environmental Effects*.

The American River, Battle Creek, and Clear Creek MFE analysis indicates that there would be no MFEs (at any magnitude of floodplain area) for the baseline or 55 w/WSAs scenarios. MFEs may occur at magnitudes lower than 25 percent of the habitat area needed to support the doubling goal but are not evaluated in this analysis.

The Bear River MFE analysis indicates a higher frequency of MFEs (at all magnitudes) for the 55 w/WSAs scenario than the baseline scenario. The maximum flow for the flow-to-floodplain area relationship for the Bear River is about 5,500 cfs. Therefore, suitable floodplain area does not increase for flows greater than 5,500 cfs.

The Feather River MFE analysis indicates a higher frequency of a 288-acre magnitude MFE (25 percent of the habitat needed to support the doubling goal) in the 55 w/WSAs scenario, such that MFEs would be expected to occur in 46 percent of years in the baseline, and 62 percent of years under the 55 w/WSAs scenario. For MFEs of a greater habitat area magnitude, results show that there is little difference between baseline and the 55 w/WSAs scenario, although MFE occurrence is slightly lower for 55 w/WSAs than baseline at 576 acres (50 percent doubling goal habitat area).

The Mokelumne River MFE analysis generally indicates a higher frequency of MFEs (at all magnitudes) when comparing baseline and the 55 w/WSAs scenario with the greatest difference occurring at the 59-acre magnitude MFE (75 percent of the habitat needed to support the doubling goal). At the 20-acre magnitude (25 percent doubling goal habitat area), MFEs would be expected to occur in 49 percent of years under baseline, and 79 percent of years under the 55 w/WSAs scenario.

The Stony Creek MFE analysis indicates a slightly lower frequency of a 43-acre magnitude (25 percent of the habitat needed to support the doubling goal) MFE for the 55 w/WSAs scenario (12 percent of years) than the baseline (15 percent of years). For MFEs of greater magnitude, there is little difference between the scenarios.

The Sutter Bypass MFE analysis indicates an equally high frequency (94 percent of years) of a 5,000-acre magnitude MFE under the baseline and 55 w/WSAs scenario. For MFEs of a greater magnitude, there is little difference between the baseline and 55 w/WSAs scenario.

The Yuba River MFE analysis indicates an equally high frequency (68 percent of years) of a 77-acre magnitude MFE (25 percent of the habitat needed to support the doubling goal) under the baseline and 55 w/WSAs scenario. Among all magnitudes, there is little difference between the baseline and 55 w/WSAs.

Table 13.5-4. Percent of Years in Which Meaningful Floodplain Events Are Attained in Each Tributary for 25% of the Doubling Goal Habitat Area (or 25% of the Maximum Habitat Area if no Doubling Goal Was Available)

Watershed	Baseline	55 w/WSAs
American River	0%	0%
Antelope Creek	29%	29%
Battle Creek	0%	0%
Bear River	94%	95%
Big Chico Creek	2%	2%
Butte Creek - FR	98%	98%
Butte Creek - SR	98%	98%
Calaveras River	0%	0%
Clear Creek	0%	0%
Cosumnes River	76%	76%
Cottonwood Creek	40%	40%
Cow Creek	27%	27%
Deer Creek - FR	22%	22%
Deer Creek - SR	15%	15%
Elder Creek	57%	57%
Feather River	46%	62%

Watershed	Baseline	55 w/WSAs
Mill Creek - FR	0%	0%
Mill Creek - SR	4%	4%
Mokelumne River	49%	79%
Paynes Creek	36%	36%
Sacramento River - FR	19%	20%
Sacramento River - SR	46%	51%
Stony Creek	15%	12%
Sutter Bypass	94%	94%
Thomes Creek	23%	23%
Yuba River	68%	68%

FR = fall-run; SR = spring-run.

13.5.3.2 Bay-Delta

Estuarine Habitat

As presented in Figure 13.5-3, estuarine habitat area was first averaged within each water year across the designated months for each species and life stage (Section 5.3.5.3, *Species*, of the Scientific Basis Report Supplement) and is represented as the total acreage (left axis) and as the proportion of the total wetted area (right axis). Habitat areas for estuarine species generally would be expected to increase in the Bay-Delta under the 55 w/WSAs scenarios. Increases would be somewhat greater under the 55 w/WSAs w/40uf scenario, which includes additional Delta outflow from implementation of the Lower San Joaquin River flow objectives in the 2018 Bay-Delta Plan, compared to the 55 w/WSAs and the 55 w/WSAs w/Tuol, which includes the Tuolumne River HRL flows. However, increases for the 55 w/WSAs scenarios would be small relative to total region size. The most noticeable increases are for Delta smelt and longfin smelt juveniles in all water year types except wet years.

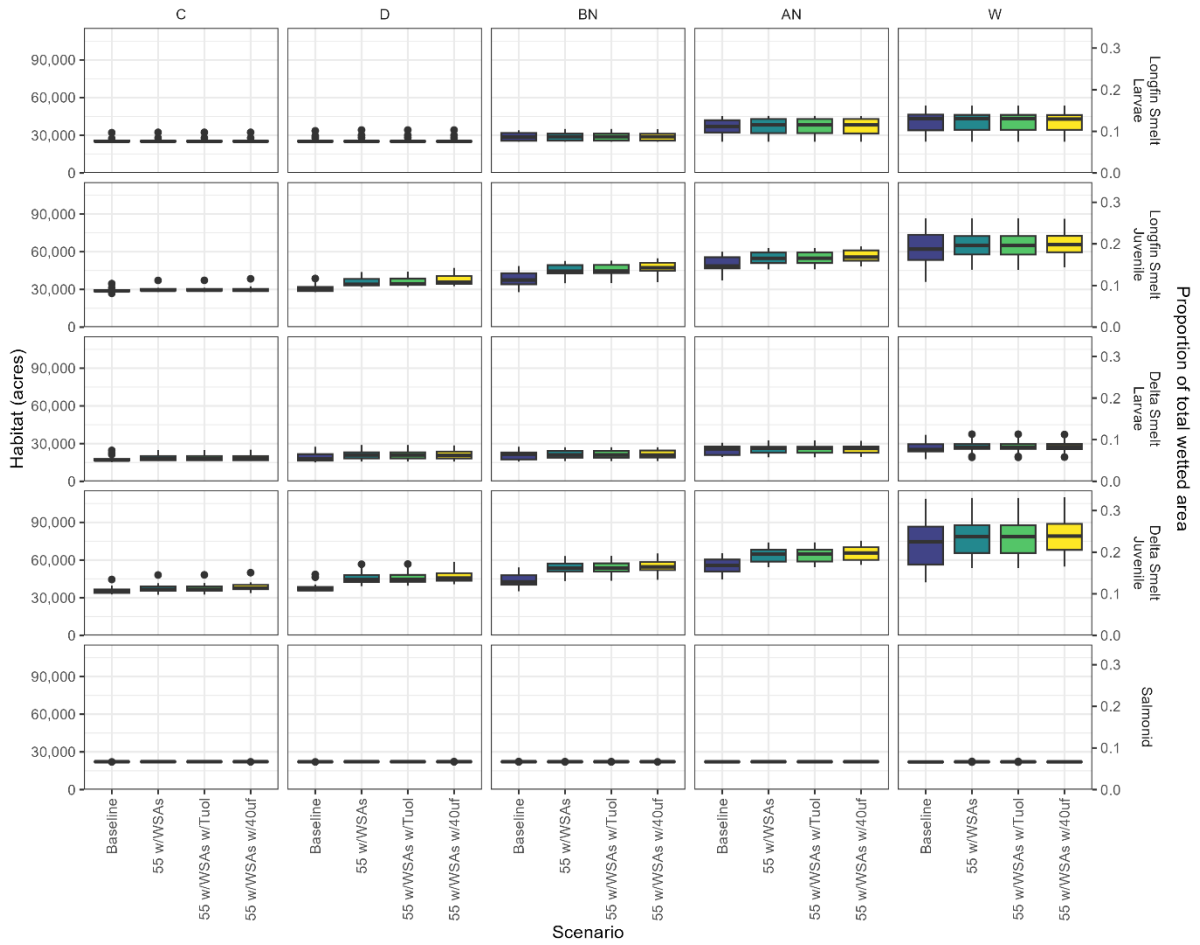


Figure 13.5-3. Total Suitable Estuarine Habitat Area Expected for Each Species, Scenario, and Water Year Type

Ecological Flow Thresholds

The frequency of achieving ecological flow thresholds generally would increase under the 55 w/WSAs scenarios compared to baseline, except for the Collinsville threshold, which would remain unchanged. The greatest increases occur for California bay shrimp and Delta smelt. The additional flow from the Tuolumne River HRL commitments ("55 w/WSAs w/Tuol") generally would not change the frequency of exceeding the ecological flow thresholds, except for a slight increase for California bay shrimp. Additional flow from the lower San Joaquin River flow objectives ("55 w/WSAs w/40uf") generally would result in a higher frequency of achieving ecological flow thresholds (Table 13.5-5). The frequencies of achieving ecological flow thresholds for the 35, 45, 55, and 65 scenarios are provided in Appendix H1c, *Beneficial Environmental Effects*.

Table 13.5-5. Frequency of Exceeding Ecological Flow Thresholds within the Seasons Specified in Table 13.5-1

Threshold (cfs)	MRDO[1]	Baseline	55 w/WSAs	55 w/WSAs w/Tuol[1]	55 w/WSAs w/40uf[1]
Georgiana Slough flow reversal low (17,000)		52%	59%		
Georgiana Slough flow reversal high (20,000)		44%	50%		
Fall run outmigration Rio Vista (20,000)		26%	31%		
Winter run outmigration Rio Vista (20,000)		57%	65%		
Late-fall and winter run outmigration Freeport (35,300)		28%	28%		
Fall, winter, and spring run outmigration Wilkins Slough (10,700)		29%	34%		
Fall, winter, and spring run fry presence (17,700)		51%	60%		
Fall, winter, and spring run fry abundance (26,500)		34%	37%		
Bay shrimp low (20,000)	0%	52%	64%	64%	71%
Bay shrimp high (25,000)	0%	43%	51%	52%	54%
Longfin smelt (43,000)	0%	30%	32%	32%	32%
Delta smelt (10,200)	0%	22%	32%	32%	35%
Sacramento splittail low (30,000)	0%	39%	45%	45%	48%
Sacramento splittail high (47,000)	0%	25%	27%	27%	28%
Starry flounder (21,000)	0%	45%	53%	53%	56%
Green and white sturgeon (37,000)	0%	16%	18%	18%	18%
Collinsville (7,100)	96%	99%	99%	99%	99%
Chipps Island (11,400)	11%	80%	87%	87%	89%
Port Chicago (29,200)	0%	40%	45%	45%	45%

cfs = cubic feet per second; MRDO = Minimum Required Delta Outflow.
[1] Flows for the MRDO, 55 w/WSAs w/Tuol, and 55 w/WSAs w/40uf scenarios are only available for Delta Outflow and therefore results for these scenarios are only available for the flow thresholds based on Delta outflow.

Abundance Indices

Under the regulatory pathway, the abundance indices of the four estuarine species are expected to increase in all water year types. In Figure 13.5-4, the percent change from baseline is on the y-axis and the median predictions (rounded to a whole number) are printed above each point. Compared to the baseline, the greatest benefits are expected for longfin smelt and Sacramento splittail under the regulatory pathway. In addition, the regulatory pathway is expected to yield the greatest benefits in dry years, and under the "55 w/WSAs w/40uf" scenario. The "55 w/WSAs w/Tuol" scenario could result in slightly higher increases in abundance indices for some species and some water year types than 55 w/WSAs.

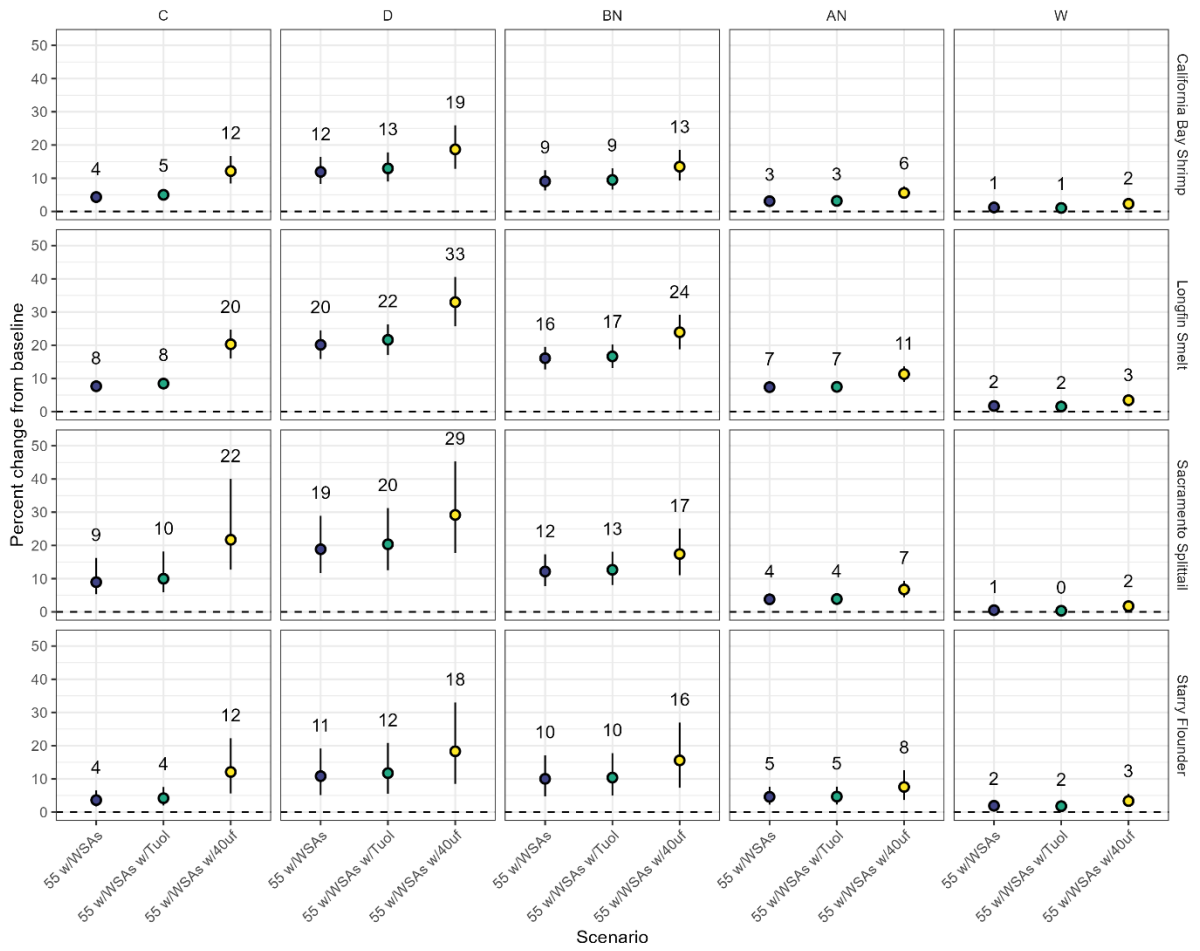


Figure 13.5-4. Potential Percent Increase (Median Prediction ± 95% Confidence Intervals) in Abundance Indices Relative to Baseline

13.5.4 Voluntary Agreement Pathway

For the VA pathway, analyses focused on the VA tributaries with the largest HRL habitat commitments: the American, Feather, Mokelumne, Sacramento, and Yuba Rivers. Results are only presented for those tributaries. The quantitative analyses described below indicate expected increases in suitable spawning and rearing habitat for salmonids and increases in suitable habitat and population abundance indices for estuarine species. Fall and spring run Chinook salmon spawning (Figure 13.5-5 and Table 13.5-6), instream rearing (Figure 13.5-6 and Table 13.5-7), and floodplain (Table 13.5-7) habitats are expected to contribute toward the narrative objectives for salmon protection and fish viability. However, the magnitude of increase would vary with water year type and tributary such that not all habitat categories would increase in all water year types or in all tributaries.

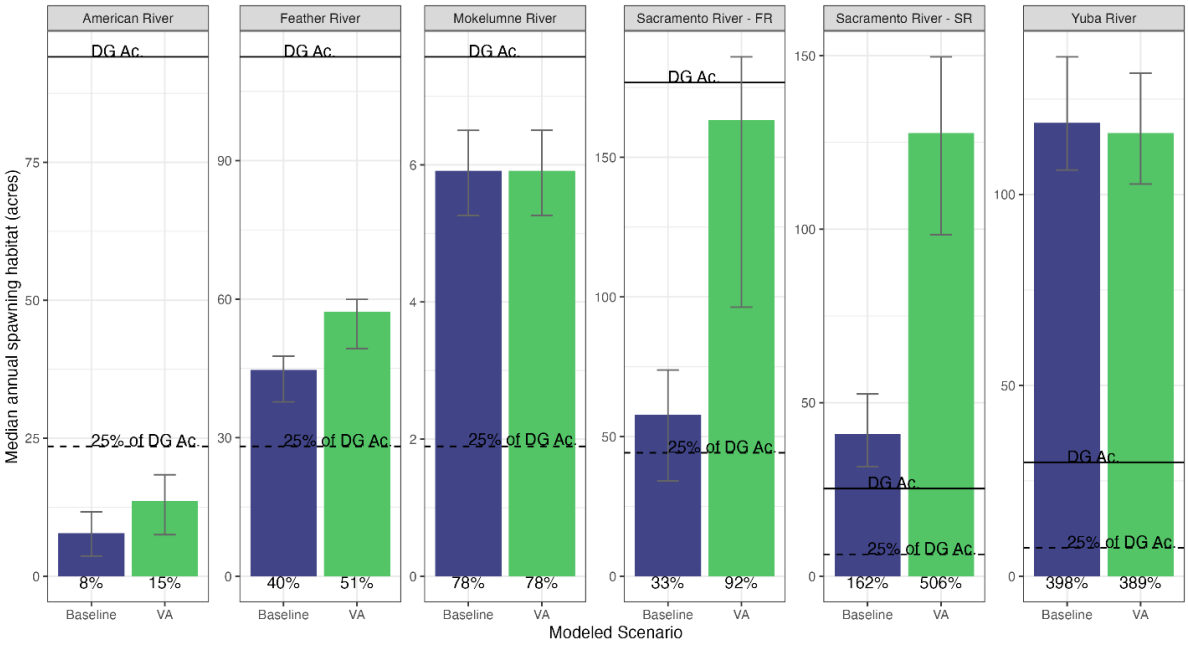
13.5.4.1 Tributaries

In the analyses presented below, fall-run and spring-run results were differentiated only for tributaries for which spring-run were evaluated; results for all other tributaries represent only fall-

run results. For the graphs, solid lines represent area of habitat required to support the doubling goal population, and dashed lines represent 25 percent of the doubling goal area. The amount of habitat as a percentage of the habitat needed to support the doubling goal is printed below each bar. Medians and quantiles were calculated across all years; therefore, the quantiles represent expected year-to-year variability, not the full uncertainty in expected outcomes.

Spawning Habitat

Under the VA pathway, all tributaries except the American River are expected to surpass the spawning habitat target threshold of 25 percent of doubling goal habitat area (the target of the HRL). However, under baseline, these tributaries were already meeting that target, with the Sacramento (for spring-run) and Yuba Rivers already surpassing the full (100 percent) doubling goal habitat area. Spawning habitat on the American River could reach 15 percent of the doubling goal habitat area under the VA pathway. The largest increase in median spawning habitat from baseline could occur in the Sacramento River for spring-run and fall-run (Figure 13.5-5 and Table 13.5-6). Results for the Yuba River show a slight decrease in spawning habitat due to slightly higher temperatures in October as a result of the lower carryover storage target in the Yuba River HRL compared to baseline. More information on the temperature results is available in Section 13.7.6.2, *Aquatic Biological Resources*.



FR = fall-run; SR = spring-run.

Figure 13.5-5. Median (across All Years Modeled) Spawning Habitat (acres)

Table 13.5-6. Spawning Habitat Results Compared to the HRL Habitat Commitments and the Habitat Required to Support 25 Percent of the Doubling Goal

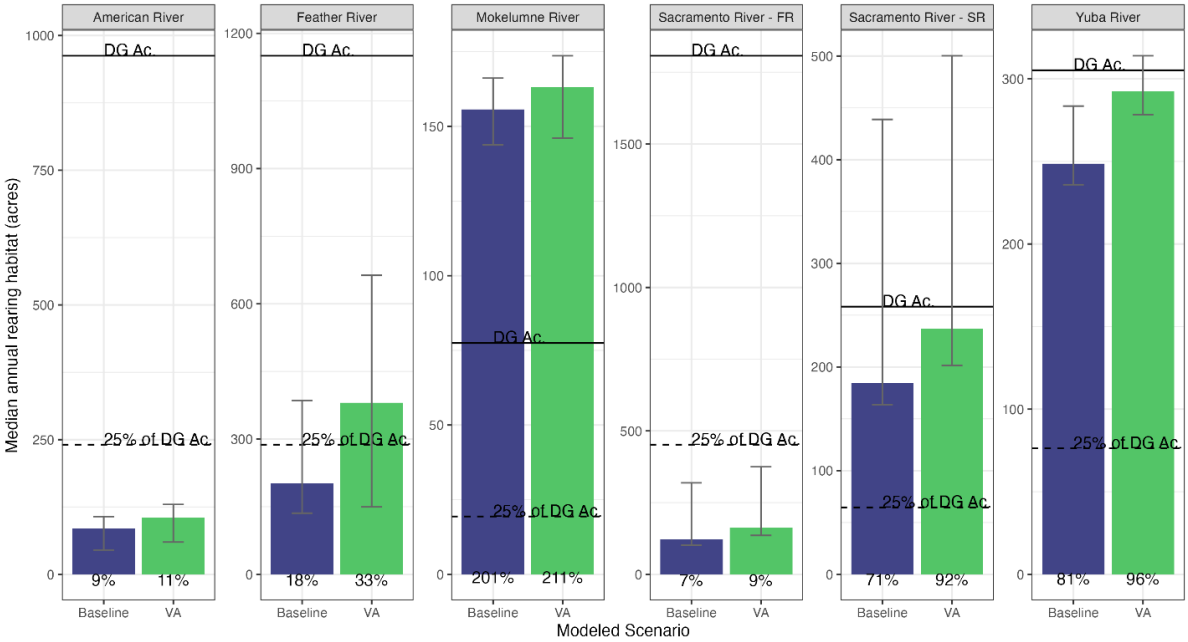
Watershed	Committed Acres	Acres to support 25% of doubling goal	Median Acres Baseline	Acres added by HRL	Median Total Acres with HRL
American River	25	23.5	7.78	5.89	13.67
Feather River	15	28	44.65	12.66	57.31
Mokelumne River	0	2	5.92	0	5.92
Sacramento River - FR	113.5	44.25	57.71	105.71	163.42
Sacramento River - SR	113.5	6.25	40.9	86.77	127.67
Yuba River	0	7.5	118.77	-2.69	116.08

FR = fall-run; SR = spring-run.

Rearing Habitat

For total rearing habitat (instream and floodplain), the Feather River, Mokelumne River, Sacramento River (spring-run) and Yuba River are expected to surpass 25 percent of the rearing doubling goal habitat area (the target of the HRL) under the VA pathway. The American River and Sacramento River (fall-run) would reach 11 and 9 percent of the doubling goal habitat area in the VA scenario, respectively. Under baseline the Mokelumne River, Sacramento River (spring-run), and Yuba River were already meeting the 25 percent of doubling goal rearing habitat area target, with the Mokelumne River already surpassing the full (100 percent) doubling goal habitat area. Under the VA scenario, the largest increase in median rearing habitat from baseline was in the Feather River (Figure 13.5-6 and Table 13.5-7). Results for instream habitat alone can be found in Appendix H1c, *Beneficial Environmental Effects*.

The Sacramento and Feather River VA scenario results do not include the 20,000 acres of valley floor floodplain restoration that may be available as rearing habitat for fish from the Feather and Sacramento Rivers or in the Delta since that habitat could not be represented and modeled in the same manner as the tributary habitat. Sacramento River rearing habitat under the VA pathway would be expected to surpass the habitat needed to support 25 percent of the doubling goal population with the addition of 20,000 acres of floodplain enhancement on the Sutter Bypass and Sacramento River, provided that juvenile fish passage can be provided.



FR = fall-run; SR = spring-run.

Figure 13.5-6. Median (across All Years Modeled) Rearing Habitat (acres)

Table 13.5-7. Rearing Habitat (Combined In-Channel and Floodplain) Results Compared to the HRL Habitat Commitments and the Habitat Required to Support 25 Percent of the Doubling Goal

Watershed	Committed Acres	Acres to support 25% of doubling goal	Median Acres Baseline	Acres added by HRL	Median Total Acres with HRL	MFE Baseline	MFE HRL
American River	75	240.5	84.85	20.68	105.53		
Feather River	1,660.25	287.5	201.66	178.98	380.64	46%	63%
Mokelumne River	26	19.25	155.69	7.4	163.09	49%	52%
Sacramento River – FR	137.5	452	121.82	40.41	162.23		
Sacramento River – SR	137.5	64.5	184.26	52.69	236.95		
Yuba River	150	76.25	248.51	43.94	292.45	68%	69%

FR = fall-run; SR = spring-run.
Meaningful floodplain event (MFE) results represent the expected percent of years with floodplain events that would support salmonid rearing for 25% of the doubling goal habitat area. MFE results are only presented for tributaries with HRL floodplain habitat commitments.

Floodplain Inundation

Floodplain inundation results for the VA pathway are only provided for tributaries with HRL floodplain habitat commitments: the Feather, Mokelumne and Yuba Rivers. For the MFE analysis, floodplain habitat is expected to be provided to support 25 percent of the doubling goal population in 52–69 percent of years in each of the Feather (63 percent), Mokelumne (52 percent), and Yuba (69 percent) Rivers (Table 13.5-7) under the VA pathway. Full results for all habitat area

magnitudes are available in Appendix H1c, *Beneficial Environmental Effects*, and are described briefly below.

The Feather River MFE analysis indicates a higher frequency of all magnitude MFEs in the VA scenario relative to baseline. However, MFEs are not expected to occur in any years based on the 2 out of every 3 year recurrence criterion for the 1,151-acre magnitude MFE (100 percent of doubling goal habitat area). The VA scenario had the greatest increase over baseline for the 576-acre magnitude MFE (50 percent of doubling goal habitat area).

The Mokelumne River MFE analysis indicates a higher frequency of all magnitude MFEs in the VA scenario relative to baseline, with the increase in MFE occurrence becoming proportionally larger with larger magnitude MFEs.

The Yuba River MFE analysis indicates a higher frequency of all magnitude MFEs in the VA scenario relative to baseline. The VA scenario had the greatest increase over baseline for the 153-acre magnitude MFE (50 percent of doubling goal habitat area) and increases were minimal for the other magnitudes.

Other HRL Tributaries

HRL commitments for Putah Creek, the Bear and Yuba Rivers and Auburn Ravine (Nevada Irrigation District [NID]), and the Bear River (South Sutter Water District [SSWD]) were not included in the quantitative analyses but would be expected to provide benefits to native fishes to contribute toward the narrative objectives.

As described in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, the Scientific Basis Reports, and above in Section 13.5.2.3, *Flow Threshold Analysis*, increased flow is expected to result in increased salmonid survival and outmigration. Studies on the Sacramento River and other large Central Valley rivers have found that altered flow regimes have contributed to reduced spring outmigration survival of juvenile salmon (Notch et al. 2020). These studies have found that flow is the most important covariate in predicting outmigration success (Michel et al. 2015; Notch et al. 2020), and Chinook smolt survival increases with flow (Michel et al. 2021). Flow pulses can trigger outmigration cues and aid juvenile outmigration from upper reaches of tributaries toward the Delta to increase systemwide longitudinal connectivity to the benefit of both juvenile and adult life stages of native fishes. In Putah Creek, Bear River, and Auburn Ravine, additional flow during the juvenile outmigration period will likely yield some survival benefits. In the Auburn Ravine, additional flow may offer increased protection from unscreened diversions by moving fish through the system faster and reducing the proportion of streamflow being diverted. On Putah Creek, increased flows in the fall could help attract fall run salmon into Putah Creek and potentially also increase connectivity within Putah Creek by improving some of the flow related fish passage issues. Similarly, increased spring flows could facilitate juvenile salmon emigration and aid in the passage issues that juvenile salmon experience at Los Rios Check Dam once the flash boards are installed in the spring. Flow contributions on Putah Creek could increase these benefits provided that contaminant issues are not carried over from Cache Creek to Putah Creek.

The NID and SSWD HRL commitments include funding for screening of water diversions. Unscreened water diversions have the potential to entrain juvenile fishes, which can either be killed or injured by the pump or transported to an alternate water body where their survival is greatly diminished (Poletto et al. 2015). In many northern California tributaries, unscreened diversions should be considered a limiting factor for native fishes (^NMFS 2019 BiOp). The 2017 Scientific

Basis Report found that mortality via unscreened diversions is a primary source of direct take of native fish species. Adding fish protective screens to unscreened diversions is a means of incrementally increasing survival without physically restoring additional habitat acres. The benefits of both flow and non-flow HRL actions could be further increased with the addition of fish screening devices at currently unscreened diversions.

13.5.4.2 Bay-Delta

Estuarine Habitat

As presented in Figure 13.5-7, estuarine habitat area was first averaged within each water year across the designated months for each species and life stage (Section 5.3.5.3 of the Scientific Basis Report Supplement) and is represented as the total acreage (left axis) and as the proportion of the total wetted area (right axis). Habitat areas for estuarine species generally are expected to increase in the Bay-Delta under the VA pathway. However, increases would be small relative to total region size. The most noticeable increases occur for Delta smelt and longfin smelt juveniles in all water year types except wet years.

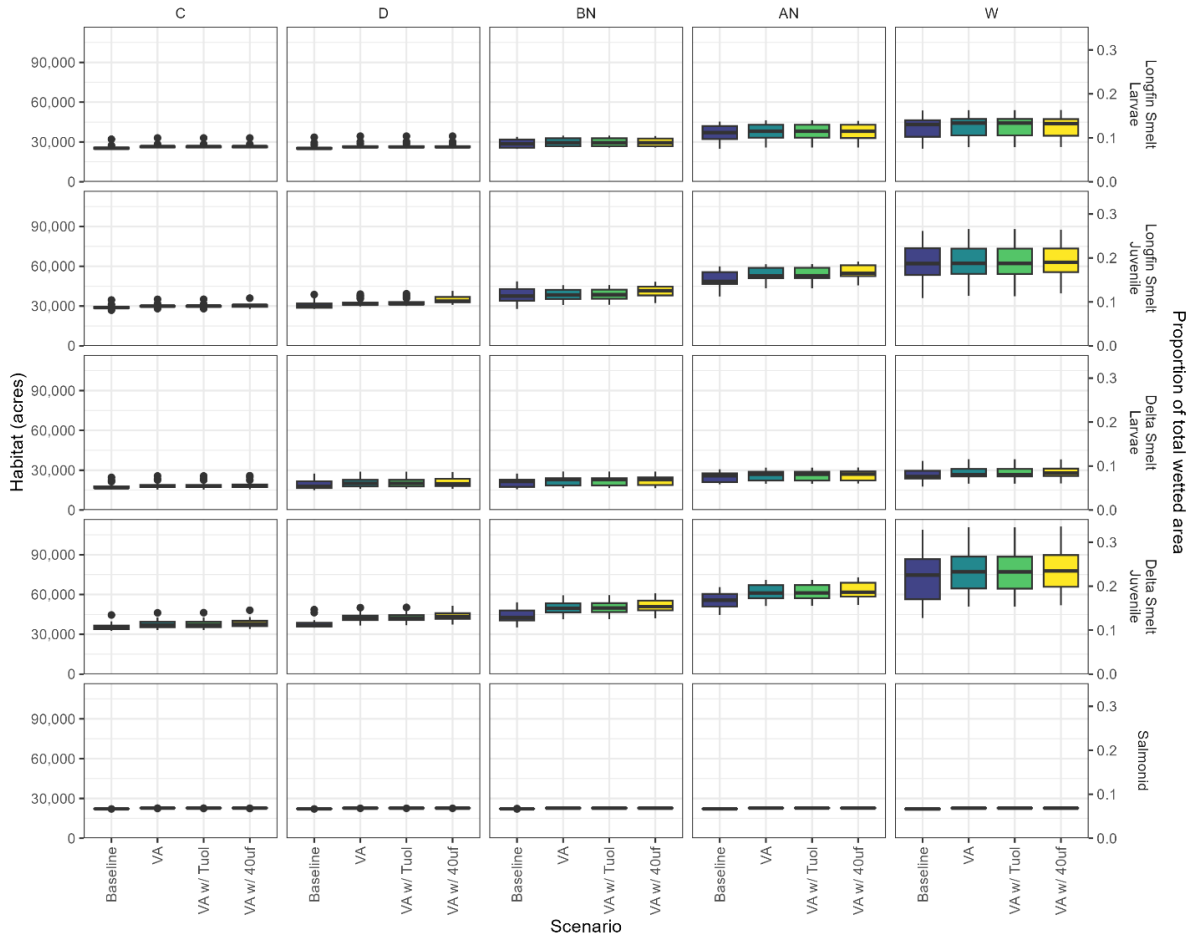


Figure 13.5-7. Total Suitable Estuarine Habitat Area Expected for Each Species, Scenario, and Water Year Type

Ecological Flow Thresholds

The frequency of achieving ecological flow thresholds would generally remain unchanged or increase under the VA pathway, although there could be a slight decrease for longfin smelt. The greatest increase could occur at Chipps Island. Results show that the additional flow from a potential Tuolumne River HRL ("VA w/Tuol") would not change the frequency of exceeding the ecological flow thresholds. Additional flow from the lower San Joaquin River flow objectives ("VA w/40uf") generally would result in a higher frequency of achieving ecological flow thresholds (Table 13.5-8).

Table 13.5-8. Frequency of Exceeding Ecological Flow Thresholds within the Seasons Specified in Table 13.5-1

Threshold (cfs)	MRDO[1]	Baseline	VA	VA w/Tuol[1]	VA w/40uf[1]
Georgiana Slough flow reversal low (17,000)		52%	54%		
Georgiana Slough flow reversal high (20,000)		44%	45%		
Fall run outmigration Rio Vista (20,000)		26%	26%		
Winter run outmigration Rio Vista (20,000)		57%	59%		
Late-fall and winter run outmigration Freeport (35,300)		28%	28%		
Fall, winter, and spring run outmigration Wilkins Slough (10,700)		29%	29%		
Fall, winter, and spring run fry presence (17,700)		51%	52%		
Fall, winter, and spring run fry abundance (26,500)		34%	35%		
Bay shrimp low (20,000)	0%	52%	53%	53%	63%
Bay shrimp high (25,000)	0%	43%	45%	45%	46%
Longfin smelt (43,000)	0%	30%	29%	29%	30%
Delta smelt (10,200)	0%	22%	22%	22%	24%
Sacramento splittail low (30,000)	0%	39%	39%	39%	44%
Sacramento splittail high (47,000)	0%	25%	25%	25%	27%
Starry flounder (21,000)	0%	45%	47%	47%	47%
Green and white sturgeon (37,000)	0%	16%	16%	16%	16%
Collinsville (7,100)	96%	99%	99%	99%	99%
Chipps Island (11,400)	11%	80%	86%	86%	88%
Port Chicago (29,200)	0%	40%	42%	42%	42%

MRDO = Minimum Required Delta Outflow.
[1] Flows for the MRDO, VA w/Tuol, and VA w/40uf scenarios are only available for Delta Outflow and therefore results for these scenarios are only available for the flow thresholds based on Delta outflow.

Abundance Indices

Under the VA pathway, the abundance indices of the four estuarine species are expected to increase in all water year types except wet years, in which they are expected to decrease. In Figure 13.5-8, the percent change from baseline is presented on the y-axis, with median predictions (rounded to a whole number) printed above each point. Compared to the baseline, the greatest benefits could be realized for longfin smelt and Sacramento splittail, in dry years, and under the "VA w/40uf"

scenario. Results show that the addition of the Tuolumne River HRL flows results in slightly higher increases in abundance indices for the "VA w/Tuol" scenario than the VA scenario.

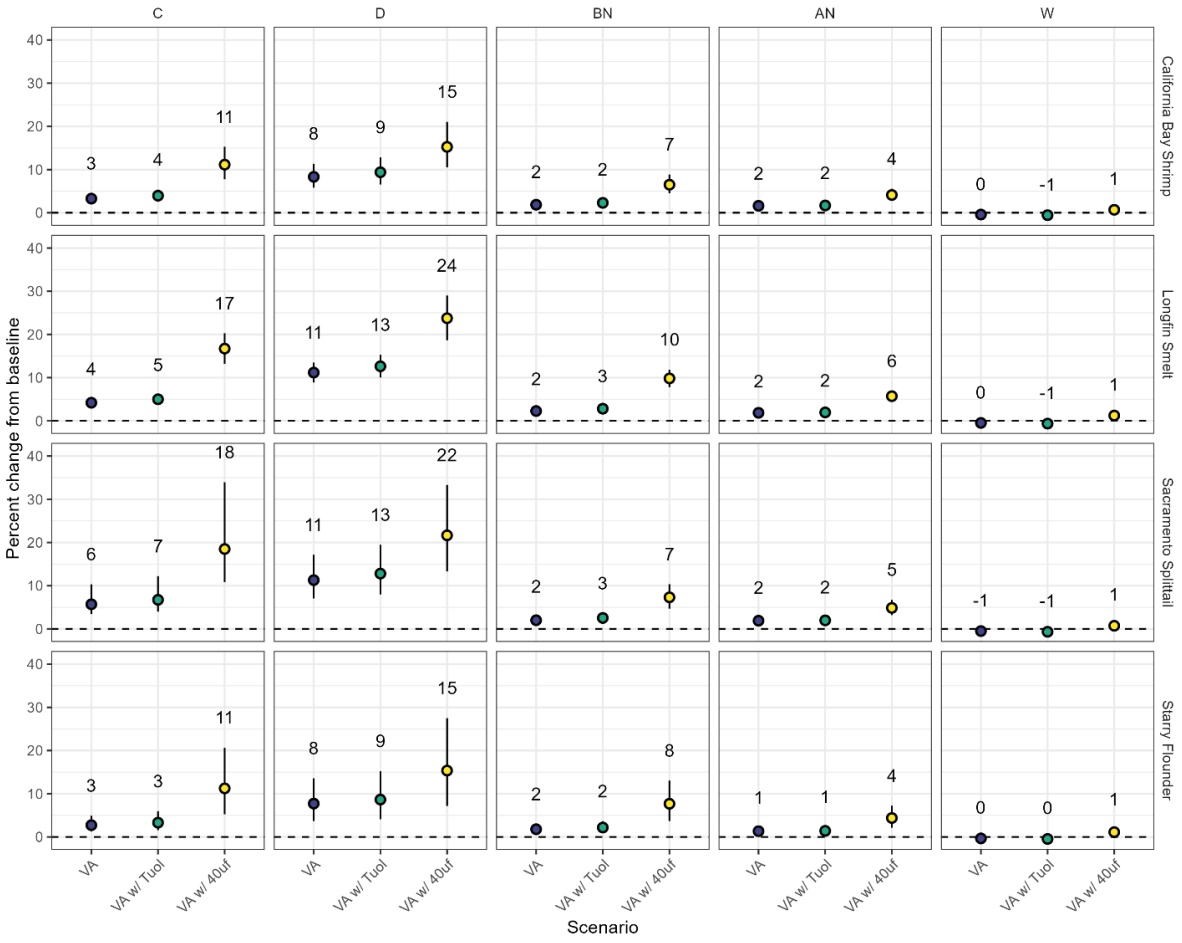


Figure 13.5-8. Potential Percent Increase (Median Prediction ± 95% Confidence Intervals) in Abundance Indices Relative to Baseline

13.5.5 Range of Possible Benefits

Other projects have the potential to increase or decrease flows with resulting effects on the benefits evaluated in this section. Possible flows from the lower San Joaquin River watershed that could result from implementation of the Tuolumne River HRL commitments or the Lower San Joaquin River flow objectives in the 2018 Bay-Delta Plan were evaluated above in the "w/Tuol" and "w/40uf" scenarios, respectively. The flows (and thus the associated benefits) resulting from the Tuolumne HRL commitments could be lower than represented above and closer to the results for 55 w/WSAs or VA scenario if only one Tuolumne HRL pulse flow is protected as outflow since the "w/Tuol" scenarios assume two pulses would be protected. Table 13.4-53 presents the changes in outflow that could result from protection of one or two pulses from the Tuolumne HRL. The greatest reduction in benefits from protecting one Tuolumne HRL flow pulse rather than two pulses would occur in dry and below normal years. The effects of other possible projects were not quantitatively evaluated in the benefits analysis but are described qualitatively below.

There are currently numerous infrastructure project proposals involving new or modified water diversions in the Sacramento/Delta watershed. The SacWAM modeling of the 55 w/WSAs and VA scenarios included unprotected flows that could be diverted in the future by these proposed projects. However, any new water supply projects would be subject to the regulatory pathway without water supply adjustments unless future modifications to the Plan are approved as part of periodic review based on any necessary supporting environmental and scientific documentation. In addition, the revised proposed Plan amendments direct the State Water Board to consider imposing requirements on new water supply projects to ensure that future authorizations for the diversion and use of water are consistent with and support the salmon protection, fish viability, inflow, inflow-based Delta outflow, and interior Delta flow objectives of the Bay-Delta Plan. These provisions are described in more detail in Sections 13.3.3.2, *Sacramento/Delta Tributary Inflows*, 13.3.4.1, *Description of the Voluntary Agreement Pathway*, and 13.3.4.2, *Protection of Base Flows and LTO Balancing Provision*. Thus, if application of water supply adjustments or the VA pathway to new water supply projects could result in conditions outside of the bounds of the scientific and environmental analysis in this Staff Report, subsequent supplemental analysis would be provided.

As described in Sections 13.1.1, *2025 Record of Decision and 2025 Incidental Take Permit,* and 13.4, *Changes in Hydrology and Water Supply,* recent changes to CVP and SWP operations could affect Delta outflows used as the basis for the results presented above. Generally, some increases in Delta outflows are expected in January through June, while outflows are expected to decrease substantially in wetter year types during July through December, particularly in above normal (AN) years. However, the LTO baseflow balancing provision is expected to prevent effects on Delta outflows under the VA pathway. In addition, during annual and periodic reviews, the State Water Board would assess needed changes to the Bay-Delta Plan or its implementation to provide for the reasonable protection of beneficial uses and could consider changes to the Plan or its implementation if needed to provide for the reasonable protection of beneficial uses, including related to the effects of the 2025 ROD/ITP or future changes.

Section 13.7.21, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes,* discusses the degree to which new projects could affect Delta outflows, which could in turn affect the benefits assumed in this section, depending on how any new projects are approved and whether they are approved and operational during the term of the VA pathway. If implemented, these projects would be expected to reduce the benefits shown for the 55 w/WSAs scenario; the 45, 55, and 65 scenarios that could potentially be implemented and are analyzed in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*; and the VA pathway. A higher proportion of Delta outflow is unprotected in wetter years, and these projects, as proposed, would generally reduce Delta outflow the most in wetter year types. However, benefits of the regulatory and VA pathway presented above are generally higher in dryer and intermediate year types. Therefore, reductions in Delta outflows in wetter conditions would be expected to have less of an effect on the benefits than reductions in Delta outflow in intermediate or dryer conditions. The extent to which new projects could affect the benefits would depend on the constraints imposed on those projects and the resulting levels of increased diversions and decreased Delta outflows. Section 5.2.3, *Discussion*, and Section 5.3.3.2, *Benefits of Increased Delta Outflow*, of the 2017 Scientific Basis Report (Appendix B, *Scientific Basis Report in Support of New and Modified Requirements for Inflows from the Sacramento River and its Tributaries and Eastside Tributaries to the Delta, Delta Outflows, Cold Water Habitat, and Interior Delta Flows (2017)*) present expected benefits of the flow scenarios based on Delta inflow and Delta outflow levels that do not include other unprotected flows and thus provide an informative bookend of the possible benefits under scenarios of increased diversions. In

addition, the flow threshold analyses above and Chapter 3 of the Staff Report evaluate the environmental conditions under the minimum required Delta outflows (MRDO). However, conditions imposed on new projects consistent with the provisions described above and in Section 13.3.3.2, *Sacramento/Delta Tributary Inflows,* and Section 13.3.4.2, *Protection of Base Flows and LTO Balancing Provision,* would prevent Delta outflow levels from being reduced to levels close to MRDO.

13.6 Public Trust and Water Code Section 13241 Analyses

13.6.1 Public Trust Analysis

The State Water Board "has an affirmative duty to take the public trust into account in planning and allocation of water resources, and to protect public trust uses whenever feasible." (*National Audubon Society v. Superior Ct.* (1983) 33 Cal.3d 419, 446.) As recognized by the California legislature through its enactment of the Delta Reform Act of 2009, the public trust doctrine is of particular importance and relevance to the state's policy surrounding water quality in the Bay-Delta. (Wat. Code, § 85023.) The public trust doctrine, however, does not create an affirmative duty to protect public trust uses in a particular manner; it requires balancing competing uses and instituting protective measures where feasible. (*Center for Biological Diversity, Inc. v. FPL Group, Inc.* (2008) 166 Cal.App.4th 1349, 1369.) In determining whether it is "feasible" to protect public trust values like fish and wildlife in a particular instance, the State Water Board must determine whether protection of public trust values and the degree of protection to be provided are "consistent with the public interest." (*State Water Resources Control Bd. Cases* (2006) 136 Cal.App.4th 674, 778.) To do this, the State Water Board must balance "competing interests in adopting water quality objectives and formulating a program of implementation to achieve those water quality objectives." (*Ibid.*) Neither a precise quantification of potential water uses and impacts on those uses nor an explicit cost-benefit analysis is required to meet the State Water Board's water quality planning obligations. (*United States v. State Water Resources Control Bd.* (1986) 182 Cal.App.3d 82, 118-119.)

Under the Porter-Cologne Act, water quality objectives are established to ensure the reasonable protection of beneficial uses and prevention of nuisance, in consideration of various factors including past, present, and probable future beneficial uses of water. (Wat. Code, § 13241.) The determination of reasonable protection of fish and wildlife uses shares the same goals and is a similar exercise to public trust balancing. As acknowledged in prior orders issued by the State Water Board, the Porter-Cologne Act is a codification of the State Water Boards' public trust duty regarding water quality. (See e.g., State Water Board Order WQ 2023-0081, at p. 35; *cf*. State Water Board Order WRO 2002-0013, at p. 20, fn. 5 [noting that Water Code section 1736, which requires the State Water Board find that a water transfer would not unreasonably affect fish, wildlife, and other instream beneficial uses before approving such a transfer, effectively codifies the State Water Board's duty to consider public trust uses].)

In the context of water quality control planning, the public trust doctrine is also closely linked to California Fish and Game Code section 5937. Section 5937 has long been recognized as a legislative expression of the public trust doctrine, requiring that "[t]he owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around, or through the dam to keep in good condition any fish that may be planted or exist below the dam." (*California Trout, Inc. v. State Water Resources Control Bd.* (1989) 207 Cal.App.3d 585, 626; Wat. Code, § 5937.) Thus, Fish and Game Code section 5937 must also be taken into consideration when the State Water Board determines how best to protect public trust uses to the extent feasible.

Throughout the environmental review and water quality control planning processes, the State Water Board has conducted detailed analyses to examine the benefits and potential impacts on different water uses and resources associated with different project alternatives:

- Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*; Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*; Sections 7.6.2, 9.7.6.2, and 13.7.6.2, each titled *Aquatic Biological Resources*; and Section 13.5, *Beneficial Environmental Effects*, present and evaluate information relevant to the reasonable protection of fish and wildlife beneficial uses. Modeling results of water temperatures and associated effects on fish in several tributaries are provided in Appendix A6, *Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, and American Rivers*; Appendix G3e, *Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, and American Rivers for the Proposed Voluntary Agreements*; Appendix H1b, *Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, American, and Yuba Rivers*; and Appendix H1a1, *Assessment of Effect of Reservoir Storage on Reservoir Release Temperatures*, and Section H1a6.6, *Changes in Water Temperature*, of Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*. Modeling results for floodplain habitat are provided in Appendix A8, *Salmonid Tributary Habitat Analysis*, Appendix H1c, *Beneficial Environmental Effects*, and Appendix G2, *Final Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan*.
- Chapter 2, *Hydrology and Water Supply*; Chapter 6, Section 9.5, and Section 13.4, each titled *Changes in Hydrology and Water Supply*; and Sections 7.12.1, 9.7.12.1, and 13.7.12.1, each titled *Surface Water*, discuss changes in water supply and hydrology, as well as potential impacts on surface water resources and the associated mitigation measures to avoid or reduce those potential impacts. Section 7.20, Section 9.7.20, and Section 13.7.20, each titled *Utilities and Service Systems*, contain analysis on municipal water supply effects associated with the various alternatives analyzed in this Staff Report. A description of other water management actions by water users who may experience reductions in Sacramento/Delta supplies under the Bay-Delta Plan, such as increased use of recycled water and conservation measures, is provided in Section 6.6, *Other Water Management Actions*. Section 7.22, *New or Modified Facilities*, addresses actions that entities may take that would involve construction to modify or build new facilities and infrastructure to supplement or conserve surface water supplies and other construction projects that may result from the Sacramento/Delta update to the Bay-Delta Plan, including desalination plants. Sections 7.8, 9.7.8, and 13.7.8, each titled *Energy*, discuss potential impacts on hydropower generation that may result from changes in hydrology or water supply and identify mitigation measures to avoid or reduce those potential impacts. Modeling results of surface water conditions related to streamflow are provided in Appendix A1, *Sacramento Water Allocation Model Methods and Results*; Appendix H1a, *Sacramento Water Allocation Model Methods*; and Appendix G3a, *Sacramento Water Allocation Model Methods and Results for the Proposed Voluntary Agreements*.
- Sections 7.12.2, 9.7.12.2, and 13.7.12.2, each titled *Hydrology and Water Quality – Groundwater*, contain evaluations of potential impacts on groundwater resources and detail associated mitigation measures to avoid or reduce those potential impacts.
- Sections 7.4, 9.7.4, and 13.7.4, each titled *Agriculture and Forest Resources*, as well as Chapter 8, Section 9.8, and Section 13.8, each titled *Economic Analysis and Other Considerations*, address economic considerations. Economic modeling results are provided in Appendix A3, *Agricultural*

Economic Analysis: SWAP Methodology and Modeling Results; Appendix A4, *Regional Economic Analysis Modeling Procedure*; and Appendix G3c, *Economic Considerations for the Proposed Voluntary Agreements*.

- Sections 7.18, 9.7.18, and 13.7.18, each titled *Recreation,* discuss potential impacts on recreation resources that may result from changes in hydrology or water supply and identify mitigation measures to avoid or reduce those potential impacts.

Informed by the analyses listed above, the State Water Board has formulated revised proposed Plan amendments that are intended to balance public trust uses and other competing uses. The revised proposed Plan amendments include new narrative water quality objectives for the reasonable protection of fish and wildlife beneficial uses, which are described in detail in Section 13.3.2, *Water Quality Objectives for Fish and Wildlife Uses*. The program of implementation contains two pathways for achieving the new narrative water quality objectives: a VA pathway that would allow for implementation of HRL commitments in lieu of implementing other provisions for tributary inflow, cold water habitat, and inflow-based Delta outflows; and a regulatory pathway that would apply to water rights not included in the VA pathway and would also apply to HRL water rights no longer covered under the VA pathway. Both pathways would have regulatory effect upon adoption of Plan amendments.

Under the regulatory pathway, flow requirements would be implemented through a water right curtailment system informed by an implementation methodology and would provide benefits to native fish and wildlife and other public trust resources. As discussed in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, a percent of unimpaired flow requirement in the range of 45 percent and 65 percent, with a starting point of 55 percent, would provide a flow regime that supports a connected and functioning ecosystem linking and integrating tributary inflow, cold water habitat, Delta outflow, and interior Delta flow measures with physical habitat restoration and other complementary ecosystem measures. As discussed in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, inflows of 55 percent of unimpaired flow would be expected to provide considerable improvements in protection of fish and wildlife beneficial uses, including achievement of flow thresholds associated with protection of aquatic species and achievement of sufficient floodplain inundation acreage. These benefits are expected to increase at 65 percent of unimpaired flow but are also associated with issues conserving sufficient cold water resources in storage and water supply concerns. At 45 percent of unimpaired flow, benefits to fish and wildlife would still be expected, but would be lower unless paired with complementary ecosystem actions. The proposed Plan amendments described in the 2023 draft Staff Report would allow for lower flows in cases in which local cooperative solutions are implemented, including flow and nonflow actions, or if the State Water Board determined that lower flows were needed to meet the narrative objective (e.g., to preserve reservoir storage supplies to maintain water quality and temperature conditions later in the same year.) The narrative cold water habitat objective would require reservoirs to be operated in a manner that provides cold water flows or that alternate protective measures be provided to ensure that fish below dams are kept in good condition.

In response to numerous public comments received expressing concern over water supply and reservoir storage impacts that would accompany the unimpaired flow requirement as presented in the 2023 draft Staff Report, the State Water Board made revisions to the numeric flow requirements, adding in water supply adjustments for water rights obtained on or before December 31, 2025 for the level of diversions occurring under those rights as of December 31, 2025, to reduce water supply

and carryover storage and associated temperature impacts and the associated economic disruption at the outset of Plan implementation. The revised flow requirements are designed to be adjusted with changing hydrology, beginning at 55 percent in the wettest third of conditions, falling to 45 percent during the intermediate third of conditions, and reducing to 35 percent during the driest third of conditions. In addition to these watershed-wide water supply adjustments, the numeric inflow requirements also include tributary-specific water supply adjustments on rainfall-dominated tributaries and those tributaries that primarily supply municipalities that allow for complete off-ramping in the driest conditions. Together, these revisions are aimed at reducing water supply impacts and allowing more water to be stored in reservoirs for temperature and water supply purposes. Water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries.

The regulatory pathway also includes adaptive implementation provisions allowing for flexibility to better tailor requirements to protect public trust and other uses. These provisions include flow shaping (the ability to meet numeric inflow requirements by providing a total volume of water within a water year for the benefit of fish and wildlife [e.g., providing pulse flows to cue migration]); local cooperative solutions for individual tributaries, two or more tributaries, or regions; and adjustment of the unimpaired flow requirement within the 45 to 65 percent range as described in Section 13.3.3.2, *Inflows*. The regulatory pathway also contains provisions for development of curtailment exceptions for human health and safety needs and other appropriate purposes.

Further, as presented in Section 13.3.3.3, *Cold Water Habitat*, the narrative cold water habitat objective helps minimize redirected impacts on cold water habitat for native fish species and helps address existing and potential future temperature management concerns in the Sacramento/Delta watershed. Under the regulatory pathway, the revised proposed Plan amendments identify that certain water right holders and reservoir owners/operators would be required to develop long-term temperature management strategies and annual plans. These strategies would include proposed carryover storage levels and evaluation of other measures to improve temperature management, including but not limited to fish passage, temperature control device measures, and riparian habitat improvements, to contribute to meeting the narrative cold water habitat objective and ensure fish below reservoirs are kept in good condition consistent with Fish and Game Code section 5937. In the event that reservoir owners do not develop carryover storage levels, the State Water Board would develop carryover storage levels for those reservoirs through a public process. The regulatory pathway is described in more detail in Section 13.3.3, *Regulatory Pathway*.

Under the VA pathway, HRL participants would provide a combination of increased flows, depending on water year type, and non-flow habitat restoration actions aimed at improving spawning and rearing capacity for salmonids, estuarine species, and other native fish and wildlife. Draft accounting provisions for the flow and non-flow measures proposed to be provided under the VA pathway are included in Appendices B.1 and B.2 of the revised proposed Plan amendments. Because the VA pathway would likely involve smaller changes in hydrology and water supply, the environmental impacts associated with changes in hydrology and water supply would likely be smaller in magnitude and geographic scope when compared with the regulatory pathway. The VA pathway thus provides an opportunity for exploring the effects of flow regimes and spawning/rearing habitat restoration on fish populations and provides additional protection for fish and wildlife public trust uses relative to baseline, while also reducing water supply impacts. HRL participants assert that the HRL proposal will serve as a comprehensive approach to managing and integrating habitat, flow, landscape, and other factors to protect native fish and wildlife species, while concurrently protecting water supply reliability and facilitating increased coordination among

state agencies, public water agencies, and stakeholder groups on scientific studies and monitoring and adaptive management of flow and non-flow commitments.

The State Water Board has encouraged voluntary actions that are consistent with the updated Bay-Delta Plan for their potential to provide large-scale benefits that will amplify the ecological benefit of new and existing flows beyond what the State Water Board could require through flow and water project operations alone. Successful voluntary measures to implement the Bay-Delta Plan could provide comprehensive, enduring, and timely benefits to the ecosystem. However, as described in the Scientific Basis Report Supplement for the VA pathway, there is some uncertainty as to what the actual benefits of the VA pathway will be and as such whether those benefits will fully protect public trust resources and fully provide for the reasonable protection of fish and wildlife beneficial uses. Given this uncertainty, the regulatory pathway provides a necessary backstop if HRL commitments are shown to not be sufficient to fully protect public trust resources and provide for the reasonable protection of fish and wildlife or in the event HRL commitments cannot be met. The VA pathway is designed to be informed by supplemental science and monitoring to evaluate effectiveness of the VA pathway and ensure compliance, as described in more detail in Section 13.3.4.7, *Supplemental Science and Monitoring*. Details on the process for continuing, modifying, or terminating the VA pathway are presented in Section 13.3.4.10, *Continuation, Modification, or Termination of the VA Pathway.* The VA pathway is described in more detail in Section 13.3.4, *Voluntary Agreement Pathway*.

As described further in Section 13.4, *Changes in Hydrology and Water Supply*, on December 4, 2025, pursuant to direction included in Action 5 of federal Executive Order 14181, Reclamation modified operational constraints included in the Record of Decision (ROD) for the Long-Term Operations (LTO) of the CVP and SWP. Those modifications included adding flexibility to reduce Old and Middle River (OMR) reverse flow restrictions and elimination of fall X2 requirements. In addition to the 2025 LTO ROD changes, two amendments to the California Department of Fish and Wildlife (CDFW) ITP issued for SWP operations pursuant to the California Endangered Species Act (CESA) were approved in 2025 to change requirements for SWP operations. DWR has also submitted a 2026 ITP amendment request to CDFW to permanently remove the requirements for fall X2. In July 2026, CDFW approved an additional 1-year modification to the ITP. CDFW is continuing to process the request for a permanent amendment to the ITP and expects to make its decision on the request by December 2026.

While the 2025 ROD and 2025 CDFW ITP (collectively, 2025 ROD/ITP) are actions taken by other agencies outside the Bay-Delta Plan, these actions could interact with changes in hydrology and water supply under the revised proposed Plan amendments because the baseline for this project reflects conditions as they have largely existed for the majority of this planning process prior to the late 2024 and late 2025 changes to CVP and SWP operational constraints. The HRL flows are intended to be additive to required flows under D-1641 and resulting flows under the 2024 LTO ROD and 2024 National Marine Fisheries Service and U.S. Fish and Wildlife Service Biological Opinions rather than the 2025 ROD/ITP. As such, because changes under the 2025 ROD/ITP could reduce the base upon which the HRL flow commitments are intended to be added, the revised proposed Plan amendments include a new base flow balancing provision for CVP/SWP operations (referred to as the LTO base flow balancing provision) that is discussed in more detail in Section 13.3, *Revised Proposed Plan Amendments*. The provision requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The additional analyses presented in this chapter show

the effects of not having the LTO baseflow balancing provision. However, the LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway.

The LTO base flow balancing provision would not apply under the regulatory pathway because the regulatory pathway flow requirements are not built on base flows but instead are requirements for tributary and Delta outflow levels based on unimpaired flows. However, the State Water Board has the authority to impose specific water right requirements if needed to implement the new narrative interior Delta flow objective. During annual and periodic reviews of the Bay-Delta Plan and its implementation, the State Water Board will evaluate the effectiveness of the interior Delta flow objectives and implementation actions and assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes. This, along with the LTO base flow balancing provision, will help ensure that public trust resources are protected to the extent feasible.

This Staff Report analyzes a range of options for updating the Bay-Delta Plan and its implementation measures, and the updated Plan is intended to be adaptable in the face of changing circumstances and information. As discussed above, under the regulatory pathway, the required percent of unimpaired flow may be adjusted within the range from 45 to 65 percent of unimpaired flow, with or without incorporated water supply adjustments. Further, in the event that the regulatory pathway, the VA pathway, or both pathways require modification to ensure the reasonable protection of beneficial uses, including public trust uses, in the Bay-Delta watershed, the State Water Board has the ability to make adjustments via the annual and periodic review processes, as described in Section 4.6 of the revised proposed Plan amendments. Annual review will consist of yearly public meetings to discuss progress on implementing the Plan and will allow the State Water Board to act on various approvals or opportunities to make adjustments as established in the Plan's program of implementation after receiving input from the public. Under the periodic review process, the State Water Board will hold public hearings every 3 years to discuss topics including implementation progress, the effectiveness of objectives and implementation measures at reasonably protecting fish and wildlife beneficial uses, and any necessary adjustments to the Plan or its implementation. Following this public hearing, State Water Board staff will prepare a report identifying recommendations for proposed amendments that will be brought before the State Water Board for consideration after a public comment period. The annual and periodic review processes afford the State Water Board more flexibility to make adjustments to the Bay-Delta Plan without beginning the entire water quality control plan amendment process anew.

As described in this section, the revised proposed Plan amendments are intended to satisfy the public trust doctrine and reasonably protect fish and wildlife beneficial uses in consideration of other beneficial uses of water. Through the analyses and balancing efforts described above, the State Water Board has duly considered the public trust and concluded that the revised proposed Plan amendments will protect public trust uses to the extent feasible.

The State Water Board derives its authority to implement the Bay-Delta Plan from both the public trust doctrine and article X, section 2 of the California Constitution, which requires that "the waste or unreasonable use or unreasonable method of use of water be prevented." (Cal. Const., Art. X, § 2.) All water rights are subject to the public trust doctrine and the constitutional requirement that water use must be reasonable. The State Water Board is uniquely qualified to act to protect public trust resources to the extent feasible and to prevent waste and unreasonable use through exercise of its regulatory powers. (See e.g., *State Water Resources Control Bd. Cases* (2006) 136 Cal.App.4th 674,

778; *Light v. State Water Resources Control Bd.* (2014) 226 Cal.App.4th 1463, 1472-1473.) It is under these authorities that the State Water Board may limit diversions of water through water right curtailments to ensure that flow is kept instream as necessary to meet the tributary inflow and inflow-based Delta outflow requirements. Section 13.3.5, *Implementation Methodology*, further describes these curtailments and how they would be used to implement the Sacramento/Delta updates to the Bay-Delta Plan.

13.6.2 Water Code Section 13241 Analysis

The State Water Board's amendments to the Bay-Delta Plan must be prepared in accordance with applicable water quality planning provisions of the Porter-Cologne Act, Water Code section 13000 et seq., and other applicable laws. Section 13241 of the Porter-Cologne Act identifies certain factors that must be considered when establishing water quality objectives. These factors include: (1) past, present, and probable future beneficial uses of water; (2) environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto; (3) water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality in the area; (4) economic considerations; (5) the need for developing housing within the region; and (6) the need to develop and use recycled water. This Staff Report discusses these factors with respect to the Sacramento/Delta updates to the Bay-Delta Plan, including the proposed objectives under the revised proposed Plan amendments articulated in Chapter 13, *Revised Proposed Plan Amendments*, original proposed Plan amendments articulated in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, proposed VAs articulated in Chapter 9, *Proposed Voluntary Agreements*, and other project alternatives. The factors are an inherent part of the analyses presented for decision makers to understand the impacts not only on the environment but also on other beneficial uses, economics, and other important considerations like the human right to water.

The primary locations where this information can be found in the Staff Report are listed below.

1. **Past, present, and probable future beneficial uses of water:** Table 7.12.1-1a in Section 7.12.1, *Hydrology and Water Quality – Surface Water*, lists the designated beneficial uses of water currently identified in the Bay-Delta Plan, which includes past, present, and future beneficial uses of water. Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, and Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, present and evaluate information relevant to the reasonable protection of fish and wildlife beneficial uses. Chapter 7, Chapter 9, and Chapter 13 include impact analyses for agriculture, municipal, wildlife refuges, and hydropower beneficial uses. Chapter 11, *Tribal Engagement, Traditional Ecological Knowledge and Tribal Beneficial Uses*, and Section 13.3.7, *Designation of Tribal Tradition and Culture (CUL) and Incorporation of Tribal and Subsistence Fishing Beneficial Uses*, identify Tribal Beneficial Uses (TBUs) that are incorporated into the Bay-Delta Plan. Both the watershed-wide and tributary-specific water supply adjustments that modify the regulatory pathway's revised flow requirements were included in part to reduce impacts on agricultural and municipal water uses. Provisions allowing adjustments to flow requirements within the adaptive range of 45 to 65 percent of unimpaired flow, local cooperative solutions, and flow shaping further allow the Plan to adapt in the face of changing circumstances and provide flexible protection to different beneficial uses, as needed. Similarly, the VA pathway's combination of flow and non-flow habitat restoration commitments balance providing benefits to fish and wildlife uses with reducing impacts on municipal and agricultural uses.

It is important to note that the term "beneficial uses" as used in water quality control planning context differs from the term "beneficial uses" in a water right context. Under the Porter-Cologne Act, water quality objectives are established for the "reasonable protection of beneficial uses." Fish and wildlife beneficial uses require volumes of water achieved through setting minimum instream flows, as the water itself is habitat for aquatic species and that habitat is degraded through excessive diversion. Other uses, such as agricultural beneficial uses, do not require specific allocations of water. For example, Table 2 of the Bay-Delta Plan sets a salinity standard adequate to reasonably protect agricultural uses, ensuring water used for irrigation is not so salty that it will harm crops. Therefore, reasonable protection of water quality for fish and wildlife, while also ensuring protection of agricultural uses, does not involve analysis of competing water allocations. Nevertheless, this does not mean the State Water Board is not evaluating or considering how people might be impacted if the amount of water for domestic or irrigation purposes changes because the reasonable protection of fish and wildlife beneficial uses requires that less water be diverted. The goal of the Porter-Cologne Act is to "attain the highest water quality that is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible" and the task of accomplishing this belongs to the Board. (*City of Burbank v. State Water Resources Control Board* (2005) 35 Cal.4th 613, 619; Water Code, § 13000.)

In a water right context, "beneficial use" is a different term of art. For example, appropriative water right holders are required to put water to "beneficial use" to maintain appropriative water rights; appropriative rights cannot accrue for more than the amount reasonably required for beneficial use. In this context, beneficial uses include domestic, irrigation, power, municipal, fish and wildlife, and many other uses. (Cal. Code Regs., tit. 23, § 659 et seq.) While these descriptive terms may look the same as those used in a water quality control planning context, they are different and refer to the end use of a specific amount of applied water. Moreover, even if water is being applied to a "beneficial use" as defined under water right law, that right does "not and shall not extend to the waste or unreasonable use or unreasonable method of use or unreasonable method of diversion of water." (Cal. Const., Art. X, § 2.) This means that a beneficial use in the water right context can still be considered an unreasonable use of water.

2. **Environmental characteristics of the hydrographic unit:** Discussion is included in Chapter 2, *Hydrology and Water Supply,* and in the environmental setting section of each Chapter 7 resource section (Sections 7.3 through 7.20).

3. **Water quality conditions that could reasonably be achieved through the coordinated control of all factors that affect water quality:** Analysis of surface water conditions related to streamflow, water temperature, and salinity is included in Chapter 2*, Hydrology and Water Supply;* Chapter 6, *Changes in Hydrology and Water Supply*; Section 7.6.2, *Aquatic Biological Resources*; Section 7.12.1, *Hydrology and Water Quality – Surface Water*; Section 9.5, *Changes in Hydrology and Water Supply*; Section 9.7.6.2, *Aquatic Biological Resources*; Section 9.7.12.1, *Hydrology and Water Quality – Surface Water*; Section 13.4, *Changes in Hydrology and Water Supply*; Section 13.7.6.2, *Aquatic Biological Resources*; and Section 13.7.12.1, *Surface Water*. Modeling results of surface water conditions related to streamflow are provided in Appendices A1 and H1a*,* each titled *Sacramento Water Allocation Model Methods and Results*, and Appendix G3a, *Sacramento Water Allocation Model Methods and Results for the Proposed Voluntary Agreements*. Modeling results of water temperatures in several tributaries are provided in Appendix A6, *Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, and*

American Rivers; Appendix G3e, *Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, and American Rivers for the Proposed Voluntary Agreements*; Appendix H1b, *Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, American, and Yuba Rivers*; and Section H1a6.6, *Changes in Water Temperature,* of Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*. Modeling results for salinity conditions in the Delta are provided in Appendix A2, *Delta Simulation Model II (DSM2) Methods and Results*, and Appendix G3b, *Delta Simulation Model II (DSM2) Methods and Results for the Proposed Voluntary Agreements*. Modeling results for floodplain habitat are provided in Appendix A8, *Salmonid Tributary Habitat Analysis*, Appendix H1c, *Beneficial Environmental Effects*, and Appendix G2, *Final Scientific Basis Report Supplement in Support of Proposed Voluntary Agreements for the Sacramento River, Delta, and Tributaries Update to the San Francisco Bay/Sacramento-San Joaquin Delta Water Quality Control Plan*. Water quality conditions to protect fish and wildlife in the Sacramento/Delta watershed could be reasonably achieved through establishment of flow requirements and requirements for the management of cold water storage and releases, or through a combination of flow commitments and non-flow habitat restoration actions. The water quality conditions that could be reasonably achieved through these flow and non-flow measures include increased flows, temperature improvements beneficial to salmonids, as well as increased area for spawning, instream rearing, and floodplain habitat for the benefit of native fish.

4. **Economic considerations:** Section 7.4, Section 9.7.4, and Section 13.7.4, each titled *Agriculture and Forest Resources*; and Chapter 8, Section 9.8, and Section 13.8, each titled *Economic Analysis and Other Considerations*, address economic considerations. Economic modeling results are provided in Appendix A3, *Agricultural Economic Analysis: SWAP Methodology and Modeling Results*; Appendix A4, *Regional Economic Analysis Modeling Procedure*; and Appendix G3c, *Economic Considerations for the Proposed Voluntary Agreements*.

5. **Need for developing housing within the region:** The project would not directly restrict development of housing. As explained in Section 7.16, Section 9.7.16, and Section 13.7.16, each titled *Population and Housing*; and Section 7.23, Section 9.7.21, and Section 13.7.21, each titled *Cumulative Impacts, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes*, the project would not induce substantial population growth either directly or indirectly. While the project would result in reductions to municipal water supply, which in turn could affect housing development, most municipalities have or are developing alternate water supplies, including replacement groundwater pumping, groundwater storage and recovery, water transfers, increased use of recycled water, and water conservation. Mitigation measures to avoid or reduce impacts on municipal supplies are discussed in Sections 7.20, 9.7.20, and 13.7.20, each titled *Utilities and Service Systems*.

6. **Need to develop and use recycled water:** Other water management actions, including water recycling, are discussed in Section 6.6, *Other Water Management Actions*, and Section 7.1, *Approach to Analysis*. The evaluation of actions that may be taken in response to changes in water supply presented in Sections 7.3 through 7.20 addresses other water management actions, including water recycling. While the project cannot be considered the driving impetus for sustainable management and water supply diversification efforts, including the need to develop and use recycled water, the project may accelerate and increase the need for such efforts to manage water sustainably and may promote development of recycled water. As detailed in Section 4.4.10.5 of the revised proposed Plan amendments, the State Water Board will continue to encourage and promote water recycling projects, including projects involving

the use of recycled water for groundwater recharge, through expediting permit processes and providing funding opportunities.

13.6.3 Antidegradation

The State Water Board's Statement of Policy with Respect to Maintaining High Quality Waters in California (Antidegradation Policy) (State Water Board Resolution 68-16) requires that the quality of existing high-quality water be maintained unless any change will be consistent with the maximum benefit to the people of the state, will not unreasonably impact present or anticipated future beneficial uses of such water, and will not result in water quality less than that prescribed in water quality control plans or policies. The Antidegradation Policy further requires best practicable treatment or control of the discharge necessary to assure that pollution or nuisance will not occur and the highest water quality consistent with maximum benefit to the people of the state will be maintained. The state Antidegradation Policy incorporates the federal Antidegradation Policy (40 C.F.R. § 131.12 (a)(1)), which requires "[e]xisting instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." (*Id*., § 131.12(a)(1).)

The revised proposed Plan amendments are consistent with the Antidegradation Policy because they establish new water quality objectives and a program of implementation that are intended to improve flow and water quality conditions over a large geographic area, and particularly for fish and wildlife beneficial uses in the Sacramento/Delta. The revised proposed Plan amendments do not relax objectives in the existing Bay-Delta Plan, including objectives and implementation responsibilities established in the 1995 Bay-Delta Plan and D-1641, in a manner that would result in a lowering of water quality in the Sacramento/Delta, nor will the revised proposed Plan amendments result in the lowering of water quality in any high quality waters. As such, an antidegradation analysis is not required.

13.7 Environmental Analysis

13.7.1 Approach

The Secretary of the Natural Resources Agency certified the State Water Board and regional water boards' basin planning process as a certified regulatory program under the California Environmental Quality Act (CEQA). (Pub. Resources Code, § 21080.5, subd. (b)(2); Cal. Code Regs., tit. 23, § 3775 et seq.) Certified regulatory programs are exempt from CEQA's requirements for preparing an environmental impact report (EIR), negative declaration, or initial study. (Pub. Resources Code § 21080.5; Cal. Code Regs., tit. 14, § 15251, subd, (g).) Accordingly, the State Water Board may prepare a substitute environmental document (SED) that meets the requirements of CEQA. (Cal. Code Regs., tit. 14, § 15252, subd, (a).) The entire Staff Report can be considered the SED that fulfills the requirements of CEQA and the State Water Board's CEQA regulations (Cal. Code Regs., tit. 23, § 3775 et seq.) to analyze the environmental effects of the proposed regulatory activity, as well as requirements of the Porter-Cologne Water Quality Control Act (Porter-Cologne Act) and other applicable requirements.

State CEQA Guidelines may be cited where appropriate and relevant to help guide or inform the CEQA analysis consistent with CEQA's goals and standards. California Code of Regulations, title 14, section 15088.5, subdivision (a) requires a lead agency to recirculate an EIR when significant new information is added, such as changes in the project or environmental setting as well as additional data or other information. If the addition of significant new information is limited to a few chapters or portions of the EIR, the lead agency need only recirculate those chapters or portions that have been modified. (Cal. Code Regs., tit. 14, subd. (c).)

In October 2024, Board staff released a draft of potential updates to the Bay-Delta Plan (i.e., proposed amendments to the text of the Bay-Delta Plan) that incorporated alternatives analyzed in the draft Staff Report with revisions based on public comments. Following a public comment period on the 2024 draft Bay-Delta Plan (2024 draft Plan), a revised draft of Plan updates was released in July 2025. The Board delayed public comment on the July 2025 revised draft Plan to make further revisions and to coordinate receipt of public comments with the recirculated portions of the draft Staff Report.

In December 2025, the Board released Chapter 13, *Revised Proposed Plan Amendments*, of the 2025 partially recirculated draft Staff Report and a December 2025 revised draft Plan. The revised proposed Plan amendments include a voluntary agreement (VA) pathway incorporating HRL commitments into the Bay-Delta Plan program of implementation, as well as a regulatory pathway based on the previously proposed Plan amendments with modifications. The pathways incorporate aspects of the other alternatives that were evaluated in the 2023 draft Staff Report. The VA pathway would apply for the water rights included in the approved VA pathway, and the regulatory pathway would apply for water rights not included as part of the approved VA pathway and if the VA pathway were discontinued, with both pathways having regulatory effect if adopted. The State Water Board developed Chapter 13 to summarize the effects of the revised proposed Plan amendments that are expected to be considered for approval by the Board. These changes are similar to the changes

identified in the December 2025 revised draft Plan and Chapter 13 of the 2025 partially recirculated draft Staff Report. The major changes to the draft Bay-Delta Plan are summarized in Section 13.3, and the major changes to Chapter 13 are summarized below.

As described in Section 13.1, *Introduction*, the 2023 draft Staff Report included a description of the proposed Plan amendments at that time in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*; the environmental analysis for those changes and a description and analysis of other project alternatives in Chapter 7, *Environmental Analysis*; and a description and analysis of the proposed VAs in Chapter 9, *Proposed Voluntary Agreements*. In addition, the 2023 draft Staff Report included consideration of adding Tribal Beneficial Uses to the Bay-Delta Plan in Chapter 11, *Tribal Engagement*. This final Staff Report also contains Chapters 5, 7, 9, and 11 (now titled *Tribal Engagement, Traditional Ecological Knowledge and Tribal Beneficial Uses*) that remain similar to the versions included in the 2023 draft Staff Report, with revisions where appropriate including updates in response to comments received on the draft Staff Report. Due to the size of the Sacramento/Delta and the complexity of water supply and use originating from the watershed, the environmental analyses cover a broad range of impact mechanisms and actions, including the evaluation of reasonably foreseeable methods of compliance and response actions that may result from implementation. A wide range of responses and associated environmental effects could occur as a result of the project due to the degree of flexibility included in the program of implementation and the scope and complexity of Sacramento/Delta water use. The impact analyses are generally organized into the following categories: (1) changes in hydrology, (2) changes in water supply, (3) habitat restoration and other ecosystem projects, and (4) new or modified facilities.

This section, *Environmental Analysis*, provides a brief project description and a supplemental analysis that compares and explains the potential environmental effects that may occur due to implementation of the revised proposed Plan amendments in the context of the analyses already contained in the prior chapters of the Staff Report with any necessary modifications. This supplemental analysis mainly focuses on (1) changes in hydrology, and (2) changes in water supply. As explained below in Section 13.7.1.3, *Impact Conclusions That Do Not Change Under the Revised Proposed Plan Amendments*, certain reasonably foreseeable methods of compliance and response actions categories for which the impact mechanisms and impact conclusions would not be changed by the refinements under the revised proposed Plan amendments are not repeated in this chapter. These topics include the “other water management actions” portion of (2) changes in water supply, as well as (3) habitat restoration and other ecosystem projects and (4) new or modified facilities. In addition, most of the impact thresholds and sub-impact mechanisms with less-than-significant or no impact determinations that are discussed in Chapter 7 are not repeated here.

The revised proposed Plan amendments integrate existing definitions for Tribal Tradition and Culture (CUL), Tribal Subsistence Fishing (T-SUB) and Subsistence Fishing (SUB) beneficial uses into Chapter 2 and designate CUL due to the cultural and spiritual importance of water and native fish and wildlife, particularly salmon, to tribes. Salmon and other native cold water fish are key indicator species for the narrative fish and wildlife objectives in the revised proposed Plan amendments. As such, the objectives needed to reasonably protect fish and wildlife beneficial uses and CUL overlap and are addressed by the objectives and program of implementation in the Bay-Delta Plan. The environmental impacts of actions, including flow measures that would provide for the reasonable protection of fish and wildlife beneficial uses are already evaluated in the Staff Report as further

discussed in Section 13.7.2, *Environmental Analysis of CUL Tribal Beneficial Use Designation*. The revised proposed Plan amendments do not designate T-SUB and SUB, which are based on the safe consumption of both native and non-native fish at a greater rate and frequency than those same activities conducted by the general population.

Section 7.1, *Introduction, Project Description, and Approach to Environmental Analysis*, describes the project purpose and goals[1], the plan area and study area, the approach to the environmental analysis, and where additional relevant information is located in the Staff Report. Tributaries in the Sacramento/Delta watershed are shown on Figure 13.7.1-1a. Figure 13.7.1-1b shows the plan area boundary and Figure 13.7.1-1c shows the larger study area which is divided into seven regions based on geography and water supply. As depicted in Figure 13.7.1-1c, the Trinity River has been added to the study area (see Section 13.7.1.2, *Summary of Revisions*, for additional information on the Trinity River). However, maps in prior chapters have not been updated to depict the Trinity River watershed. The environmental setting in Sections 7.3 through 7.20 informs the impact analyses in Chapters 7 and 9, and this chapter for the revised proposed Plan amendments.

[1] State CEQA Guidelines section 15124, subdivision (b), requires the lead agency to include a statement of the objectives sought by the proposed project. To avoid confusion with the term "objective" as it is used in reference to flow and other water quality objectives, this document will refer to the "objectives" mentioned in section 15124 instead as "goals."

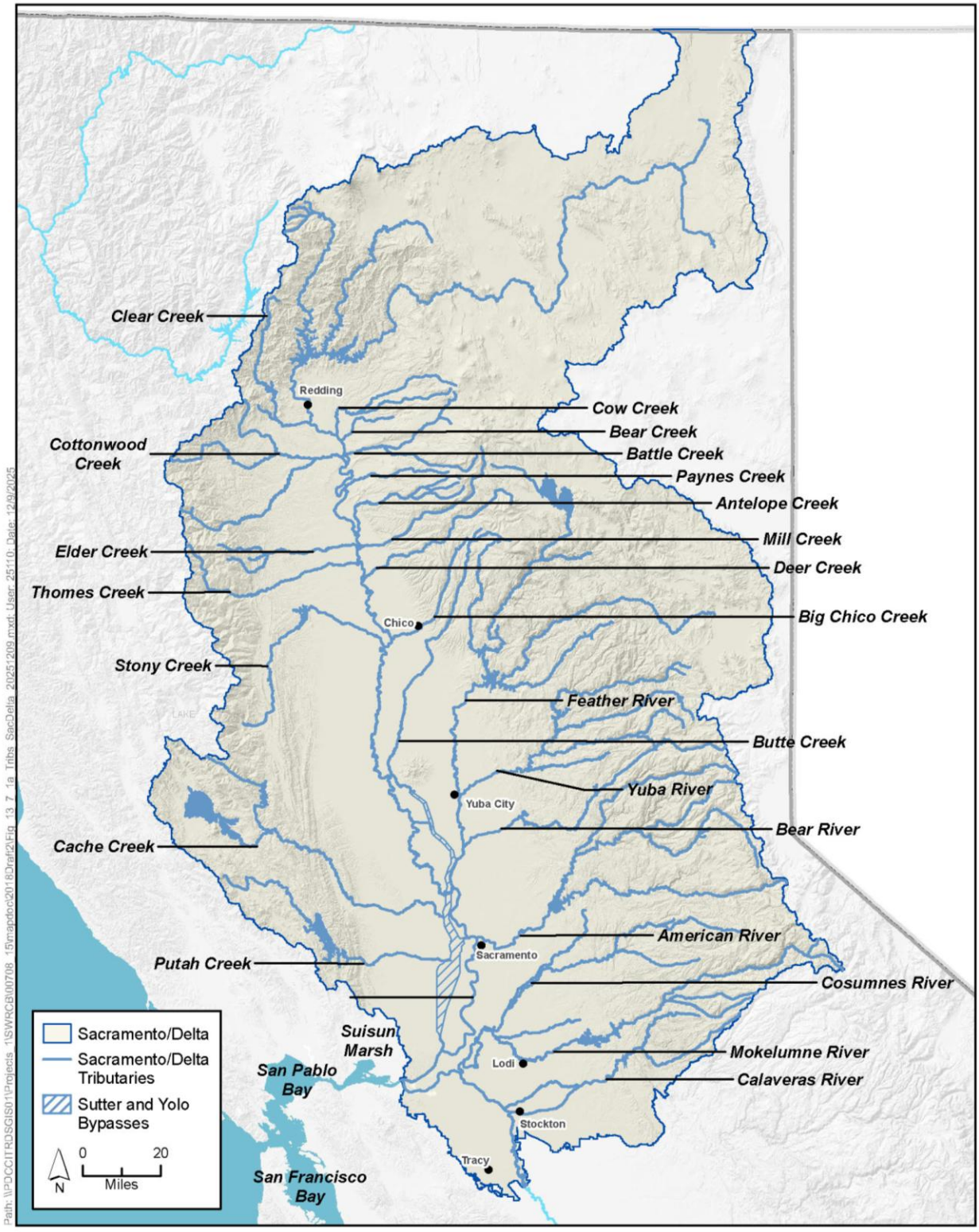


Figure 13.7-1a. Sacramento/Delta Tributaries

Figure 13.7-1b. Plan Area

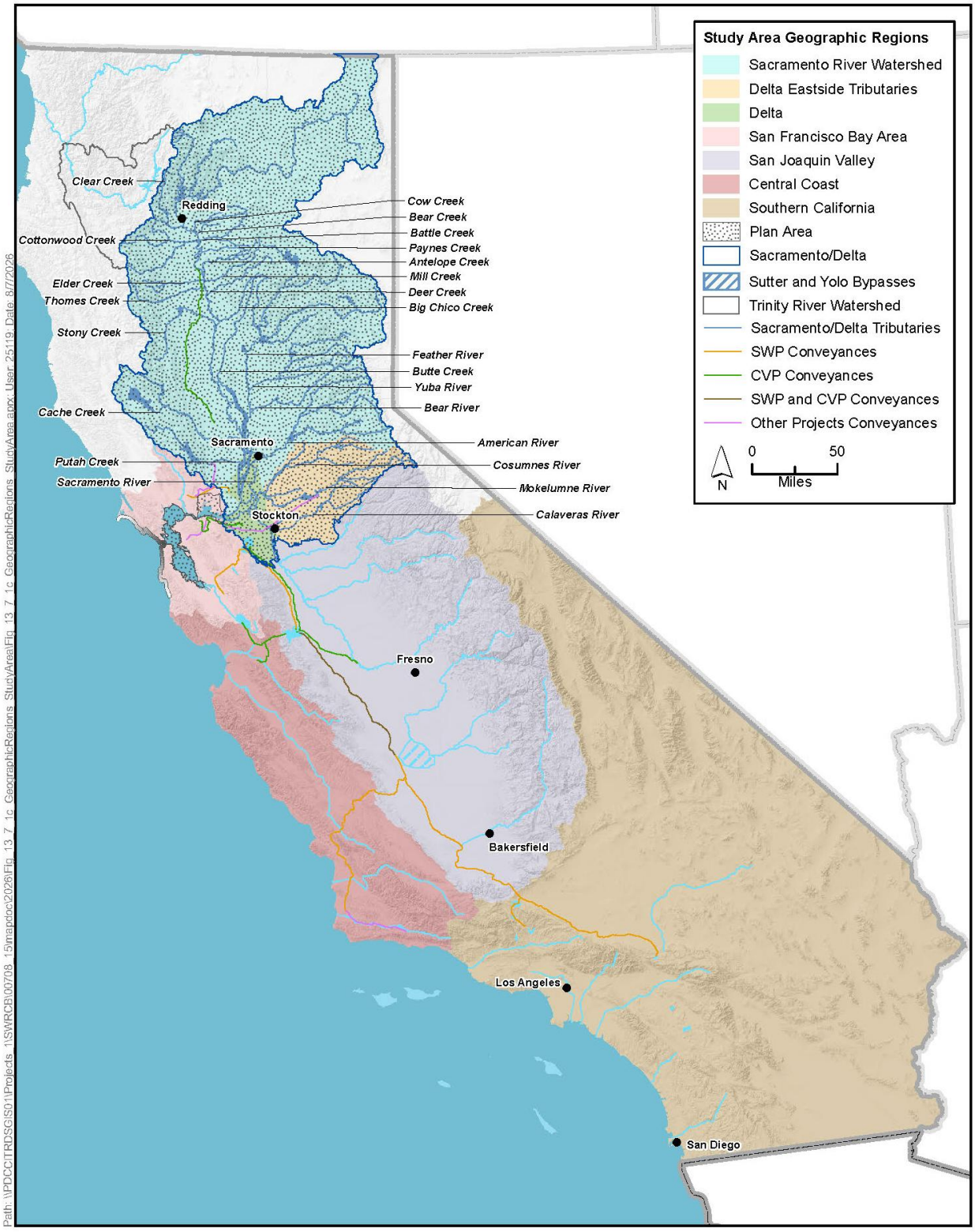


Figure 13.7-1c. Study Area Geographic Regions

CEQA requires a description of the physical environmental conditions in the vicinity of the project as they exist at the time the Notice of Preparation (NOP) is published (January 24, 2012 [supplemental NOP for the Sacramento/Delta update to the Bay-Delta Plan]), or if no NOP is published, at the time environmental analysis is commenced. (Cal. Code Regs., tit. 14, § 15125). This environmental setting will normally constitute the baseline physical conditions by which a lead agency determines whether an impact is significant. Where existing conditions change or fluctuate over time, and where necessary to provide the most accurate picture practically possible of the project's impacts, a lead agency may define existing conditions by referencing historic conditions, or conditions expected when the project becomes operational, or both, that are supported with substantial evidence. As discussed in Section 7.1, the environmental analyses in the Staff Report, including analyses presented in Chapter 13, utilize a quantitative and qualitative approach to compare the potential impacts to baseline conditions. For the quantitative evaluation, the Sacramento Water Allocation Model (SacWAM) is used to simulate changes in hydrology and water supply that could result from the project. Section 13.4, *Changes in Hydrology and Water Supply*, describes the modeling approach, including SacWAM general updates since the release of SacWAM version 2023.06.12 to support the 2023 draft Staff Report. Section 13.4 also describes SacWAM modeled changes in hydrology and water supply that could occur as a result of the revised proposed Plan amendments. Appendix H1a, *Sacramento Water Allocation Model Methods*, provides detailed descriptions of the model assumptions, and Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*, provides detailed SacWAM results. Section 7.1.5.2, *Baseline, Evaluation Approach, and Modeling Tools*, provides more discussion of the CEQA baseline.

Section 7.1 also provides an overview of other modeling and technical analyses that were utilized to evaluate environmental impacts and economic effects in Chapters 7 and 9 (see Table 7.1-1 in Chapter 7 of the 2023 draft Staff Report). For the revised proposed Plan amendments, modeling and technical analyses that are utilized to evaluate environmental impacts and economic effects include SacWAM (see Section 13.4, Appendix H1a, and Appendix H1a2), water temperature models (HEC-5Q) (see Appendix H1b, *Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, American, and Yuba Rivers*), and salmonid tributary habitat analyses (see Appendix H1c, *Beneficial Environmental Effects*). Other modeling and technical analyses from Chapters 7 and 9 (i.e., Delta Simulation Model II [DSM2], Statewide Agricultural Production [SWAP], California Sub-Regional Agricultural Analysis [CASRAA], IMPLAN, hydropower calculations, and power flow modeling) are referenced in discussions where appropriate to provide additional context in relevant resource analyses.

For the qualitative analyses, baseline conditions are generally defined by conditions present at the time the NOP was issued, or current conditions at the time of the analysis. When establishment and analysis of baseline conditions is constrained by data availability, the most current readily available information is used. The analyses consider the relevance of changes in information that may have occurred since the issuance of the 2012 NOP, where appropriate. Qualitative analyses follow an approach parallel to the quantitative analyses: they compare potential impacts to narrative descriptions of resource conditions that may vary over time. For many resources, project-related effects could be sufficiently inferred from changes in hydrologic conditions.

As discussed above, the environmental analysis presented in the Section 13.7 resource sections evaluates the potential impacts on resources that may result from changes in hydrology or changes

in water supply under the revised proposed Plan amendments. Changes in hydrology include changes in streamflows and reservoir storage levels. Changes in water supply include reduced Sacramento/Delta supplies for agriculture, municipal, and wildlife refuge uses, as well as potential changes in groundwater levels and use, including increased groundwater pumping in response to reduced Sacramento/Delta supply. Details regarding the modeled changes in hydrology and water supply that could occur under the revised proposed Plan amendments are presented in Section 13.4, *Changes in Hydrology and Water Supply*, and Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*.

The potential impacts of changes in hydrology and changes in water supply that could result from implementation of the revised proposed Plan amendments are described in Sections 13.7.3 through 13.7.20 with references to analyses in Chapter 7 and Chapter 9 that have not changed. Sections 13.7.3 through 13.7.20 are organized by environmental resource category following the State Water Board's environmental checklist (Cal. Code Regs, tit. 23, §§ 3720-3781, Appendix A). The CEQA environmental checklist for the revised proposed Plan amendments is provided in Appendix H2. For a summary of environmental impacts and mitigation measures identified for the revised proposed Plan amendments, see Table 13.7.22-1. The CEQA environmental checklist questions are listed in the same order as they are addressed in Chapter 7, 9, and 13 resource sections. Some impact questions are sufficiently related and are addressed together.

Section 13.7.1.2, *Summary of Revisions*, discusses revisions to the impact conclusions and mitigation measures under the revised proposed Plan amendments. Section 13.7.1.3, *Impact Conclusions That Do Not Change Under the Revised Proposed Plan Amendments*, identifies the impact conclusions that would not be changed by the refinements under the revised proposed Plan amendments. Appendix H3, *Mitigation Measures for the Revised Proposed Plan Amendments*, presents the full description of the mitigation measures that will reduce or avoid potentially significant impacts from changes in hydrology and water supply, habitat restoration and other ecosystem projects, and new or modified facilities. The mitigation measures presented in Appendix H3 supersede the mitigation measures presented in Sections 7.3 through 7.22 of the 2023 draft Staff Report.

Other State Water Board CEQA requirements addressed in Section 13.7 include analyzing cumulative impacts (Cal. Code Regs., tit. 14, § 15355), growth-inducing impacts (Cal. Code Regs., tit. 14, §15126.2, subd. (e).), and significant irreversible environmental changes (Cal. Code Regs., tit. 14, § 15126.2, subd. (d).) Section 13.7.21, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes*, describes the cumulative impacts associated with the revised proposed Plan amendments, includes an evaluation of potential growth-inducing impacts, and discusses significant irreversible environmental changes.

13.7.1.1 Project Description

As described in Section 13.3, *Revised Proposed Plan Amendments*, the revised proposed Plan amendments include a regulatory pathway that builds on and modifies the proposed Plan amendments presented in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta,* including the narrative inflow, cold water habitat, Delta outflow, and interior Delta flow objectives and the inflow-based Delta outflow objective, and other alternatives presented and analyzed in Chapter 7, *Environmental Analysis*, with modifications in response to public comments received throughout the planning process. The revised proposed Plan amendments also

include a VA pathway, which is an alternative implementation pathway for new narrative objectives applicable to the HRL water rights identified in Appendix B.1 allowing for implementation of the HRL commitments in lieu of certain actions described in the regulatory pathway. The VA pathway is largely consistent with the proposed voluntary agreements that were described and evaluated in Chapter 9, *Proposed Voluntary Agreements*. The regulatory pathway is described in Section 13.3.3, *Regulatory Pathway,* and the VA pathway is described in Section 13.3.4, *Voluntary Agreement Pathway*. Detailed SacWAM results for both pathways are presented in Section 13.4, *Changes in Hydrology and Water Supply,* and an ecological benefits analysis is presented in Section 13.5, *Beneficial Environmental Effects*. Additionally, quantitative results for the proposed Plan amendments and associated alternatives are presented in Chapter 6, *Changes in Hydrology and Water Supply*, and in certain resource sections of Chapter 7. Following additional work and collaboration as discussed in Chapter 11, *Tribal Engagement, Traditional Ecological Knowledge and Tribal Beneficial Uses,* the revised proposed Plan amendments add TBU definitions (Chapter 2, *Beneficial Uses*) and designate CUL throughout the Bay-Delta watershed due to the cultural and spiritual importance of native fish and wildlife, particularly salmon, to California Native American Tribes.

The starting point for the flow requirements under the regulatory pathway includes water supply adjustments that would apply to water rights existing as of 2025. As described in Section 13.3, *Revised Proposed Plan Amendments*, these adjustments include both watershed-wide adjustments and tributary-specific adjustments. The watershed-wide adjustments would require flows of 55 percent of unimpaired flow during wetter conditions, with required flows at 45 percent of unimpaired flows during intermediate conditions, and flows of 35 percent of unimpaired flow under the driest conditions. The tributary-specific water supply adjustments would allow for additional adjustments on rainfall-dominated and municipal supply-dominated tributaries, including Putah Creek and the Mokelumne and Calaveras Rivers, that would allow for more frequent reductions in the required flow levels within this range, as well as no new flow requirements during the driest conditions. These refinements to the regulatory pathway for the revised proposed Plan amendments were designed to reduce water supply impacts and allow more water to be stored in reservoirs on initial implementation. These refinements include the possibility of moving up in the range of unimpaired flow under certain conditions and the potential for modifying the water supply adjustments in the future. The flow requirements under the regulatory pathway along with other provisions in the program of implementation would enable Plan implementation to adjust to future changing conditions, including climate change.

The VA pathway includes HRL flow commitments and non-flow habitat restoration measures on the American, Bear, Feather, Mokelumne, Sacramento, and Yuba Rivers, Putah Creek, Auburn Ravine, and in the Delta, that are proposed over 8 years (with the possibility of extension) for the HRL water rights as an alternative to the implementation provisions of the regulatory pathway for inflow, inflow-based Delta outflow, and cold water habitat. The VA pathway includes varying amounts of increased flow, depending on water year type, and non-flow actions targeted at improving spawning and rearing capacity for juvenile salmonids, estuarine species, and other native fish and wildlife. The HRL flows are intended to be additive to defined base Delta outflows, including flows required by D-1641 and the 2024 BiOps/Record of Decision (ROD), as described in Section 13.3.4, *Voluntary Agreement Pathway*.

The State Water Board will implement the flow components of the Sacramento/Delta updates to the Bay-Delta Plan through water right or water quality actions, as necessary, including and primarily through water right curtailments based on water right priorities subject to possible modifications (e.g., drought, public health and safety, public trust obligations). In order to inform the curtailments, the State Water Board will develop an implementation methodology to determine when water is not available at water right holders' priorities of right (see Section 13.3.5, *Implementation Methodology*). This methodology will be developed through a public process and will be subject to regular review and update, as appropriate, based on improved data or methods.

Changes in hydrology and Sacramento/Delta water supply from baseline would be smaller under the revised proposed Plan amendments than the changes previously evaluated under the proposed Plan amendments in Chapter 7 due to lower flow requirements under the VA pathway, and the water supply adjustments under the starting point for the regulatory pathway. However, because in the future required flows could be higher in the range of unimpaired flow, and the water supply adjustments could be modified, the proposed project includes a range of possible outcomes moving forward; these contingencies are required to be disclosed and evaluated under CEQA.

As previously noted, the environmental resources sections in this chapter focus primarily on the potentially significant impacts from changes in hydrology and changes in water supply that may result from implementation of the revised proposed Plan amendments. The analyses discuss how impact mechanisms may differ from the analyses presented in Chapter 7 or Chapter 9. In some cases, implementation of the VA pathway may have a different impact significance compared to the regulatory pathway for the term of the VA pathway. Any differences in impacts between the regulatory pathway and VA pathway are discussed, with references to model output as appropriate. The impact conclusions reference the highest impact determination with mitigation measures identified for both pathways as necessary and appropriate. A summary of impacts and mitigation measures is provided in Table 13.7.22-1.

13.7.1.2 Summary of Revisions

This chapter evaluates the potential impacts on resources that may result under the revised proposed Plan amendments, including the regulatory pathway and the VA pathway, which are evaluated as separate implementation pathways and together as co-occurring pathways. Impacts under the regulatory pathway are compared to the Low Flow Alternative (35 and 45 scenarios) and 55 scenario of the proposed Plan amendments. Generally, effects of the starting point for the regulatory pathway of the revised proposed Plan amendments (55 w/WSAs scenario) on changes in hydrology and water supply are more similar to the Low Flow Alternative than the 55 scenario evaluated in Chapter 7, *Environmental Analysis*, due to the water supply adjustments. Accordingly, the impact analyses generally find that the impacts of the starting point for the regulatory pathway, as compared to baseline, would be less than those evaluated in Chapter 7, but because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could be as high as those identified in Chapter 7.

The following are a summary of the primary revisions to the environmental analyses presented in this chapter as compared to Chapters 7 and 9, *Proposed Voluntary Agreements*, in the 2023 draft Staff Report:

- **CUL**. Section 13.7.2, *Environmental Analysis of CUL Tribal Beneficial Use Designation,* includes an environmental analysis in support of the designation of CUL in the Bay-Delta watershed. Section 13.7.2 provides an overview of foreseeable actions that could be taken to reasonably protect CUL and describes where environmental impacts have already been evaluated in the Staff Report pursuant to other impact mechanisms.

- **Trinity River**. The State Water Board received numerous public comments about existing water quality issues in the Trinity River and potential impacts to the Trinity River from the Bay-Delta Plan Update. The Trinity River flows from the Trinity Alps in northwestern California through steep canyons to its confluence with the Klamath River at Weitchpec. The Trinity River supports coho and Chinook salmon and steelhead (North Coast Regional Water Board 2026). As explained in Section 2.2.1, *Sacramento River*, the Sacramento River receives imports from the Trinity River system through operations of the CVP. Water is transferred to the Sacramento River from the Trinity River basin through a system of dams, reservoirs, tunnels, and power plants. The Trinity River is not included in the plan area because the new flow requirements would not apply to the Trinity River. The Trinity River watershed was previously not included in the defined study area in the 2023 draft Staff Report because it does not receive Sacramento/Delta supply, and therefore reductions in Sacramento/Delta supply would not affect the area. However, flows from the Trinity River to the Bay-Delta watershed are already incorporated into the existing analyses and as such, it is appropriate to explicitly acknowledge the inclusion of the Trinity River as part of the study area as was done with Chapter 13, *Revised Proposed Plan Amendments*, of the 2025 partially recirculated draft Staff Report. The revised proposed Plan amendments include a provision that would require Reclamation to ensure that implementation of the Bay-Delta Plan, including HRL flow commitments, does not result in redirected impacts to native fish and wildlife resources in the Trinity River watershed, including temperature and instream flow impacts. As described in Section 13.4, *Changes in Hydrology and Water Supply*, streamflows in the Trinity River and storage levels are not expected to change under the regulatory or VA pathways. Accordingly, there would be no impacts on the Trinity River. This impact conclusion is identified in Section 13.7.6.2, *Aquatic Biological Resources*.

- **Terrestrial Biological Resources and Surface Water Quality.** Two impact conclusions under the VA pathway were modified compared to the 2023 draft Staff Report from less than significant to potentially significant to be consistent with other impact conclusions associated with changes in reservoir levels. As described in Section 13.4.3.2*, Reservoir Storage and Elevation,* SacWAM results show that the average annual change in water surface elevation under the VA pathway would be the same as or similar to baseline. However, SacWAM does not model the location of additional inflows from unspecified water purchases given the unknown origin of these water purchases and actual operation could vary from modeled outcomes with additional changes in reservoir levels beyond the modeled changes, including from new HRL commitments not previously evaluated. Consistent with the generally conservative approach to the impact analyses, impacts identified for riparian and wetland habitats associated with reservoirs in the plan area and increased bioaccumulation of methylmercury in fish from increased fluctuations

in reservoirs were changed from less than significant to potentially significant. Because flows under the VA pathway would generally be lower than the regulatory pathway, the magnitude of these potential impacts would be less during the term of the VA pathway.

- **Aquatic Biological Resources**. Section 13.7.6.2, *Aquatic Biological Resources* reflects that some impact conclusions on aquatic biological resources related to changes in Delta outflows and interior Delta flows for the regulatory pathway and the VA pathway differ compared with the impact determinations in Chapters 7 and 9. For changes in Delta outflows during the January through June period, the overall impact conclusions were unchanged from the 2023 draft Staff Report for both pathways. Both pathways will cause overall increases in Delta outflow during January through June that would benefit native fish species. Consistent with Chapter 9 of the 2023 draft Staff Report, the VA pathway will cause decreases in Delta outflow during wet years, which will result in less-than-significant impacts to native fish species. For changes in Delta outflows during the July through December period, the impact conclusion was unchanged for the VA pathway from the 2023 draft Staff Report. The VA pathway will have less-than-significant impacts on native fish species due to decreases in Delta outflow during July through December. For changes in Delta outflows under the regulatory pathway during the July through December period, Chapter 7 found no impacts, whereas this chapter identifies less-than-significant impacts due to decreases in Delta outflow during July through December of certain water year types. In addition, Chapter 13 identifies that very small decreases in Delta outflow that could occur during February under the regulatory pathway and during February and May under the VA pathway would result in less-than-significant impacts on native fish species. Chapter 13 also identifies that there could be increases in the frequency of negative Old and Middle River (OMR) flows under both the regulatory pathway and VA pathway compared to baseline that could increase entrainment of native fish species into the interior Delta and draw them into the area of influence of the SWP and CVP export facilities. While the changes in operations that result in more negative OMR flows are the result of other non-State Water Board actions that have changed since the baseline for this project was established, Chapter 13 identifies the potential for significant impacts on native fish species residing in or migrating through the Delta. While these changes would not be inconsistent with federal Endangered Species Act (ESA) and California Endangered Species Act (CESA) requirements, there could be impacts on listed species and non-listed native species. Mitigation Measure MM-AQUA-a,d: 10, Implement Existing Laws to Protect and Mitigate Fisheries Impacts from Changes in Interior Delta Flows, is added to reduce or avoid these impacts on aquatic species.

- **Hydrology and Water Quality**. Section 13.7.12.1, *Surface Water*, evaluates potential water quality impacts from the additional HRL commitments from the Yolo County Flood Control and Water Conservation District (YCFCWCD). This chapter identifies that the YCFCWCD HRL commitments would have potentially significant impacts because the HRL flow commitments include the possible routing of surface water or banked groundwater from Cache Creek to Putah Creek to increase flows in Putah Creek, which could possibly affect water quality in Putah Creek because Cache Creek surface water and banked groundwater can have worse water quality conditions than Putah Creek at times for certain constituents. This chapter also identifies that this potential impact can be mitigated to a less-than-significant level due to the required monitoring and operations to ensure that any releases of Cache Creek water into Putah Creek do

not impact water quality in Putah Creek (Mitigation Measure MM-SW-a,f: 12, Water Quality Monitoring and Management in Putah Creek).

- **Recreation (harmful algal blooms [HABs])**. The 2023 draft Staff Report Sections 7.18, *Recreation*, and 9.7.18, *Recreation*, identified less-than-significant impacts on recreation from increased HAB production in reservoirs and Delta channels. Increased HABs can interfere with contact recreation, including causing temporary closures to recreation in some waterbodies; however, potential increased frequency of closures is not expected to result in a substantial number of recreationists moving to alternate recreational locations to the extent that it would substantially physically deteriorate those alternate locations. In response to a substantial number of public comments received from tribal and environmental justice communities stating that HABs cause significant impacts to recreational users of water, the impact conclusion in Section 13.7.18, *Recreation*, was revised in Chapter 13 of the 2025 partially recirculated draft Staff Report to potentially significant and mitigation measures identified (Mitigation Measure MM-REC-a: 3, Protect Water Quality and Avoid or Reduce Harmful Algal Blooms and Invasive Aquatic Weeds).

- **Cumulative Impacts**. Section 13.7.21, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental* Changes, evaluates the potential effects on Delta outflow from new water supply projects or changes to operations of existing water supply projects. The revised proposed Plan amendments would have the effect of adding Delta outflows. However, new water supply projects and changes to existing projects could at the same time reduce Delta outflows. To address these issues, the revised proposed Plan amendments identify that the State Water Board will consider imposing requirements, based on the record established during the administrative proceeding for water right actions before the Board, including any hearing, to ensure that the use of water is consistent with and supports the salmon protection, fish viability, inflow, inflow-based Delta outflow, and interior Delta flow objectives. While these provisions are expected to reduce impacts related to reductions in Delta outflows from new water supply projects and changes to existing projects, the specific outcomes of future proceedings are not known at this time. In addition, there are other changes to existing water diversions that may not be fully addressed by the provisions described above (e.g., exercise of an existing water right more fully, changes to other regulatory requirements, etc.). While the revised proposed Plan amendments would have the overall effect of adding flows and reducing possible future reductions in Delta outflows, they may not necessarily avoid future reductions in Delta outflows from other activities. Due to this uncertainty, this chapter identifies a potentially significant cumulative impact on aquatic biological resources in the Delta.

- **Mitigation Measures**. Three mitigation measures were added in the 2025 partially recirculated draft Staff Report to reduce or avoid impacts identified in the analyses described above for aquatic biological resources, surface water, and recreation: MM-AQUA-a,d: 10, Implement Existing Laws to Protect and Mitigate Fisheries Impacts from Changes in Interior Delta Flows; MM-SW-a,f: 12, Water Quality Monitoring and Management in Putah Creek; and MM-REC-a: 3, Protect Water Quality and Avoid or Reduce Harmful Algal Blooms and Invasive Aquatic Weeds. See Appendix H3 for the full text of the mitigation measures for the revised proposed Plan amendments.

In addition, the environmental analyses reflect minor changes to the identified mitigation measures. The environmental analysis in Chapter 7 of the 2023 draft Staff Report incorporated certain elements of the Bay-Delta Plan program of implementation as mitigation strategies to reduce or avoid potentially significant impacts on some environmental resources. In response to comments on the 2023 draft Staff Report that cited *Lotus v. Dept. of Transportation* (2014) 223 Cal.App.4th 645, 657-658, the State Water Board has revised this approach and removed cold water habitat objective implementation measures and voluntary implementation plans (now called local cooperative solutions), from the list of mitigation measures in Sections 7.3 through 7.20 and in Appendix H3, *Mitigation Measures for the Revised Proposed Plan Amendments*, as they are properly part of the proposed project. Cold water habitat implementation measures are no longer identified as mitigation for potential temperature impacts on aquatic biological resources. Additionally, several other corresponding changes have been made to mitigation measures including the reservoir management mitigation for aesthetics, terrestrial biological resources, cultural resources, energy (hydropower generation), surface water, and recreation. Similarly, implementation of local cooperative solutions is no longer included in the list of identified mitigation measures to reduce or avoid impacts on agriculture and forest resources, terrestrial biological resources, aquatic biological resources, energy, groundwater, and utilities and service systems. Local cooperative solutions remain as a fundamental component of the project to support implementation of the Bay-Delta Plan objectives. The process and requirements for parties proposing local cooperative solutions have not changed.

13.7.1.3 Impact Conclusions That Do Not Change Under the Revised Proposed Plan Amendments

Chapter 7, *Environmental Analysis* describes and evaluates certain reasonably foreseeable methods of compliance and response actions categories for which the impact mechanisms and impact conclusions would not be changed by the refinements under the revised proposed Plan amendments and need not be repeated in Chapter 13, *Revised Proposed Plan Amendments*. These topics include other water management actions, habitat restoration and other ecosystem projects, and new and modified facilities, and are described below. In addition, most of the impact thresholds and sub-impact mechanisms with less-than-significant or no impact determinations are discussed in Chapter 7 and not repeated here.

Other Water Management Actions

In response to changes in hydrology and water supply, other entities may implement other water management actions to offset reductions in Sacramento/Delta surface water supply. These other water management actions include groundwater storage and recovery, water transfers, water recycling, and water conservation and are described in Section 7.1.5.3, *Reasonably Foreseeable Methods of Compliance and Response Actions*. Many of these types of actions are already being implemented in response to increasing water scarcity from a variety of factors, including growth, environmental needs, drought, and climate change. While the revised proposed Plan amendments cannot be considered the impetus for alternative water planning actions, the process may increase the need for other water supplies and accelerate efforts to manage and plan more carefully. The impacts of these other water management actions are already evaluated in the environmental analysis in Sections 7.3 through 7.20 and are not repeated here. As explained in Chapter 9, *Proposed*

Voluntary Agreements, while the magnitude of changes from other water management actions that would occur as a result of changes in water supply would be less for the term of the VA pathway, the impact mechanisms and significance determinations would be the same as or similar to what is described in Chapter 7.

Other water management actions could result in potentially significant impacts on the following resources: agriculture and forest resources, terrestrial biological resources, aquatic biological resources, energy, greenhouse gas emissions, surface water hydrology and water quality, groundwater hydrology and water quality, and utilities and service systems. Specific impacts and mitigation measures are discussed and detailed comprehensively in Sections 7.3 through 7.20. While impacts from other water management actions under the revised proposed Plan amendments would be less under the regulatory and VA pathways compared with the 45 to 65 flow scenarios of the proposed Plan amendments (e.g., less frequent, lower magnitude, shorter duration), these actions would still be expected to occur in response to changes in hydrology and water supply and could result in potentially significant impacts. Impacts can be avoided or reduced by implementation of the mitigation measures indicated in Sections 7.3 through 7.20. Impacts and mitigation measures associated with other water management actions are reflected in Table 13.7.22-1. Appendix H3, *Mitigation Measures for the Revised Proposed Plan Amendments*, provides detailed descriptions of identified mitigation measures.

Additional Reasonably Foreseeable Methods of Compliance and Response Actions

The other two main categories of reasonably foreseeable methods of compliance and response actions are physical habitat restoration and other complementary ecosystem projects, and new and modified facilities that involve construction. Descriptions and analysis of potential environmental impacts of these actions are evaluated in Section 7.21, *Habitat Restoration and Other Ecosystem Projects*, and Section 7.22, *New or Modified Facilities*, respectively, and are discussed briefly below but not repeated here. Many of the actions evaluated in Sections 7.21 and 7.22 would involve construction, and in some cases, large construction projects that would require site-specific environmental impact analyses. Because the potential combination of future actions such as restoration actions or development of new or modified water facilities is unknown, these actions are discussed generally and qualitative comparisons to baseline conditions are made. The impact mechanisms and the reasons for the significance determinations presented in Sections 7.21 and 7.22 would not be changed under the revised proposed Plan amendments but would remain as explained in Chapter 7.

Habitat Restoration and Other Ecosystem Projects

Section 7.21, *Habitat Restoration and Other Ecosystem Projects*, evaluates the environmental impacts of non-flow projects, including physical habitat restoration, fish passage projects, predation, and aquatic invasive species control. These impacts would likely be the same or similar under the revised proposed Plan amendments for both the regulatory pathway and the VA pathway. Impacts and mitigation measures associated with habitat restoration and other ecosystem projects are reflected in Table 13.7.22-2. The CEQA environmental checklist for habitat restoration and other ecosystem projects is presented in Appendix H2, *Environmental Checklists for the Revised Proposed Plan Amendments*.

New or Modified Facilities

Section 7.22, *New or Modified Facilities*, evaluates the environmental impacts of new or modified water facilities, including new or modified reservoirs, new or changed points of diversion, new or upgraded drinking water treatment and wastewater treatment plant facilities, desalination plants, new groundwater wells, and groundwater storage and recovery. Section 7.22 also describes and evaluates new or modified boat ramps, stream gages and other monitoring devices, and water conservation projects. These impacts would likely be the same or less under the revised proposed Plan amendments for both the regulatory pathway and the VA pathway. Impacts and mitigation measures associated with new or modified facilities are reflected in Table 13.7.22-3. The CEQA environmental checklist for new or modified facilities is presented in Appendix H2, *Environmental Checklists for the Revised Proposed Plan Amendments*.

Less-than-Significant and No Impact Conclusions

Potential impacts determined to be less than significant or to have no impact under the flow scenarios in Chapter 7 or in Chapter 9 are also expected to be less than significant or have no impact for the revised proposed Plan amendments for the same reasons discussed in Chapters 7 and 9, and are not further discussed in this chapter. Several resource sections contain only no impact and/or less-than-significant impact conclusions, and no additional analysis of these topics is presented in this chapter.

These topics are:

- Hazards and Hazardous Materials (Section 13.7.11)
- Land Use and Planning (Section 13.7.13)
- Mineral Resources (Section 13.7.14)
- Population and Housing (Section 13.7.16)
- Public Services (Section 13.7.17)
- Transportation and Traffic (Section 13.7.19)

In addition to these resource sections, individual impact statements for several resource topics have no impact or less-than-significant conclusions and no new analysis is presented in this chapter because these impact mechanisms and the reasons for the significance determinations would not be changed under the revised proposed Plan amendments but would remain as explained in Chapter 7 and Chapter 9 as appropriate.

Impact statements that have no impact or less-than-significant impact conclusions are presented in Table 13.7.22-1.

13.7.1.4 Alternatives Analysis

The 2023 draft Staff Report evaluated proposed Plan amendments and alternatives for the Bay-Delta Plan update, including stand-alone alternatives of various flow scenarios and the proposed VAs and modular alternatives that could be layered onto the stand-alone alternatives. Chapter 7, *Environmental Analysis*, describes and evaluates the proposed Plan amendments. Section 7.2,

Description of Alternatives, describes Alternatives 1 through 5, and Section 7.24, *Alternatives Analysis*, analyzes the environmental impacts and economic effects of each, and compares environmental impacts and benefits of each to those of the proposed Plan amendments. Appendix F, *Impact Summary Tables for Alternatives 1, 2, and 3*, presents impact summary tables that detail the potential environmental impacts of the No Project Alternative (Alternative 1), the Low Flow Alternative (Alternative 2), and the High Flow Alternative (Alternative 3). Chapter 9, *Proposed Voluntary Agreements,* evaluates the environmental impacts and economic effects of the Proposed Voluntary Agreements Alternative (Alternative 6) and modular Alternative 6a.

The revised proposed Plan amendments utilize and combine previously evaluated alternatives and bring together in the Bay-Delta Plan program of implementation a VA pathway and a regulatory pathway. The analysis in this chapter builds upon the analysis of the proposed Plan amendments, the proposed VAs, and the alternatives presented in the 2023 draft Staff Report. The regulatory pathway is built from a combination of the proposed Plan amendments, the Low Flow Alternative (Alternative 2), and the Exclusion of Interior Delta Flow and Fall Delta Outflow Related Amendments Alternative (Alternative 4a), and the VA pathway is built from a combination of the VA Alternative (Alternative 6) and a variation of the Protection of Voluntary Agreement Flows Alternative (Alternative 6a). Thus, the revised proposed Plan amendments are presented as the proposed project that is comprised of elements from the range of reasonable alternatives already evaluated.

Appendix H4, *Impact Summary Table for Alternatives*, has been added to the Staff Report. The appendix presents a summary of the potential environmental impacts of the proposed Plan amendments, Low Flow Alternative (Alternative 2), High Flow Alternative (Alternative 3), proposed Voluntary Agreements (Alternative 6), and No Project Alternative (Alternative 1) compared to the revised proposed Plan amendments that are presented and evaluated in Chapter 13, *Revised Proposed Plan Amendments*.

Appendix H4 supplements the analysis provided in Section 7.24, *Alternatives Analysis,* and the summary provided in Appendix F by providing additional context and information concerning the environmental impacts of the revised proposed Plan amendments compared to the proposed Plan amendments and each of the stand-alone project alternatives. The impact determinations presented in the Appendix H4 (Table H4-1) reflect the highest level of potential impact for the alternative or pathway presented, including consideration of mitigation measures as necessary and appropriate. The comparison of alternatives to the revised proposed Plan amendments is to the highest impact determination between the regulatory pathway or VA pathway. For example, if the impact determination for the regulatory pathway is potentially significant (PS) and the impact determination for the VA pathway is less than significant (LTS), the comparison of the alternative is to the PS determination. Mitigation measures that could reduce potentially significant impacts are identified in Chapter 13, Table 13.7.22-1, *Impact and Mitigation Measure Summary—Changes to Hydrology and Supply*, and details of each mitigation measure are presented Appendix H3, *Mitigation Measures for the Revised Proposed Plan Amendments*.

Environmentally Superior Alternative

CEQA requires a discussion of the environmentally superior alternative. If that alternative is the No Project alternative, the environmental document shall also identify an environmentally superior alternative among the other alternatives. (Cal. Code Regs., tit. 14, § 15126.6(e).) In considering the

selection of the environmentally superior alternative, this Staff Report evaluates which alternatives result in fewer significant impacts relative to the other alternatives and which would bring greater benefits to the environment.

Fundamentally, the Plan amendments are intended to improve aquatic habitat conditions in the Sacramento/Delta watershed from current impaired and declining conditions. Section 7.24.7, *Environmentally Superior Alternative*, provides information on the environmentally superior alternative based on the information contained in the 2023 draft Staff Report. It explains that the proposed Plan amendments would provide more environmental benefits than the other alternatives evaluated in the 2023 draft Staff Report. However, focusing on potential adverse environmental impacts related to hydrology and water supply, the proposed VAs could be viewed as the environmentally superior alternative, although the improvements in flows would be more limited than under the proposed Plan amendments. The proposed VAs also provide some environmental benefit through physical habitat restoration. The revised proposed Plan amendments include a regulatory pathway based on the proposed Plan amendments with modifications and a VA pathway that includes implementation of the HRL commitments. With this combined project, they would provide the types of environmental benefits identified for both the proposed Plan amendments and the proposed VAs. The revised proposed Plan amendments would also reduce water supply impacts that would occur under the proposed Plan amendments at the outset of Plan implementation.

The regulatory pathway under the revised proposed Plan amendments provides a necessary backstop to HRL commitments. The VA pathway is being implemented in an experimental framework for a period of eight years. As part of the periodic review process, the State Water Board could consider modifying or terminating the VA pathway before year if the VA pathway does not provide reasonable protection of beneficial uses or will jeopardize the continued survival of native fishes. Under a red light determination, the State Water Board may shift HRL water rights to the regulatory pathway. The backstop will help ensure that the environmental benefits of the revised proposed Plan amendments are realized.

For these reasons, the revised proposed Plan amendments are the environmentally superior alternative, even though the improvements in flows would be more limited than under the proposed Plan amendments at the outset of Plan implementation.

13.7.1.5 2025 Record of Decision and 2025 Incidental Take Permit

As described further in Section 13.4, *Changes in Hydrology and Water Supply*, on December 4, 2025, pursuant to direction included in Action 5 of federal Executive Order 14181, the U.S. Bureau of Reclamation (Reclamation) modified operational constraints included in the Record of Decision (ROD) for the Long-Term Operations (LTO) of the CVP and SWP. Those modifications included adding flexibility to reduce Old and Middle River (OMR) revers flow restrictions and elimination of fall X2 requirements. In addition to the 2025 LTO ROD changes, two amendments to the California Department of Fish and Wildlife (CDFW) Incidental Take Permit (ITP) issued for SWP operations pursuant to the CESA were approved by CDFW in 2025 to change requirements for SWP operations, including: 1) a one-year modification to remove the requirements for fall X2 in exchange for a summer food and habitat action, and 2) flexibility to reduce OMR flow restrictions at certain times. DWR has also submitted a 2026 ITP amendment request to CDFW to permanently remove the requirements for fall X2. In July 2026, CDFW approved an additional one-year modification to the

ITP. CDFW is continuing to process the request for a permanent amendment to the ITP and expects to make its decision on the request by December 2026.

While the 2025 ROD and 2025 CDFW ITP (collectively, 2025 ROD/ITP) are actions taken by other agencies outside of the Bay-Delta Plan, these actions could interact with changes in hydrology and water supply under the revised proposed Plan amendments because the baseline for this project reflects conditions as they have largely existed for the majority of this planning process prior to the late 2024 and late 2025 changes to CVP and SWP operational constraints. The changes in CVP and SWP operational constraints affect the modeling and analyses even though those effects are not the result of this project. Those changes are summarized and discussed in relevant resource sections below and are informed by the hydrologic analyses discussed in Section 13.4, *Changes in Hydrology and Water Supply*. The hydrologic analyses of changes in hydrology and supply that could occur under the starting point for the regulatory pathway in combination with the 2025 ROD/ITP and for the VA pathway in combination with the 2025 ROD/ITP are presented in Section 13.4. Section 13.4 summarizes Sacramento Water Allocation Model (SacWAM) results and post processing results for changes in hydrology, including changes in streamflows and reservoir levels under the 55 w/WSAs + 2025 ROD/ITP and the VA + 2025 ROD/ITP scenarios.

Changes in hydrology that could result from the 2025 ROD/ITP could interact with the revised proposed Plan amendments to affect water temperatures, contaminants, HABs and invasive aquatic plants, water quality compliance by utilities, flooding, changes in Delta inflows and outflows, and interior Delta flows. Those effects are discussed further in Section 13.7.6.2, *Aquatic Biological Resources*, Section 13.7.12.1, *Surface Water*, and Section 13.7.18, *Recreation*. In those sections, the effects of the 2025 ROD/ITP are considered by comparing SacWAM results for changes in hydrology under the starting point for the regulatory pathway and under the VA pathway in combination with the 2025 ROD/ITP (55 w/WSAs + 2025 ROD/ITP and VA + 2025 ROD/ITP scenarios) with results for the starting point for the regulatory pathway and VA pathway without the 2025 ROD/ITP (55 w/WSAs scenario and VA scenario) and baseline. For the water temperature analysis, the effects of the 2025 ROD/ITP are evaluated by comparing temperature modeling using the SacWAM results for the 55 w/WSAs + 2025 ROD/ITP scenario and VA + 2025 ROD/ITP scenario with the results for the 55 w/WSAs scenario and VA scenario. The new analysis presented in Sections 13.7.6.2, 13.7.12.1, and 13.7.18 provides additional information about the expected effects of the 2025 ROD/ITP, but does not change the conclusions of the Staff Report's environmental analysis.

The changes to OMR flow restrictions under the 2025 ROD/ITP could affect interior Delta flows, including causing greater net flows toward south Delta Project pumping facilities during December through June compared with the baseline conditions. These changes could interact with changes in hydrology evaluated for the revised proposed Plan amendments resulting in effects on Aquatic Biological Resources that are discussed further in Section 13.7.6.2, *Aquatic Biological Resources*. .

The removal of the fall X2 requirements under the 2025 ROD/ITP could cause streamflows on Project tributaries (Sacramento River, Feather River and American River) to be lower in the fall of wet and above normal years compared with baseline conditions and the regulatory and VA pathways without the 2025 ROD/ITP. Flows could also be somewhat higher on Project tributaries in the winter and spring due to increased reservoir spill caused by elimination of fall X2 that are not expected to negatively interact with the revised proposed Plan amendments, except for a small increased risk of flooding (discussed in Section 13.7.12.1, *Surface Water*). The reduction in flows in the fall resulting

from elimination of fall X2 could interact with changes in hydrology evaluated for the revised proposed Plan amendments resulting in effects on Surface Water Quality, Aquatic Biological Resources, and Recreation. These effects include reductions in dilution of contaminants and incremental effects on instream chemical constituent concentrations on Project tributaries (discussed in Section 13.7.12.1). The elimination of fall X2 requirements under the 2025 ROD/ITP would also be expected to cause small changes in water temperatures on Project tributaries compared to the regulatory and VA pathways without the 2025 ROD/ITP due to changes in storage, streamflow, reservoir release target temperatures associated with changes in storage, and changes in the triggering of the power bypass in Oroville Reservoir (see Sections 13.7.12.1, *Surface Water* and 13.7.6.2, *Aquatic Biological Resources*). These changes would be small and would not be expected to affect the fish assessment results presented in Section 13.7.6.2.

In addition, removal of fall X2 would be expected to reduce Delta inflows and outflows in the fall which could affect migration cues and the quality and quantity of estuarine habitat in the fall of wet and above normal years compared to baseline and the regulatory and VA pathways without the 2025 ROD/ITP. In combination, the changes to OMR flows and elimination of fall X2 requirements under the 2025 ROD/ITP could also affect Delta outflows in the winter and spring. The changes in OMR flow restrictions could reduce Delta outflows in the spring but the removal of fall X2 could offset these reductions through increased spill. These changes could affect benefits to some degree but would not be expected to affect the impact conclusions for changes in Delta outflows during the winter and spring. These effects are discussed further in Section 13.7.6.2, *Aquatic Biological Resources*.

Reductions in inflows and outflows during the fall with the 2025 ROD/ITP could also cause incremental increases in HABs and invasive aquatic plants in Delta channels, although possible increases in exports that could increase net flows in south Delta channels leading to the export pumps could reduce HABs in those channels. Reductions in Delta outflow with removal of fall X2 could also allow X2 and seawater intrusion to move inland, which would be expected to have small effects on Delta salinity. However, operational adjustments are expected to be made by the CVP and SWP such that Delta water quality objectives continue to be met with the 2025 ROD/ITP. The effects on salinity and HABs in Delta channels are discussed in Section 13.7.12.1, *Surface Water*.

The HRL flows are intended to be additive to required flows under D-1641 and resulting flows under the 2024 LTO ROD and 2024 National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) Biological Opinions (BiOps) rather than the 2025 ROD/ITP. As such, because changes under the 2025 ROD/ITP could reduce the base upon which the HRL flow commitments are intended to be added, the revised proposed Plan amendments include a new base flow balancing provision for CVP/SWP operations (LTO base flow balancing provision) that is discussed in more detail in Section 13.3, *Revised Proposed Plan Amendments*. The provision requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The additional analyses presented in Sections 13.7.6.2, 13.7.12.1, and 13.7.18 show the effects of not having the LTO base flow balancing provision. However, the LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway.

The LTO base flow balancing provision would not apply under the regulatory pathway because the regulatory pathway flow requirements are not built on base flows but instead are requirements for tributary and Delta outflow levels based on unimpaired flows. However, increases in Delta outflows under the regulatory pathway could also be reduced due to the 2025 ROD/ITP at times that the prior fall X2 and OMR flow restrictions that were modified in the 2025 ROD/ITP would be controlling Delta outflows versus required instream flows under the regulatory pathway. This is more likely with water supply adjustments (WSAs) than without WSAs, but could occur without WSAs, particularly in the fall. Chapter 13, *Revised Proposed Plan Amendments*, has been updated to evaluate these possible effects of changes to other regulatory requirements on the expected outcomes of the Bay-Delta Plan under the regulatory pathway. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the new narrative interior Delta flow objective that is described in Section 13.3.6, *Interior Delta Flows*. While the narrative objective is expected to be met through implementation of CESA and ESA requirements and compliance with the existing numeric interior Delta flow objectives in the Plan, as appropriate, during annual or periodic reviews of the Bay-Delta Plan and its implementation, the State Water Board will evaluate the effectiveness of the interior Delta flow objectives and implementation actions and assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

The removal of fall X2 as part of the 2025 ROD/ITP could increase reservoir levels or result in smaller reductions in reservoir levels in Project tributaries at certain times than what would occur under the revised proposed Plan amendments. These effects are discussed in Section 13.7.12.1, *Surface Water* and Section 13.7.18, *Recreation* in relation to HABs but are not discussed further in Sections 13.7.3 through 13.7.20.

Reductions in Sacramento/Delta water supply would be less than those under the revised proposed Plan amendments alone. The magnitude of groundwater-related and other water management response actions and environmental impacts would also be expected to be less under the revised proposed Plan amendments in combination with the 2025 ROD/ITP compared to the revised proposed Plan amendments alone. These effects are not discussed further in Sections 13.7.3 through 13.7.20. Effects on water supply under the 55 w/WSAs + 2025 ROD/ITP and VA + 2025 ROD/ITP scenarios are summarized in Section 13.4, *Changes in Hydrology and Water Supply*, and detailed in Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments* and Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*.

13.7.2 Environmental Analysis of CUL Tribal Beneficial Use Designation

13.7.2.1 Introduction

The Tribal Tradition and Culture (CUL) beneficial use is defined as uses of water that support the cultural, spiritual, ceremonial, or traditional rights or lifeways of California Native American Tribes, including but not limited to, navigation, ceremonies, or fishing, gathering, or consumption of natural aquatic resources, including fish, shellfish, vegetation, and materials. The CUL beneficial use is expressly designed to encompass the great variety of California Native American cultural,

ceremonial, and traditional uses of waters within the State. While not designed to directly protect fish populations and aquatic life, which are protected by other aquatic life beneficial uses, including EST, COLD, WARM, MIGR, SPWN, WILD, and RARE (also referred to as fish and wildlife beneficial uses) that are designed to support aquatic habitats for the production or maintenance of fish populations, consumption activities under the CUL use depend on healthy fish populations. As such, actions to protect the fish and wildlife beneficial uses can be related to, and may indirectly benefit, consumption activities that are culturally significant to tribes and fall under the CUL beneficial use. For example, flow requirements that support fish and aquatic life indirectly support the CUL beneficial use, as long as the fish and other aquatic species are safe to eat. Measures taken to protect fish and wildlife beneficial uses can help ensure that consumption remains possible for tribal communities under the CUL use.

Similarly, CUL, which includes the ceremonial and spiritual significance of fish and wildlife to tribes, is not designed to ensure the protection of water quality for the benefit of fish and wildlife. Protection of aquatic species and ecosystems occurs through the fish and wildlife beneficial uses. However, actions taken to protect fish and wildlife beneficial uses, such as maintaining adequate flows and habitat, also indirectly support the ceremonial and spiritually significant tribal practices that rely on healthy water bodies and fish populations.

The revised proposed Plan amendments designate CUL specifically due to the cultural and spiritual importance of native fish and wildlife, particularly salmon, to tribes. The reasonable protection of CUL as it relates to the tribes' cultural ceremonies and spiritual lifeways that are connected to salmon overlaps with the reasonable protection of the aquatic life beneficial uses identified in the Bay-Delta Plan or designated in the applicable regional water boards' water quality control plans, including the fish and wildlife beneficial uses. Although the CUL beneficial use does not itself authorize implementation actions aimed at protecting fish populations, there is a practical overlap: implementation actions taken to protect aquatic life beneficial uses related to flow, water project operations, and physical habitat restoration, also support the healthy fish populations on which tribal cultural and spiritual uses depend. To the extent that other tribal uses and activities encompassed within the CUL use may be directly supported by flow actions, including for example, navigation, gathering and consumption of natural resources, and immersion ceremonies, the implementation actions protecting the fish and wildlife beneficial uses may also incidentally support those cultural activities and lifeways.

The water quality objectives needed to protect fish and wildlife beneficial uses are addressed by the objectives and program of implementation in the Bay-Delta Plan. The environmental impacts of actions, including flow measures that would provide for the reasonable protection of fish and wildlife beneficial uses are already evaluated relevant to those uses in Chapters 7 and 9 of the Staff Report and are summarized and refined in Sections 13.7.3 through 13.7.21 of this chapter under the revised proposed Plan amendments. The Staff Report evaluates effects of flow requirements and habitat restoration and other measures focused on the Sacramento River and its tributaries, Delta eastside tributaries (including the Calaveras, Cosumnes, and Mokelumne Rivers), Delta outflows, and interior Delta flows (see Sections 13.1 through 13.3). The analyses also may be used to inform future flow-based actions if necessary for the reasonable protection of CUL uses not already addressed in the Bay-Delta Plan. It's possible that additional flow-based water quality objectives or site-specific water right requirements could be considered if it is determined that additional flow is needed to

reasonably protect other tribal uses and activities encompassed within the CUL use, such as tribal cultural ceremonies, swimming, and navigation. Generally, CUL activities like navigation, swimming, and ceremonies are not expected to require more flow than already designated beneficial uses such as REC-1, although it is possible that a ceremony could require more flow at certain places and times.

The future designation of other CUL activities for waterbodies identified in the Bay-Delta Plan would require consideration of regulatory actions that may be necessary to reasonably protect those other cultural activities and lifeways within the CUL uses, such as swimming, consumption of fish, and immersion ceremonies, independent from consideration of regulatory actions intended to protect aquatic beneficial uses (which are addressed elsewhere in this Staff Report). As stated above, the environmental impacts of flow requirements and other actions are evaluated in the pertinent chapters of the Staff Report. In addition, such consideration requires a programmatic evaluation of reasonably foreseeable water quality regulatory controls that may be developed through the State Water Board's Division of Water Quality and the regional water boards' water quality authorities. New beneficial use designations alone, including CUL, do not necessarily mean that additional water quality objectives, restrictions on waste discharges, or other new or different actions will be necessary. Other tribal uses and activities encompassed within the CUL use may be directly supported by water quality objectives and control measures in place for already designated beneficial uses such as Water Contact Recreation (REC-1) and Commercial and Sport Fishing (COMM). Although there are differences between recreational and commercial and sportfishing uses and tribal uses, a water quality objective designed for the protection of one beneficial use may be sufficiently protective of other beneficial uses. That said, there may be instances where REC-1, COMM and other beneficial uses may not be protective of tribal and cultural uses, or where REC-1 or COMM is not designated in a specific waterbody, resulting in the need to consider new water quality objectives or site-specific discharge requirements for the reasonable protection of CUL uses in the watershed.

As stated in Part 2 of the Inland Surface Waters, Enclosed Bays, and Estuaries Plan (ISWEBE), both the consumption component of the CUL use and the T-SUB use "relate to the risks to human health from the consumption," but the T-SUB use "normally involve[s] higher rates of consumption … than those protected under the [general population's] Commercial and Sport Fishing [COMM] and the Tribal and Tradition and Culture beneficial uses." The ISWEBE assumes that the tribal consumption practices under CUL are similar to the general population's consumption practices under COMM. However, consumption of natural resources contemplated under CUL may require additional protections beyond those afforded by COMM, including studies to determine protective levels and the need for potentially more stringent site-specific discharge requirements or new water quality objectives (SWRCB 2017, Chapter 3).

Incidentally, it should be noted that one disadvantage with the CUL designation, as it relates to the spiritual and cultural connection with salmon, is that it may raise somewhat false expectations that certain water quality objectives (e.g., for mercury, polychlorinated biphenyls (PCBs), others) that may support fish consumption within the beneficial use can be readily achievable. This may not be possible in some waters for many decades because the level of persistent pollutants is high. Evidence exists that the ISWEBE sport fish objective for mercury (which applies to COMM, CUL, MAR and WILD beneficial uses) are not achievable for trophic level 4 fish (Black bass, sturgeon). The CUL

designation in the update to the Bay-Delta plan is focused on salmon, not on other species or broader health risks. Eating fish from the Delta regularly can be harmful. Even one fish meal per week from the Delta may not be safe to eat due to high levels of methylmercury. Fishing signs are handled by local county health departments, but many people still fish and eat what they catch. Anadromous salmon are generally safe to eat when it comes to mercury levels (^SWRCB 2017c). Other fish like striped bass, black bass, and sturgeon have mercury levels that are too high to be considered safe for regular consumption. OEHHA health advisories should be followed when consuming fish (OEHHA 2022).

The CUL designation is supported by the cultural and spiritual importance of fish and wildlife and does not constitute evidence of specific consumption practices, ceremonies, collection of aquatic material, swimming, and other activities that are recognized under the CUL use. The latter activities are generally foreseeable at this time. This programmatic analysis is provided to streamline future designation processes and assist the regional water boards with CEQA coverage to the extent possible. Because their specific frequency, duration, and timing on specific waterbodies throughout the Bay-Delta watershed are not yet known, the analysis in this section can only evaluate them at a programmatic level for future designations for these other CUL activities in the Bay-Delta watershed. It describes at a high level the types of activities associated with CUL uses, and the reasonably foreseeable non-flow compliance measures and response actions that may become relevant in a future permit or planning setting. The environmental analyses already evaluate a wide range of foreseeable compliance measures and responses that may result from the Sacramento/Delta updates to the Bay-Delta Plan; therefore, the reasonably foreseeable water quality compliance measures and response actions resulting from a CUL designation are already identified and evaluated as response actions to compliance measures previously identified for possible updates to the Bay-Delta Plan or the applicable regional water boards' water quality control plans. This section identifies where these are evaluated in the Staff Report, including a link to the summary of any adverse environmental effects associated with those means of compliance and response actions, and any mitigation measures to lessen those adverse environmental effects.

T-SUB and SUB are not designated by the Bay-Delta Plan for any waterbodies in the Bay-Delta watershed and are therefore not evaluated, although the analyses below would likely be applicable. T-SUB and SUB uses are for consumption at a greater rate and frequency than those same activities conducted by the general population as part of the COMM beneficial use. The T-SUB and SUB definitions are included in Chapter 2, along with the recognition that a thriving fishery could support fishing at higher consumptive rates; therefore, flow actions for the reasonable protection of fish and wildlife are related to the T-SUB and SUB beneficial uses on the same waters. Individual stream segments could be designated for T-SUB and SUB beneficial uses as appropriate by the regional water boards.

13.7.2.2 Relationship of Tribal Uses of Water with Other Beneficial Uses

Examples of CUL-related uses include (but are not limited to): Long-standing cultural practices tribes have involving aquatic species; The spiritual significance aquatic species occupy within the worldview and lifeways of tribes; Practices that involve body contact with or inadvertent ingestion of water (e.g., ceremonies, navigation, plant preparation, swimming); Gathering of natural aquatic resources, species, vegetation materials; Consumption of fish, shellfish, and natural aquatic

resources tied to a tribe's ceremonial or traditional practices; and, Seasonal or event-based exposure to waters. These activities implicate potential human-health-related risks to various types of exposure pathways (e.g., skin, ingestion).

REC-1 involves uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs. Exposure to contaminants in water from harvesting, fishing, and collection of aquatic plants and contacting water would likely be a similar exposure to that which would occur for activities that are part of the REC-1 use. Exposure to contaminants in water from inadvertently digesting untreated water during basket weaving and food preparation could be at a similar rate and frequency than activities covered under REC-1.

COMM involves uses of water for commercial or recreational collection of fish and shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes. Consumption of fish as part of CUL is presumed to occur at a similar rate as the general population as part of the COMM beneficial use, absent site-specific surveys or studies. Consumption of native fish species, such as anadromous salmon that are low in methylmercury, is associated with CUL. California Native American Tribes historically relied on a variety of fish species for their diets, with anadromous salmon being a particularly important food source.

Consumption of other fish, including warmwater non-native species like bass that bioaccumulate methylmercury at high rates may be more problematic, depending on the consumption rate and duration (e.g., limited during a seasonal ceremony or year-round). The majority of fish consumption advisories in California are issued because of mercury and polychlorinated biphenyls (PCBs) (^SWRCB 2017c). In a few cases, advisories are issued for legacy pesticides (pesticides that are no longer used but remain in the environment, such as dichloro-diphenyl-trichloroethane [DDT]), selenium, or polybrominated diphenyl ethers (PBDEs). Therefore, additional protections beyond those afforded by COMM may be needed to protect CUL, depending on the rate, duration, exposure pathway, and specific aquatic resource being consumed, including studies to determine necessary human health protective levels.

Mercury objectives already apply to waterbodies that are designated with the COMM, WILD, or MAR, although there is evidence that even the mercury objective for COMM may not be attainable in the near term. Additional protection and implementation actions may be needed to protect CUL uses from exposure to other toxins. For example, toxic compounds produced by HABs, such as cyanotoxins, could potentially impair CUL uses such as fishing, gathering materials and ceremonies in polluted water. While there are guidelines available that identify thresholds of cyanotoxins associated with adverse health impacts, there are no specific water quality objectives yet for these compounds to protect human health when contacting water or consuming fish or shellfish. Any water quality objectives or implementation measures that would be developed in the future for cyanotoxins are not necessarily the result of CUL designations. (See Section 13.3.9.2, *Harmful Algal Blooms*, and Appendix H3, Section H3.1.10, *Hydrology and Water Quality – Surface Water*, for descriptions of efforts to address HABs and cyanotoxins in the Sacramento/Delta). It is likely that water quality control measures for HABs are needed to protect other existing beneficial uses such as REC-1. As a result, for waters already designated REC-1 and COMM, the human health protections area already part of the regulatory baseline. REC-1 and COMM includes activities that have human

health exposure pathways, and cyanotoxins are a known hazard to people recreating water and consuming aquatic resources.

The Clean Water Act was intended to clean up the nation's waters, not simply to perpetuate the status quo (33 U.S.C. § 1251(a) ["The objective of this Act is to *restore* and maintain the chemical, physical, and biological integrity of the Nation's waters."] [emphasis added]). This work can be difficult and, in some cases, is constrained by the implementation authority available to the State and regional water boards. The Clean Water Act aims as an interim goal to eliminate all water pollution, to achieve water quality levels to allow waters to be fishable and swimmable. (33 U.S.C. § 1251 (a)(2); 40 CFR § 131.2.) In some cases, we are still aiming to achieve these interim goals. Thus, a designation of beneficial uses is really a starting point for Clean Water Act implementation that can take time and is iterative in nature. The designation of CUL could, in large part recognize the significant overlap of tribal cultural uses with the fishable/swimmable goals of the Clean Water Act to elevate tribal voices and invite important tribal input on already existing processes.

13.7.2.3 Reasonably Foreseeable Compliance Measures and Response Actions

The designation of CUL could result in the need to consider new water quality control measures, including new water quality objectives or site-specific discharge requirements for the reasonable protection of a designated TBU. While these compliance measures are more likely for the designations of T-SUB or SUB in specific water body segments, they are also reasonably foreseeable for future designations of CUL with respect to tribal activities that involve basic body-contact with water and consumption of aquatic resources. As explained above, additional water quality protections would not be required or established for CUL uses if existing protections for REC-1 and COMM already protect the uses involving contact with water, and consumption of aquatic resources. If additional water quality objectives and implementation measures are needed and developed in the future for REC-1 and COMM, these actions are not the result of CUL designation; however, it is reasonably foreseeable that tribal advocacy could accelerate the processes. While waters already designated for REC-1 and COMM are part of the regulatory baseline, the future designation of other CUL activities could lead to more active engagement and on the ground efforts to protect these uses as well as additional CUL uses.

In addition, consumption of fish, shellfish, and natural aquatic resources tied to a tribe's ceremonial or traditional practices could include different methods, rates, and durations of consumption than what occurs under the COMM beneficial use which could result in increased exposure to contaminants. Gathering of natural aquatic resources, species, and vegetation materials could result in exposure to contaminants from, for example, the licking of reeds for basketry, which is unique to tribal uses, and require additional or different control measures. Site-specific discharge requirements or prohibitions may be applicable for specific tribal uses, such as a ceremony at a particular location in close proximity to a specific discharge, or the gathering of materials that are affected by a specific application of pesticide or herbicide.

The water boards have existing regulatory programs that control discharges of waste from wastewater treatment facilities, industrial facilities, urban areas, irrigated agricultural lands, and other sources of wastewater to the Bay-Delta and tributaries. When a regional water board establishes a new water quality objective, an implementation program to achieve that objective must

describe required actions, a timeline for those actions, and the monitoring necessary to determine compliance with the objective. Regional water boards implement the basin plans in part by issuing National Pollutant Discharge Elimination System (NPDES) permits or waste discharge requirements (WDRs) that control discharges of waste (for a more detailed discussion, see Regulation of Waste Discharges, Section 7.12.1.2, *Existing Setting*). NPDES permits typically regulate the discharge of treated sewage, storm water, and other pollutants discharged through a discrete conveyance, such as a pipe, ditch, or channel. NPDES permits include technology-based and, where appropriate, water quality-based effluent limitations.

New water quality objectives or site-specific discharge requirements would be implemented by point-source dischargers (e.g., cities, counties, WWTPs) through site-specific projects to meet the requirements, such as more stringent treatment requirements, prevention or minimization of discharges, dilution and remediation measures. More stringent treatment requirements could result in the construction or modification of wastewater treatment plants (WWTP). The construction of new WWTPs or modification of existing WWTPs is already identified as a response action to support the development of recycled water sources to augment water supply. In addition, changes in hydrology and water supply under the revised proposed Plan amendments could alter the chemical composition of the existing water supply or could encourage the use of other water supply sources, creating the potential for exceedances of discharge requirements. While wastewater districts and agencies often can meet waste discharge requirements through operational changes that do not require construction, in some instances changes may require or result in construction of new or modified wastewater treatment facilities or expansion of existing facilities as analyzed in Impact UT-b under *Changes in Hydrology and Water Supply* (refer to Section 7.20, *Utilities and Service Systems*). Section 7.22, *New or Modified Facilities*, addresses actions that entities may take that would involve construction to modify or build new facilities and infrastructure to supplement or conserve surface water supplies and other construction projects that may result from implementation of the revised proposed Plan amendments. Projects include new or modified drinking water treatment plants, and WWTPs. The designation of CUL is an additional impact mechanism that has been added to the introduction in Section 7.22.

Section 7.22 evaluates construction impacts related to new or modified treatment facilities and actions implemented as part of operation and maintenance of these projects, such as chemical transport, handling, and storage, periodic inspections, brine disposal, repairs, and sediment and debris management and is summarized in Table 13.7.22-3 with applicable mitigation measures. A discussion of common construction and operational impacts and mitigation for all projects is included in the beginning of each resource discussion and also summarized in Table 13.7.22-3. The analysis and impact determinations presented in this section reflect the highest level of potential impact. The specific projects that could be undertaken will depend on several factors, such as project size, feasibility, cost, timeline, and expected outcomes. Depending on the specific project, implementation of mitigation measures may or may not fully reduce all potentially significant impacts to less-than-significant levels.

New water quality objectives or site-specific discharge requirements would also be implemented by agricultural and other dischargers through site-specific projects to meet the requirements for agricultural discharges, and other non-point source WDRs. Discharges of waste that are not subject to NPDES permits typically include runoff from nonpoint sources, such as agricultural and timber

activities and waste discharges to land or to groundwater. WDRs prescribe requirements, such as limitations on temperature, toxicity, or pollutant levels, as to the nature of any discharge. WDRs may also specify conditions where no discharge will be permitted and may include monitoring and reporting requirements. Agricultural water conservation measures, such as reuse of agricultural drainage water and on-field application measures for improved irrigation efficiency (e.g., drip irrigation), would reduce the volume of agricultural drainage. Conservation measures are already evaluated in Sections 7.3 through 7.20 as a water management action in response to reduced Sacramento/Delta supply and summarized in Table 13.7.22-1 with applicable mitigation measures. Potentially significant impacts from the construction of conservation measures are addressed and analyzed in Section 7.22 and summarized in Table 13.7.22-3. This would address best management practices (BMPs) in WDRs that involve movement of sediment to control discharges of waste. The analysis and impact determinations presented in this section reflect the highest level of potential impact. The specific projects that could be undertaken will depend on several factors, such as project size, feasibility, cost, timeline, and expected outcomes. Depending on the specific project, implementation of mitigation measures may or may not fully reduce all potentially significant impacts to less-than-significant levels.

Habitat restoration projects through enforcement actions, voluntary permit actions, and non-regulatory actions are another mechanism that can be used to control contaminants that impact activities involving body-contact with water and consumption of aquatic resources. Under Water Code section 13301, the State Water Board or a regional water board may issue a cease and desist order (CDO) if it finds a discharge or threatened discharge of waste in violation of WDRs or prohibitions. Under Water Code section 13304, the State or regional water board may issue a cleanup and abatement order (CAO) to any person who has discharged or discharges waste into waters of the state, or who has caused or permitted, or threatens to cause or permit, waste to be discharged or deposited where it will be discharged or threatens to create a condition of pollution or nuisance. Civil monetary remedies may be pursued for violations of WDRs, waivers, prohibitions, CDOs, CAOs, and other orders. (See e.g., Wat. Code, § 13350.) Regional water boards can require habitat restoration as part of these enforcement actions that require pollution abatement and restoration of the environment. Under the State Water Board's enforcement policies, a discharger can voluntarily agree to undertake an environmentally beneficial project as part of the settlement for an administrative civil liability (ACL). This allows a portion of the monetary penalty to be used for restoration work. Restoration projects can also be required in WDRs as compensatory mitigation for permitted impacts to aquatic resources, or so-called voluntary permit actions.

Restoration projects also may occur under non-regulatory actions. Numerous habitat restoration activities have already occurred or are taking place by various tribes and other entities, absent any TBU designation. While voluntary habitat restoration projects are not the direct result of a CUL designation, it is the intent of the State Water Board to facilitate these efforts by providing environmental review in this Staff Report that individual projects may tier from if needed, and other streamlined permitting efforts. Tribal restoration projects integrate TEK and address both environmental and cultural priorities, including planting of native plants such as tules that have traditional cultural uses such as fashioning traditional fishing boats and regalia. For example, the Shingle Springs Band of Miwok Indians has stewarded and utilized resources from the waterways of the Sacramento-San Joaquin River Delta for sustenance, medicine, transportation, ceremony, clothing, and shelter among other cultural and subsistence uses, since time immemorial. The tribe

has recently focused on a tract of land near an ancestral village implementing restoration efforts that improve native ecosystem functions including sedge grasses whose roots are used for traditional basket weaving. Earthmoving, construction, modification, and/or enhancement of vegetation cover are examples of possible actions for physical habitat restoration projects. The actual restoration could vary in project scope, magnitude, duration, and methods.

Section 7.21, *Habitat Restoration and Other Ecosystem Projects*, evaluates construction and operational impacts related to habitat restoration and other ecosystem projects and is summarized in Table 13.7.22-2 with applicable mitigation measures. Section 7.21 addresses actions that entities may take to address other ecosystem stressors for the overall goal of improving conditions for fish and wildlife in the Sacramento/Delta. The proposed program of implementation identifies actions that other entities should take to address other ecosystem stressors and provides a framework to incorporate both flow and complementary ecosystem projects such as physical habitat restoration into local cooperative solutions and the VA pathway. In addition, some complementary ecosystem projects may also serve as an implementation mechanism for the proposed cold water habitat objective. These actions collectively include physical habitat restoration (in-Delta and upstream tributary), fish passage improvements (screens, fishways, water temperature control devices [TCDs], dam removal), predatory fish control, and aquatic invasive species control. The designation of CUL is an additional impact mechanism that has been added to the introduction in Section 7.21, *Habitat Restoration and Other Ecosystem Projects*. The analysis and impact determinations presented in this section reflect the highest level of potential impact. The specific projects that could be undertaken will depend on several factors, such as project size, feasibility, cost, timeline, and expected outcomes. Depending on the specific project, implementation of mitigation measures may or may not fully reduce all potentially significant impacts to less-than-significant levels.

Water quality actions to be implemented to protect CUL largely overlap and are similar to actions in response to changes in water supply or overlap with existing requirements established by other permitting programs, state and federal regulations, and voluntary efforts. Thus, many of the requirements have already been implemented and will continue independently from the designation of CUL. Any potential environmental impacts associated with CUL depend upon the specific compliance methods and mitigation selected by the entities responsible for implementing site-specific projects, most of which are public agencies subject to their own CEQA obligations. Although the exact scope and scale of environmental impacts cannot be determined because identifying the exact nature of actions to comply is speculative, upgrades to water treatment facilities, structural BMPs in WDRs, or habitat restoration and associated construction of expanded or new infrastructure are the types of projects that the Staff Report considers to be reasonably foreseeable methods of compliance and acknowledges each of these actions potentially will have environmental impacts.

13.7.2.4 Summary of CUL Tribal Beneficial Use Designation

The environmental analyses cover a wide range of foreseeable compliance measures and responses that may result from the Sacramento/Delta updates to the Bay-Delta Plan, including the reasonably foreseeable water quality compliance measures and response actions resulting from the designation, as well as future designations of other CUL activities. CUL uses may be adequately protected by water quality control measures also needed to reasonably protect REC-1 and COMM; however,

additional water quality control may be needed to protect higher rates of consumption, if surveys or studies of a tribe's consumption activities on specific waterbodies occur and demonstrates a higher protective level is necessary. Tribal engagement and advocacy could accelerate efforts to develop new water quality objectives or site-specific discharge requirements for the reasonable protection of REC-1 and COMM, as well as CUL beneficial uses. Water quality control measures could include new water quality objectives or site specific-waste discharge requirements, which could result in the need for new or modified WWTPs, WDRs that impose conservation measures, and voluntary and enforcement actions that involve habitat restoration. The discussion above points to where these types of projects are evaluated for environmental impacts with mitigation measures identified. It is not known where specific additional CUL uses occur, what the specific uses are, and what, if any, additional water quality controls would be needed to reasonably protect the use. Any additional specificity would invite undue speculation and is outside the scope of what is required in this analysis.

13.7.3 Aesthetics

This section describes the potential impacts on aesthetics that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

13.7.3.1 Impact Analysis

Impact AES-a: Have a substantial adverse effect on a scenic vista

Impact AES-b: Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway

Impact AES-c: Substantially degrade the existing visual character or quality of the site and its surroundings

Because the impact mechanisms that inform the analyses of scenic vistas, scenic resources viewed from within a state scenic highway, and visual character and quality are similar, Impacts AES-a, AES-b, and AES-c are combined and addressed together.

Changes in Hydrology

Regulatory Pathway

Changes in hydrology from implementation of the regulatory pathway would result in changes in water levels at some reservoirs, which could cause altered views (e.g., from highways, trails, or other

viewpoints) from increased severity or duration of bathtub ring[2] effects. The regulatory pathway would have similar effects as evaluated in Section 7.3, *Aesthetics*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in reservoir levels would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reservoir levels under the starting point for the regulatory pathway generally would remain at higher elevations more frequently than evaluated in Section 7.3 due to these refinements. SacWAM results show that average annual changes in water surface elevations in reservoirs would generally be smaller under the 55 w/WSAs scenario (see Section 13.4 and Table H1a2-136 in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*) than under the 55 scenario and more similar to the changes under the Low Flow Alternative (35 and 45 scenarios) presented in Appendix A1 (see Table A1-145 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.3. Cold water habitat provisions in the Bay-Delta Plan would provide flexibility for reservoir operators to manage temperature, flow, and carryover storage in a coordinated manner, which would be expected to reduce the magnitude of the effects.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway would result at times in changes in water levels at some reservoirs on the tributaries with HRL commitments which could at times leave more exposed, barren land along the edges of some reservoirs, very similar to the effects described in Section 9.7.3, *Aesthetics*. Flows under the VA pathway for the revised proposed Plan amendments would generally be lower on the tributaries with HRL commitments than under the regulatory pathway, so the impact on reservoir levels would be less than under the regulatory pathway for the term of the VA pathway. SacWAM results show that the average annual change in water surface elevation under the VA pathway would be the same as or similar to baseline (see Section 13.4 and Appendix H1a2, Table H1a2-136). Changes in hydrology, including changes in reservoir levels, with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat greater, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, changes in water levels at some reservoirs could be large enough to be noticed by viewers at times and could affect scenic vistas, views of reservoirs visible from state scenic highways or national scenic byways, or visual character. Surface water elevations for reservoirs normally fluctuate throughout the year and from year to year. Under the revised proposed Plan amendments,

[2] A line on the stone or other substrate in a reservoir roughly at the high-water point that is visible when water levels recede and expose bare area.

the primary potential effect on views of reservoirs would be associated with potential reservoir drawdown that increases the severity or duration of the bathtub ring effect. Most of the changes in reservoir elevations would be within the historical ranges; however, elevations could be lower more frequently than under baseline for some reservoirs. Under the starting point for the regulatory pathway (55 w/WSAs scenario), additional releases from reservoirs in the winter and spring would be expected to be larger than under the VA pathway, potentially leading to greater changes in reservoir levels relative to baseline. Because flows under the VA pathway would generally be lower than the regulatory pathway, the magnitude of this impact would be less during the term of the VA pathway. These impacts could be potentially significant.

Implementation of Mitigation Measure MM-AES-a–c: 1 will reduce or avoid aesthetics impacts at reservoirs, including export reservoirs. Reservoir operators in the Sacramento/Delta will be required to avoid or reduce aesthetics in their long-term strategies and annual operations plans for implementation of the cold water habitat objective under the regulatory pathway. In addition, under the revised proposed Plan amendments, all reservoir owners and operators are subject to existing regulatory requirements that protect water quality in reservoirs and streams below reservoirs (Mitigation Measure MM-AQUA-a,d: 1). Additionally, in exercising its regulatory authorities related to issuance of new water rights orders or decisions, Federal Energy Regulatory Commission (FERC) licenses, and other future regulatory requirements, the State Water Board will consider aesthetics and ensure that any aesthetics impacts are avoided or reduced. However, unless and until the mitigation is implemented, and due to some uncertainty that remains regarding the precise implementation of the cold water habitat objective measures, impacts from changes in reservoir storage levels on aesthetics, including reservoirs in the plan area and export reservoirs in other regions (Bay Area, San Joaquin Valley, Central Coast, and Southern California) that receive Sacramento/Delta supply remain potentially significant.

Changes in Water Supply

Regulatory Pathway

Changes in water supply from implementation of the regulatory pathway could result in changes in Sacramento/Delta surface water supplies to regions both within and outside of the Sacramento/Delta watershed. The regulatory pathway would have similar effects as evaluated in Section 7.3, including reductions in agricultural water supply that could lead to land conversion resulting in effects on visual character; however, as discussed in Section 13.4, under the starting point for the regulatory pathway changes in water supply under the regulatory pathway would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reductions in agricultural supply under the starting point for the regulatory pathway for the revised proposed Plan amendments generally would be lower than evaluated in Section 7.3 due to these refinements. However, because the water supply adjustments could be modified after initial implementation, flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.3.

Voluntary Agreement Pathway

Changes in water supply from implementation of the VA pathway also would result in reductions in Sacramento/Delta surface water supply; these reductions would primarily affect agricultural uses. A reduction in irrigation water available for existing agricultural lands could lead to removing land from agricultural production with effects on visual character very similar to the effects described in Section 9.7.3. Flows under the VA pathway for the revised proposed Plan amendments would generally be lower than the regulatory pathway on tributaries with HRL commitments, so the reduced Sacramento/Delta water supplies for agricultural uses would be less than under the regulatory pathway for the term of the VA pathway. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, implementation of the revised proposed Plan amendments could result in conversion of agricultural land that could affect aesthetic resources if properties are developed or neglected. A reduction in irrigation water available for existing agricultural lands could result in changes to agricultural production, the types of agricultural uses, or land fallowing. Under the revised proposed Plan amendments, a reduction in irrigation water could result in some land being permanently taken out of production and converted to other uses. If fallowed land was left undeveloped, it could function visually as open space, and the change would not adversely affect scenic vistas or visual character. In some areas, land taken out of agricultural production could be developed for nonagricultural uses, such as the construction of houses, businesses, or other buildings, which could adversely affect existing scenic vistas and could substantially affect the existing visual character. If a property owner abandons use and maintenance of existing structures on land removed from agricultural production, and the property is left to deteriorate, then those features could contribute to rural blight. As discussed in Section 13.8, *Economic Analysis and Other Considerations*, potential effects on food processors under either pathway is not likely to lead to closures of any processing facilities. This reduces or removes the possibility of plant closures as a contributing factor to rural blight. Reductions in agricultural water supply and the potential for converting agricultural lands to nonagricultural uses would be greater compared to baseline. Because flows under the VA pathway would be lower than the regulatory pathway, the magnitude of this impact would be less during the term of the VA pathway. These impacts could be potentially significant.

Mitigation Measure MM-AES-a–c: 2, which incorporates Mitigation Measure MM-AG-a,e to reduce the conversion of agricultural land to other uses, would reduce or avoid aesthetic impacts under the revised proposed Plan amendments. However, unless and until the mitigation is implemented, any visual impacts from agricultural land conversion that results in neglected and blighted property remain potentially significant.

13.7.4 Agriculture and Forest Resources

This section describes the potential impacts on agriculture and forest resources that may result from changes in water supply or changes in hydrology under the revised proposed Plan amendments. This

section summarizes previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

13.7.4.1 Impact Analysis

Impact AG-a: Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Important Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use

Impact AG-e: Involve other changes in the existing environment that, due to their location or nature, could result in conversion of important farmland to nonagricultural use

The analyses of conversion of important farmland under Impact AG-a and Impact AG-e are closely related and are, therefore, combined and addressed together.

A conservative threshold of significance for conversion is used that captures the importance of agriculture as a resource in California. All irrigated agriculture is used as a proxy for important farmland. The analysis assumes that any reduction in irrigated crop acreage is important farmland converted to nonagricultural use. This is consistent with the approach to the analysis in Section 7.4, *Agriculture and Forest Resources.*

Reductions in Sacramento/Delta surface water supplies to agriculture could lead to changes in distribution of crop types and acreage and conversion of important farmland to nonagricultural use. In the analysis presented in Section 7.4, *Agriculture and Forest Resources*, and 9.7.4, *Agriculture and Forest Resources*, growers' response to changes in water supply in the valley floor portion of the Sacramento/Delta and San Joaquin Valley regions are estimated using the Statewide Agricultural Production (SWAP) model. SWAP model results are presented in Section 7.4 for the 35, 45, 55, 65, and 75 scenarios, for average and dry hydrologic conditions. SWAP model results are presented in Section 9.7.4 both with and without considering the effects of the unspecified water purchases for average and dry hydrologic conditions. The SWAP model results are referenced in the discussions below where appropriate and to provide additional regional context.

Reductions in Sacramento/Delta surface water supplies to agriculture could also lead to changes in distribution of crop types and acreage in other regions in the study area. In the analysis presented in Section 7.4, changes in crop acreage in areas not modeled using the SWAP model, including the San Francisco Bay Area, Central Coast, and Southern California, are estimated using an analytical approach, the California Sub-Regional Agricultural Analysis (CASRAA) model, that emulates the same optimization process that is used in the SWAP model. The CASRAA model results are referenced in the discussions below where appropriate and to provide additional regional context.

As discussed in Section 7.12.2, *Groundwater*, it is uncertain how all water users may respond to reduced Sacramento/Delta water supply regarding groundwater pumping. The dynamic between potential groundwater resources impacts and potential agricultural impacts creates a challenge for the impact analyses since the majority of groundwater pumping in many areas is for agricultural

irrigation. Because of the uncertainties about groundwater availability and water users' response to reduced Sacramento/Delta supply regarding groundwater pumping, the analyses in Section 7.4 cover a range between *maximum replacement groundwater pumping* and *no replacement groundwater pumping*. This approach captures the breadth of likely responses, which would be somewhere in between; water users likely would increase groundwater pumping to replace some amount of the reduced surface water supplies, but not at volumes sufficient to replace all of the reduced surface water supplies. Assuming lower groundwater replacement pumping by farmers and ranchers in response to decreased surface water supplies will result in lower impact conclusions for groundwater resources but will increase the severity of impact conclusions for agricultural resources (e.g., levels of potential permanent conversion of important farmland). Conversely, assuming higher groundwater replacement pumping by farmers and ranchers increases the severity of impact conclusions for groundwater resources but assumes that more water is available for agriculture, which reduces the severity of impact conclusions for agricultural resources. Importantly, the analysis cannot assume both "worst-case" scenarios simultaneously: there cannot be both maximum potential impacts on groundwater resources from replacement pumping and maximum potential impacts on agricultural resources.

Changes in Water Supply

Regulatory Pathway

Changes in water supply from implementation of the regulatory pathway under the revised proposed Plan amendments would result in reduced Sacramento/Delta surface water supply for agricultural use, particularly in regions that rely heavily on Sacramento/Delta supplies. Reduced Sacramento/Delta surface water supply and increased groundwater use could lead to fallowing of lower-revenue or high-water-use crops such as alfalfa, pasture, and rice, and may accelerate the conversion of irrigated farmland to nonagricultural uses, especially in areas with limited groundwater access or high urban development pressure. Additionally, increased groundwater pumping could reduce the availability of groundwater supply for agricultural uses, which could lead to conversion of groundwater-irrigated land to nonagricultural use. The regulatory pathway would have similar effects as those that were evaluated in Section 7.4; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in water supply would be expected to be more similar to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These adjustments include both watershed-wide adjustments and tributary-specific adjustments. The watershed-wide adjustments would require flows of 55 percent of unimpaired flow during wetter conditions, with required flows at 45 percent of unimpaired flows during intermediate conditions and flows down to 35 percent of unimpaired flow under the driest conditions. The tributary-specific water supply adjustments would allow for additional adjustments in rainfall-dominated and municipal-supply-dominated tributaries, including Putah Creek and the Mokelumne and Calaveras Rivers, that would allow for more frequent reductions in the required flow levels within this range, as well as no new flow requirements during the driest conditions. Changes in distribution of crop types and acreage and conversion of farmland to nonagricultural use, as well as the potential for reduced groundwater availability for agricultural uses under the starting point for the regulatory pathway, would be less than evaluated in Section 7.4 and more similar to the

Low Flow Alternative (35 to 45 scenarios) due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.4.

Voluntary Agreement Pathway

Changes in water supply from implementation of the VA pathway would result in reductions in Sacramento/Delta surface water supplies; these reductions would primarily affect agricultural uses with effects that would be very similar to those described in Section 9.7.4. These changes would be unlikely to substantially affect agricultural water availability or irrigation timing, as compared to baseline conditions, in a manner that would lead to widespread conversion of farmland. Sacramento/Delta water supply reductions under the VA pathway would be based on voluntary measures, including agricultural land fallowing, reservoir reoperations, and groundwater substitution. These measures are designed to minimize impacts on agricultural production by targeting lower-revenue or more water-intensive crops and by leveraging flexible water management strategies. The Sacramento Water Allocation Model (SacWAM) results indicate that the overall reduction in agricultural water supply under the VA pathway would be less than the reduction under the starting point for the regulatory pathway (see Section 13.4). Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Reductions in Sacramento/Delta water supply to agricultural users would vary by region. Table 13.7.4-1 presents SacWAM estimates for regional changes in the amount of Sacramento/Delta water supplied to agricultural users under the starting point for the regulatory pathway (55 w/WSAs scenario) and under the VA pathway (VA scenario).

Table 13.7.4-1. Change from Baseline Conditions: Annual Average Sacramento/Delta Supply for Agricultural Use by Region and Pathway (thousand acre-feet per year)

Region	Annual Average Total Agricultural Supply	Sacramento/ Delta Supply	Change from Baseline	
			55 w/WSAs Scenario	VA Scenario
Sacramento River watershed, Delta eastside tributaries, Delta (Sacramento/Delta)	8,782	5,940	-220	-98 to -211
San Joaquin Valley	16,803	2,445	-60	+48 to -65
San Francisco Bay Area, Central Coast, Southern California	6,055	79	-4	+1
Total	31,640	8,464	-284	-162

Sources: Historical water deliveries data (see Section 2.8, *Existing Water Supply*) and SacWAM results (see Section 13.4, *Changes in Hydrology and Water Supply*).
VA = voluntary agreement; WSAs = water supply adjustments

The estimates presented in Table 13.7.4-1 show that under existing conditions Sacramento/Delta surface water is supplied for agriculture use primarily in the Sacramento/Delta and in the San Joaquin Valley, although a smaller amount of Sacramento/Delta surface water is also supplied to agriculture in the San Francisco Bay Area, Central Coast, and Southern California. These estimates show that changes in flow requirements could result in reductions in agricultural water supply to all regions under the starting point for the regulatory pathway (55 w/WSAs). These reductions in supply would be much lower compared to the 55 flow scenario analyzed in Chapter 7. Based on the SacWAM results presented above (Table 13.7.4-1), changes in Sacramento/Delta water supply to agricultural use under the 55 w/WSAs scenario would be more similar to those under the Low Flow Alternative (35 and 45 scenarios) due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.4.

The VA pathway would also result in a total average annual reduction in Sacramento/Delta surface water supply to agriculture for the term of the VA pathway as shown above in Table 13.7.4-1, although the effects of these changes would vary by region. For the Sacramento/Delta watershed and San Joaquin Valley regions, Table 13.7.4-1 shows a range for the possible change in agricultural water supply from baseline under the VA pathway to reflect the potential sources of water provided through unspecified water purchases. As discussed in Section 9.5, *Changes in Hydrology and Water Supply*, under the VA pathway, unspecified water purchases could be provided from willing sellers in the Sacramento/Delta watershed or from export reductions. Unspecified water purchases could also be provided through a combination of willing sellers in the Sacramento/Delta watershed and from export reductions. The actual change from baseline would be within the range above. Because it is assumed that unspecified water purchases would not be provided from users in the San Francisco Bay Area, Central Coast, and Southern California regions, the results for these regions are not reflected as a range.

The overall reduction in agricultural water supply under the VA pathway would be less than the reduction under the starting point for the regulatory pathway. Reductions in agricultural water supply under the VA pathway would be very similar to those described in Chapter 9. Under the VA pathway, most of the reductions in Sacramento/Delta surface water supply to agriculture would occur for users within the Sacramento/Delta watershed. The SacWAM results show that Sacramento/Delta water supplies to the San Francisco Bay Area, Central Coast, and Southern California could increase slightly on average when compared to baseline. The VA pathway could result in a change in total Sacramento/Delta supplies to the San Joaquin Valley region. The overall effect would be dependent on the sources of the unspecified water purchases, which are not fully known at this time.

Reductions in Sacramento/Delta surface water supplies to agriculture could lead to changes in distribution of crop types and acreage and conversion of important farmland to nonagricultural use. Additional discussion is provided below at the regional level.

Sacramento River Watershed, Delta, and Delta Eastside Tributaries Regions

Table 13.7.4-2 displays SacWAM-estimated reductions in Sacramento/Delta supply for agriculture in the Sacramento River watershed, Delta, and Delta eastside tributaries regions (Sacramento/Delta

watershed) for the starting point for the regulatory pathway (55 w/WSAs) and for the VA pathway by water year type. These results show that annual average reductions in Sacramento/Delta supply for agriculture could range from 220 thousand acre-feet per year (TAF/yr) under the starting point for the regulatory pathway (55 w/WSAs) to 98 to 211 TAF/yr under the VA pathway for the term of the VA pathway across all water year types. The largest reduction in supply under the 55 w/WSAs scenario would occur in critical years. The reductions in annual average Sacramento/Delta supply to agriculture under the 55 w/WSAs scenario would be lower compared to the 55 scenario analyzed in Chapter 7 across the Sacramento/Delta watershed and would be more similar to those under the Low Flow Alternative (35 to 45 scenarios) (see Chapter 6, Table 6.4-1) due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.4.

Changes in Sacramento/Delta water supply under the VA pathway would also result in reduced Sacramento/Delta surface water supply to agricultural users in the Sacramento/Delta watershed. The largest reductions in supply under the VA pathway would occur in dry, below normal, and above normal water years (see Table 13.7.4-2, Chapter 7). The reductions under the VA pathway would be much lower in magnitude compared to the 55 scenario for most water year types but could be similar to the 55 scenario in above normal water years depending on the source of the unspecified water purchases (see Table 7.4-15, Chapter 7). The changes in Sacramento/Delta water supply under the VA pathway would be less compared to the 55 w/WSAs scenario on average across all water year types for the term of the VA pathway.

Table 13.7.4-2. Annual Average Sacramento/Delta Supply to Agriculture in the Sacramento River Watershed, Delta, and Delta Eastside Tributaries Regions: Change from Baseline (thousand acre-feet per year)

Water Year Type	Baseline	55 w/WSAs Scenario	VA Scenario
Critical	5,520	-716	-7 to -72
Dry	5,969	-178	-179 to -337
Below normal	6,066	-121	-182 to -252
Above normal	6,020	-71	-179 to -316
Wet	6,032	-112	-2 to -125
All	5,940	-220	-98 to -211

Source: SacWAM results (See Section 13.4, *Changes in Hydrology and Water Supply*).
VA = voluntary agreement; WSAs = water supply adjustments

Reductions in Sacramento/Delta surface water supplies to agricultural users could lead to changes in distribution of crop types and acreages and conversion of important farmland to nonagricultural use in the Sacramento/Delta. As discussed in Section 7.4, if groundwater is not used to offset Sacramento/Delta surface water supply reductions, the SWAP model results estimate that crop acres primarily in decline under the flow scenarios in the Sacramento/Delta are alfalfa and pasture and rice (see Tables 7.4-17 and 7.4-18, and Figures 7.4-11 and 7.4-12). Some other crops could also experience a decline in acreage in this region under the flow scenarios, but to a lesser extent. The SWAP model results presented in Section 7.4 show that changes in crop acreages under the 35 and 45 scenarios (Low Flow Alternative) would be less than under the 55 scenario.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed presented above in Table 13.7.4-1 and in Section 7.4, the 55 w/WSAs scenario could also lead to a reduction in alfalfa and pasture and rice acreages, but with a much smaller decrease in acreage than under the 55 scenario as compared to baseline. These changes under the 55 w/WSAs scenario would be comparable to changes in crop acreage under the Low Flow Alternative due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.4.

As discussed in Section 9.7.4, SWAP model results for changes in crop acres in the Sacramento/Delta watershed for the VA pathway indicate that there could be a decline in crop acres for the VA pathway, both with and without considering SWAP model estimated effects of unspecified water purchases. These changes would also be less than under the 55 scenario. A large share of the decrease is associated with reduced rice and pasture acreage. Changes in crop acreages with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

San Joaquin Valley Region

Table 13.7.4-3 displays SacWAM-estimated reductions in Sacramento/Delta supply for agriculture use in the San Joaquin Valley region for the starting point for the regulatory pathway (55 w/WSAs) and for the VA pathway by water year type. These results show that annual average change in Sacramento/Delta supply for agricultural use in the San Joaquin Valley could range from -60 TAF/yr under the starting point for the regulatory pathway (55 w/WSAs scenario) to +48 to -65 TAF/yr under the VA pathway (VA scenario) for the term of the VA pathway across all water year types. The reductions in average annual supply to agriculture under the 55 w/WSAs scenario would be substantially less than those under the 55 scenario and would be more similar to those under the Low Flow Alternative (35 to 45 scenarios) (see Table 7.4-19) due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.4.

Under the regulatory pathway, the inclusion of water supply adjustments would reduce water supply impacts to a greater extent for certain agricultural water users. In particular, some CVP contractors in the San Joaquin Valley region receive water supplies that are exported from the Delta. As discussed in Section 13.4, average south of Delta exports for the 55 w/WSAs scenario fall between the baseline and 55 scenario in all months except for April and May. Results for the 55 w/WSAs scenario show increases from baseline in April and May (due primarily to the difference in I:E assumptions between baseline and 55 w/WSAs scenario discussed in Section 13.4), decreases from baseline in June through December, and minimal departures from baseline in January through March. The overall effect would be a reduction in supply to these users on an annual basis, but these increases in supply during April and May would reduce the water supply impacts to CVP south-of-Delta agricultural contractors.

Changes in Sacramento/Delta water supply under the VA pathway would also result in a change in Sacramento/Delta supply to agricultural users in the San Joaquin Valley region. As discussed in Section 9.7.4, the overall effect would be dependent on the sources of the unspecified water purchases, which are not fully known at this time. However, any reduction under the VA pathway would be substantially less than under the 55 scenario. The changes in Sacramento/Delta water supply to agricultural users in the San Joaquin Valley under the VA pathway would be less than or similar to the 55 w/WSAs scenario on average across all water year types, for the term of the VA pathway.

Table 13.7.4-3. Annual Average Sacramento/Delta Supply to Agriculture in the San Joaquin Valley Region: Change from Baseline (thousand acre-feet per year)

Water Year Type	Baseline	55 w/WSAs Scenario	VA Scenario
Critical	1,443	-192	-9 to -74
Dry	2,249	-201	+22 to -136
Below normal	2,414	-25	+47 to -23
Above normal	2,550	81	+45 to -92
Wet	3,101	36	+98 to -25
All	2,445	-60	+48 to -65

Source: SacWAM results (See Section 13.4, *Changes in Hydrology and Water Supply*).
VA = voluntary agreement; WSAs = water supply adjustments

In addition, the revised proposed Plan amendments would be implemented consistent with the water right priority system through curtailments that would apply to water rights under both the regulatory pathway and VA pathway. It is possible that implementation of the water right priority system could result in small reductions to agricultural water supply in the San Joaquin Valley region. Reductions in Sacramento/Delta surface water supplies to agricultural users could lead to changes in distribution of crop types and acreage and conversion of important farmland to nonagricultural use in the San Joaquin Valley region. As discussed in Section 7.4, if groundwater is not used to offset Sacramento/Delta surface water supply reductions, the SWAP results estimate that crop acres primarily in decline under the 35, 45, and 55 scenarios are wheat and field crops, corn and silage, alfalfa and pasture, and almonds and pistachios (see Chapter 7, Tables 7.4-21 and 7.4-22, and Figures 7.4-14 and 7.4-15). Some other crops could also experience a decline in acreage in this region under the 35, 45, and 55 scenarios, but to a lesser extent. The SWAP results presented in Section 7.4 show that changes in crop acreages under the 35 and 45 scenarios (Low Flow Alternative) would be less than under the 55 scenario.

Based on SacWAM results for changes in Sacramento/Delta supply to agriculture in the San Joaquin Valley region presented above in Table 13.7.4-1 and in Section 7.4, the 55 w/WSAs scenario could also lead to a reduction in acreage of wheat and field crops, corn and silage, alfalfa and pasture, and almonds and pistachios and other crops to a lesser extent, but with a much smaller decrease in acreage than under the 55 scenario as compared to baseline. These changes under the 55 w/WSAs scenario would likely be comparable to changes in crop acreage under the Low Flow Alternative. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.4.

The western portion of the San Joaquin Valley is potentially more sensitive to reductions in Sacramento/Delta surface water supplies because of groundwater conditions. In the southern San Joaquin Valley, proximity to multiple groundwater storage banks could help reduce conversions of agricultural land to nonagricultural; however, these banks receive Sacramento/Delta supply, which could also be reduced, and therefore reduce the amount of banked water available for return for agricultural use and lead to conversion within and outside of the San Joaquin Valley. Localized effects could be experienced by the Friant Division if calls on Friant are made by the San Joaquin River exchange contractors in response to reduced Sacramento/Delta supply. Overall, reductions under the 55 w/WSAs scenario for all of these locations at the outset of Plan implementation would be much less than those that could occur under the 55 scenario and more similar to those under the Low Flow Alternative (35 and 45 scenarios) due to water supply adjustments.

As discussed in Section 9.7.4, SWAP results for changes in crop acres in the San Joaquin Valley region for the VA pathway indicate that there could be a decline in crop acres for the VA pathway with and without considering SWAP model estimated effects of unspecified water purchases. A large share of the decrease is estimated to be associated with reduced rice and pasture acreage. Changes in water supply and associated changes in crop acreages with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

San Francisco Bay Area, Central Coast, Southern California Regions

Table 13.7.4-4 displays SacWAM-estimated reductions in Sacramento/Delta supply for agriculture in the San Francisco Bay Area, Central Coast, and Southern California regions for the starting point for the regulatory pathway (55 w/WSAs scenario) and for the VA pathway (VA scenario) by water year type. These results show that annual average changes in Sacramento/Delta supply for agriculture would be estimated to be -4 TAF/yr under the starting point for the regulatory pathway (55 w/WSAs scenario), and +1 TAF/yr under the VA pathway (VA scenario) for the term of the VA pathway. These changes in Sacramento/Delta supply to agriculture in these regions under both the starting point for the regulatory pathway and the VA pathway are less than under the 55 scenario. For the 55 w/WSAs scenario, these changes would be smaller than those under the Low Flow Alternative (35 and 45 scenarios) due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.4.

For the VA pathway, water supply could increase slightly on average but decrease slightly for some water years. However, any reductions in Sacramento/Delta surface water supply to agriculture in these regions would be less than under the 55 w/WSAs scenario and would also be smaller than those under the Low Flow Alternative.

Table 13.7.4-4. Annual Average Sacramento/Delta Supply to Agriculture in the San Francisco Bay Area, Central Coast, Southern California Regions: Change from Baseline (thousand acre-feet per year)

Water Year Type	Baseline	55 w/WSAs Scenario	VA Scenario
Critical	49	-7	-1
Dry	72	-7	0
Below normal	78	-5	+2
Above normal	81	-1	+2
Wet	101	-1	+3
All	79	-4	+1

Source: SacWAM results (See Section 13.4, *Changes in Hydrology and Water Supply*).
VA = voluntary agreement; WSAs = water supply adjustments

Reductions in Sacramento/Delta surface water supplies could lead to changes in distribution of crop types and acreage and conversion of important farmland to nonagricultural use in the San Francisco Bay Area, Central Coast, and Southern California regions. As discussed in Section 7.4, if groundwater is not used to offset Sacramento/Delta surface water supply reductions, the CASRAA results estimate that crop acres primarily in decline under the flow scenarios are alfalfa and pasture and vineyards in the San Francisco Bay Area, vegetables and vineyards in the Central Coast, and deciduous orchards in Southern California (see Chapter 7, Tables 7.4-27, 7.4-28, 7.4-31, 7.4-32, 7.4-35, and 7.4-36; and Figures 7.4-27, 7.4-28, 7.4-29, 7.4-30, 7.4-31, 7.4-32). Some other crops could also experience a decline in acreage in these regions under the flow scenarios, but to a lesser extent. The CASRAA results presented in Section 7.4 show that changes in crop acreage under the 35 and 45 scenarios (Low Flow Alternative) would be less than under the 55 scenario.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed presented above in Table 13.7.4-1 and in Section 7.4, the 55 w/WSAs scenario could also lead to a reduction in acreage of alfalfa and pasture and vineyards in the San Francisco Bay Area, vegetables and vineyards in the Central Coast, and deciduous orchards in Southern California, but with a much smaller decrease than under the 55 scenario as compared to baseline. These changes under the 55 w/WSAs scenario would be similar to or less than those under the low end of the Low Flow Alternative (35 scenario) due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.4.

As discussed in Section 9.7.4, although there could be localized impacts in the San Francisco Bay Area, Central Coast, and Southern California, there would likely be very little to no change in crop acreage in these regions resulting from implementation of the VA pathway. Changes in water supply and associated changes in crop acreages with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Conclusion

Overall, reductions in Sacramento/Delta water supply under the revised proposed Plan amendments could lead to the removal of important farmland from irrigation within the study area, and as a result, to its conversion to nonagricultural uses. If groundwater substitution is used to supplement reductions in surface water supplies, the change in crop acreage could be reduced. Nonetheless, these impacts would be potentially significant.

In addition to the above analysis focused on changes in Sacramento/Delta surface water supplies, the groundwater analyses in Section 7.12.2, Section 9.7.12.2, *Groundwater*, and Section 13.7.12.2, *Groundwater*, show that increased groundwater pumping and reductions in incidental groundwater recharge from applied irrigation could contribute to groundwater overdraft, particularly in areas where groundwater storage volumes are already in decline. If such reductions became severe, either through absolute shortages (i.e., failed wells) or through increased costs of drilling and operating deep wells, farmers could choose to convert groundwater-irrigated land to nonagricultural use. These reductions could particularly affect growers who rely on groundwater in areas where groundwater levels are currently already in decline. In addition, the availability of Sacramento/Delta surface water supply for managed groundwater recharge could decrease. Irrigation or water districts that rely on conjunctive use could, over time, have less water available for agricultural purposes both from surface water and from groundwater. Lower groundwater levels could lead to less flexibility for water management because of an inability to get groundwater supply when or where it is needed, leading to potential conversion of agricultural land to nonagricultural uses. These changes could occur under both the regulatory pathway and under the VA pathway, and impacts would be potentially significant.

Under the regulatory pathway, the proposed Bay-Delta Plan program of implementation promotes local cooperative solutions that could amplify the ecological benefit of new and existing flows with physical habitat restoration and other complementary ecosystem measures. The local cooperative solutions also may reduce the volume of water that needs to be dedicated for instream purposes, resulting in smaller Sacramento/Delta water supply reductions for agriculture.

Implementation of Mitigation Measure MM-AG-a,e: 1 through 5 could avoid or reduce the amount of agricultural conversion as a result of the revised proposed Plan amendments. Water users can and should diversify their water supply portfolios to the extent possible, in an environmentally responsible manner and in accordance with the law. Diversification includes sustainable conjunctive use of groundwater and surface water, water transfers, water conservation and efficiency upgrades, and increased use of recycled water. Farmers are likely to implement efficiency and conservation measures on their own initiative in response to reduced supply. The State Water Board will continue to work with farmers and districts to develop and implement programs to increase water use efficiency and conservation in order to maximize the beneficial use of Sacramento/Delta supplies, including through conditions on discretionary approvals for funding and other approvals as appropriate. In addition, local agencies can and should impose conditions on such approvals to provide the permanent protection of an area of farmland equal to the converted area.

While the State Water Board has some authority to ensure mitigation is implemented for some actions, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the revised proposed Plan amendments. Accordingly, the

State Water Board cannot guarantee that measures will always be adopted or applied to fully mitigate potential impacts. Therefore, unless and until the mitigation is fully implemented, the impacts remain potentially significant.

Changes in Hydrology

Stream and Reservoir Elevation at Diversions

Regulatory Pathway

Changes in hydrology from implementation of the regulatory pathway under the revised proposed Plan amendments could result in reduced streamflow and water levels at some times and locations. At some times for some locations, the lower water levels could affect the usability of existing diversion intakes to divert water for agricultural use, which could potentially lead to conversion of agricultural land to nonagricultural use. This is particularly true on regulated tributaries during summer in drier years because flows on regulated streams are generally stored during winter and spring and released in summer and fall for water supply purposes. Under the baseline condition, flows can be higher during summer and fall than the flow levels that would be required under the regulatory pathway in some locations, particularly on regulated tributaries because as described in Chapter 2, *Hydrology and Water Supply*, water development under existing conditions has resulted in reduced spring flows and artificially high summer flows compared with unimpaired conditions. In locations where water users are not coordinating their diversions, reduced water levels below existing diversion intakes could result in inadequate access to water supply for agriculture. Changes in reservoir levels also could result in conditions where storage levels drop below levels needed for water supply intake diversions and could result in reduced availability of agricultural supply (e.g., at San Luis Reservoir). Increased frequency of water level reductions could lead to construction to modify diversion intake structures to ensure access to water supply. Impacts associated with larger construction projects are evaluated in Section 7.22, *New or Modified Facilities*.

The regulatory pathway would have similar effects as evaluated in Section 7.4; however, as described in Section 13.4, changes in streamflow and reservoir levels under the starting point for the regulatory pathway would be expected to be more similar to the Low Flow Alternative (35 to 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. The likelihood of changes in hydrology affecting the usability of existing diversion intakes to divert water for agricultural use under the starting point for the regulatory pathway would be less than evaluated in Section 7.4 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow on some or all tributaries in the future, impacts could also be as high as those identified in Section 7.4.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway could result in changes in streamflows and reservoir levels that could affect the usability of existing diversion intakes to provide access and divert water for agricultural use. Under the VA pathway, increases in flow are generally expected during the spring months and occasional decreases are expected at some locations during some summer or early fall months. Changes in flows would be less than under the

regulatory pathway; the changes in flow would be expected to be within the historical range of flows seen on tributaries with HRL commitments under the baseline condition with limited effects on water levels. Similarly, the impact on reservoir levels, including export reservoirs, would be less than under the regulatory pathway for the term of the VA pathway. As a result, it is unlikely that the VA pathway would significantly affect use of existing diversion structures and ability to divert water for agricultural use during the term of the VA pathway. Changes in hydrology, and associated effects on stream and reservoir elevation at diversions, with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Overall, changes in hydrology under the revised proposed Plan amendments could have effects that range from less than significant under the VA pathway for the term of the VA pathway, to potentially significant impacts under the regulatory pathway due to reduced access to divert water for agricultural use at some times and at some locations. In the absence of coordination among diverters and, potentially, modifications to diversion intakes at some locations, reduced water volumes in streams during the irrigation season could bring water levels below intakes, limiting diversions and potentially leading to farmland conversion. These impacts could be potentially significant.

Mitigation Measure MM-AG-a,e: 6 identifies actions to help ensure the effectiveness of diversion intakes under the regulatory pathway, including monitoring and coordination activities among water users and modifying intakes. Private individuals and irrigation districts are strongly encouraged to implement these actions. The revised proposed Plan amendments do not include any State Water Board action that would require them to do so. Therefore, unless and until these mitigation measures are implemented, the impacts remain potentially significant.

Sutter and Yolo Bypasses

Regulatory Pathway

Changes in hydrology from implementation of the regulatory pathway under the revised proposed Plan amendments could result in increased inundation of the Sutter and Yolo Bypasses during the planting season (April through June), prompting some farmers in the area to convert land to nonagricultural uses. The regulatory pathway would have similar effects as those evaluated in Section 7.4; however, as described in Section 13.4, under the starting point for the regulatory pathway changes would be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. The likelihood of increased inundation in the Sutter and Yolo Bypasses under the starting point for the regulatory pathway would be less than evaluated in Section 7.4 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.4.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway would result in small changes in streamflow compared to baseline and, similar to the effects described in Section 9.7.4, would not be expected to result in increased inundation of the Sutter and Yolo Bypasses during planting season (April through June). As discussed in Section 9.7.4, while Sutter Bypass inundation is expected to increase under the VA pathway, changes in flow in the Sutter Bypass would primarily be due to changes in operation of the Tisdale Weir notch, rather than direct effects of HRL flow commitments. The HRL participants propose to operate the Tisdale Weir notch to increase flows into the Sutter Bypass during December through mid-March, which would not significantly affect crop production within the Sutter Bypass and conversion of land to nonagricultural uses is unlikely. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

The Sutter and Yolo Bypasses of the Sacramento Valley contain agricultural lands, including important farmland. Typically, floods occur in winter months that do not affect planting or growing of rice or other crops. When floods in the bypasses occur in later spring, it can delay planting and cause a reduction in agricultural productivity.

As discussed in Section 7.4, after flow over Fremont Weir stops, there is a lag of 6 to 8 weeks before planting can occur due to time required for field drainage and preparation. When inflow to the Yolo Bypass stops before early April, the effect on agriculture is much smaller than when inflow stops after early April. It is likely that agriculture in the Sutter Bypass is similarly affected.

Changes in streamflows under the starting point for the regulatory pathway (55 w/WSAs) would not result in large changes in the frequency or extent of inundation in the Sutter and Yolo Bypasses during April through June that would affect agriculture. Based on SacWAM results for the Sutter Bypass near Karnak and Yolo Bypass below Putah Creek inflow, changes in hydrology in the Sutter and Yolo Bypasses under the 55 w/WSAs scenario would be less than the 55 flow scenario analyzed in Chapter 7 and are expected to be more similar to the Low Flow Alternative (35 and 45 scenario) during these months due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.4. Although increases in flows in April and later months would not be large, they could result in some farmland conversion to nonagricultural uses. Under the regulatory pathway, changes in hydrology could overlap with farming activities on the bypass lands, particularly for crops such as rice, pasture, and seasonal row crops typically cultivated in the early growing months. Because land in the bypasses is restricted by easements that preclude landowners from building structures that would significantly obstruct flood flows, any potential conversion likely would be to natural habitat and not development. Although acreage affected under the regulatory pathway likely would be small at the outset of Plan implementation, this impact could be potentially significant.

Under the VA pathway, it is unlikely that changes in flows would significantly increase flows into the Sutter and Yolo Bypasses for the term of the VA pathway during April through June, based on monthly results presented in Section 13.4 for the Yolo Bypass below Putah Creek inflow and Sacramento Slough at the downstream end of the Sutter Bypass. The VA pathway includes a notch in the Tisdale Weir that is proposed to be operated to increase flows into the Sutter Bypass during December through mid-March, which would not significantly affect crop production within the Sutter Bypass.

Overall, changes in hydrology under the revised proposed Plan amendments could have effects that range from less than significant for the term of the VA pathway, to potentially significant under the regulatory pathway associated with increased inundation of the Sutter and Yolo Bypasses that could affect agricultural production and land conversion. These impacts could be potentially significant.

Implementation of Mitigation Measure MM-AG-a,e: 3 and 7 could reduce or avoid disruptions to agricultural operations and associated potential land use conversions from increased inundation in the Sutter and Yolo Bypasses as a result of the revised proposed Plan amendments. Another measure is to communicate and collaborate with farmers to maintain the economic feasibility of continued use of land for agricultural purposes in the bypasses. An interagency coordination group such as the Yolo Bypass and Cache Slough Partnership could serve as a forum for expanding existing efforts and developing additional planning and implementation measures to reduce the impacts on agricultural operations associated with increased floodplain inundation during the planting season. These measures could be implemented in conjunction with planned habitat restoration and other efforts, which could promote multiple beneficial uses within the Yolo Bypass. However, the State Water Board cannot guarantee such implementation. Therefore, unless and until mitigation is implemented, the impact remains potentially significant.

13.7.5 Air Quality

This section describes the potential impacts on air quality that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

13.7.5.1 Impact Analysis

Impact AQ-a: Conflict with or obstruct implementation of the applicable air quality plan

Impact AQ-b: Violate any air quality standard or contribute substantially to an existing or projected air quality violation

Impact AQ-c: Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)

The analyses of activities that generate emissions that could conflict with applicable air quality plans, contribute to National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) violations, and result in project-level and cumulative air quality impacts are closely related and are therefore combined and addressed together under Impacts AQ-a through AQ-c.

Changes in Water Supply

Regulatory Pathway

Changes in water supply from implementation of the regulatory pathway under the revised proposed Plan amendments could result in reductions in Sacramento/Delta water supply that could lead to increased groundwater pumping in response to the reduced supply. The regulatory pathway would have similar effects as evaluated in Section 7.5, *Air Quality*; however, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in water supply would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reductions in water supply under the starting point for the regulatory pathway generally would be lower than evaluated in Section 7.5 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.5.

Voluntary Agreement Pathway

Changes in water supply from implementation of the VA pathway would also result in reductions in Sacramento/Delta surface water supply that would primarily affect agricultural uses. A reduction in irrigation water available for existing agricultural lands could lead to increased groundwater pumping that would result in effects on air quality from use of diesel pumps and generators very similar to the effects described in Section 9.7.5, *Air Quality*. Flows under the VA pathway would generally be lower than under the regulatory pathway on tributaries with HRL commitments, so the reduced Sacramento/Delta water supplies for agricultural uses would be less than under the regulatory pathway for the term of the VA pathway. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be

expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, implementation of the revised proposed Plan amendments would result in reductions in Sacramento/Delta supply, which could lead to increased groundwater pumping to replace supply.

As described in Sections 7.5 and 9.7.5, increases in groundwater pumping would likely be powered by electric pumps. Additional electricity to facilitate such pumping would come from either a renewable or nonrenewable energy source that is already permitted, and thus, no new operational air quality emissions would be expected. However, some portion of groundwater pumping may utilize diesel or other fuels. Depending on the type of fuel used, emissions could vary, and diesel pumps are typically more polluting than pumps powered by other fuels. Diesel pumps would generate exhaust-related emissions and toxic air contaminants during operations. The installation of additional diesel pumps would need to comply with the air pollutant rules and requirements of respective air districts to reduce associated emissions. Based on calendar year 2025 emission factors from the California Emissions Estimator Model (CAPCOA 2022), using an 11-horsepower (model default) diesel pump for 1 hour would generate 4.67 grams of reactive organic gas, 24.43 grams of carbon monoxide (CO), 35.28 grams of nitrogen oxide, 0.065 grams of sulfur dioxide, 1.47 grams of particulate matter less than 10 microns in aerodynamic diameter (PM10), and 1.35 grams of particulate matter less than 2.5 microns in aerodynamic diameter (PM2.5). These emissions would occur locally at the pump source and are well below published air district thresholds. However, depending on the extent of groundwater pumping, multiple diesel-powered pumps could be operating simultaneously within an air district where the combined emissions level of all other groundwater pumping could exceed the applicable air district thresholds.

This impact would be potentially significant. To reduce potential air quality impacts from diesel pumps, entities undertaking or agencies approving these actions would need to implement Mitigation Measure MM-AQ-a–c, which includes provisions such as the use of energy-efficient pumps and equipment alternatives to diesel-fueled pumps, or replacement with electric pumps, that would mitigate criteria air pollutant emissions from groundwater pumping. However, unless and until the mitigation is fully implemented, the impact remains potentially significant.

13.7.6 Biological Resources

13.7.6.1 Terrestrial Biological Resources

This section describes the potential impacts for terrestrial biological resources that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

The revised proposed Plan amendments were developed to improve flow and water quality conditions over a large geographic area, and particularly for fish and wildlife beneficial uses in the

Sacramento River watershed, Delta eastside tributaries, and Delta regions (Sacramento/Delta). Implementation of the revised proposed Plan amendments is expected to improve watershed functions and to provide benefits to terrestrial biological resources associated with the aquatic ecosystem within the tributaries, the Delta, and the Bay. However, there could also be adverse effects on terrestrial biological resources, primarily associated with changes in water supply.

Impact Analysis

Impact TER-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service

Changes in Hydrology

Regulatory Pathway

Changes in hydrology would result in changes in flows that could increase the frequency and duration of inundation in some floodplains in the Sacramento/Delta, affecting natural communities and agriculture, which could in turn affect special-status wildlife species that use these areas. Increases in the frequency and duration of floodplain inundation in the Sutter and Yolo Bypasses and other floodplains in the Sacramento/Delta would generally improve habitat for wintering waterfowl and may benefit some other wildlife species that occur in floodplains. However, an increase in the frequency and duration of flooding in the Yolo and Sutter Bypasses could delay planting crops, as well as increase inundation of natural communities in the bypasses that could affect special-status wildlife species that utilize these areas.

The regulatory pathway would have similar effects as those that were evaluated in Section 7.6.1, *Terrestrial Biological Resources*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in hydrology would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These adjustments include both watershed-wide adjustments and tributary-specific adjustments. The watershed-wide adjustments would require flows of 55 percent of unimpaired flow during wetter conditions, with required flows at 45 percent of unimpaired flows during intermediate conditions and flows down to 35 percent of unimpaired flow under the driest conditions. The tributary-specific water supply adjustments would allow for additional adjustments in rainfall-dominated and municipal-supply-dominated tributaries, including Putah Creek and the Mokelumne and Calaveras Rivers, that would allow for more frequent reductions in the required flow levels within this range, as well as no new flow requirements during the driest conditions. The likelihood of increased inundation of the Yolo and Sutter Bypasses adversely affecting special-status wildlife species under the starting point for the regulatory pathway would be less than evaluated in Section 7.6.1 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

Voluntary Agreement Pathway

Changes in hydrology under the VA pathway would also result in small changes in streamflows compared to baseline and, similar to the effects described in Section 9.7.6.1, *Terrestrial Biological Resources,* would not be expected to result in increased inundation of the Yolo Bypass. The VA pathway includes modifications to Tisdale Weir that would increase the flows into the Sutter Bypass at the Tisdale Weir in December through March by more than 100 thousand acre-feet per year (TAF/yr) on average. Increases in the frequency and duration of floodplain inundation during the winter months would generally improve habitat for wintering waterfowl and may benefit some other wildlife species that occur in floodplains. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Under both the regulatory pathway and VA pathway, increased flows could help restore and maintain natural processes, such as sediment deposition, marsh accretion, nutrient transport, seed dispersal, and flow-related disturbance, which would maintain and improve habitat conditions for native freshwater wetland and riparian species. This benefit would include any special-status plants and wildlife found in these habitats, including freshwater emergent wetlands; seasonal wetlands; seeps, springs, and meadows; and managed wetlands. Increases in Delta inflows and Delta outflows could benefit freshwater marshes and tidal marshes in the Delta and Suisun Bay.

Increases in the frequency and duration of floodplain inundation during the winter months in the Yolo and Sutter Bypasses and other floodplains in the Sacramento/Delta would generally improve habitat for wintering waterfowl and may benefit some other wildlife species that occur in floodplains. However, increased inundation in the Yolo and Sutter Bypasses during the planting season could affect natural communities and agriculture there. Delays in planting crops, as well as the increased inundation of natural communities in the bypasses, could affect special-status wildlife that utilize these areas. Typically, floods occur in winter months that do not affect planting or growing of rice or other crops. However, when floods in the bypasses occur in later spring, it can delay planting and cause a reduction in agricultural productivity. Special-status species that are known to or could occur in the floodplains of the Yolo and Sutter Bypasses include woolly rose-mallow (*Hibiscus lasiocarpos* var. *occidentalis*), grass alisma (*Alisma gramineum*), watershield (*Brasenia schreberi*), bristly sedge (*Carex comosa*), giant gartersnake (*Thamnophis gigas*), western pond turtle (*Emys marmorata*), Swainson's hawk (*B. swainsoni*), white-tailed kite (*Elanus leucurus*), and tricolored blackbird (*Agelaius tricolor*).

As discussed in Section 13.7.4, *Agriculture and Forest Resources*, changes in streamflows under the starting point for the regulatory pathway (55 w/WSAs) would not result in large changes in the frequency or extent of inundation in the Sutter and Yolo Bypasses during April through June that would affect agriculture. Changes in hydrology in the Sutter and Yolo Bypasses under the 55 w/WSAs scenario would be less than the 55 flow scenario analyzed in Chapter 7 and are expected to be more similar to the Low Flow Alternative during these months (see Section 13.4 and Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*). However,

the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries and therefore impacts on special-status wildlife species could also be as high as those identified in Section 7.6.1.

Under the VA pathway, it is unlikely that changes in flows would significantly increase flows into the Sutter and Yolo Bypasses for the term of the VA pathway during April through June, based on monthly results presented in Section 13.4. The VA pathway includes a notch in the Tisdale Weir that is proposed to be operated to increase flows into the Sutter Bypass during December through mid-March, which would not significantly affect crop production within the Sutter Bypass, and therefore would not significantly affect special-status wildlife.

Overall, changes in hydrology under the revised proposed Plan amendments could have effects that range from no impact for the term of the VA pathway to potentially significant under the regulatory pathway associated with increased inundation of the Yolo and Sutter Bypasses. Delays in planting crops, as well as the increased inundation of natural communities in the bypasses, could affect special-status wildlife species that utilize these areas (e.g., giant gartersnake, western burrowing owl (*Athene cunicularia*), white-tailed kite, Swainson's hawk, tricolored blackbird) by making these habitats less available. If some crops are no longer planted in portions of the bypasses due to extended periods of flooding, this could result in a reduction in crop acreage used as agricultural habitat by certain special-status wildlife species, which could be a potentially significant impact.

Implementation of Mitigation Measure MM-TER-a: 1 will reduce or avoid impacts on special-status species that use agricultural habitat in the Sutter and Yolo Bypasses. Mitigation Measure MM-TER a: 1 incorporates Mitigation Measures MM-AG-a,e: 3 and 7 to reduce or avoid disruptions of agricultural operations and associated potential land use conversions due to increased inundation in the Sutter and Yolo Bypasses (see Section 7.4, *Agriculture and Forest Resources,* and Appendix H3, *Mitigation Measures for the Revised Proposed Plan Amendments*). Increased acquisition of conservation easements is one method to encourage continued use of land for agricultural purposes in the bypasses. Another is to communicate and collaborate with farmers to maintain economic feasibility of continued use of land for agricultural purposes in the bypasses. An interagency coordination group such as the Yolo Bypass and Cache Slough Partnership could serve as a forum for expanding existing efforts and developing additional planning and implementation measures to reduce the impacts on agricultural operations associated with increased floodplain inundation during the planting season. These measures could be implemented in conjunction with planned habitat restoration and other efforts, which could promote multiple beneficial uses within the bypasses. However, the State Water Board cannot guarantee such implementation. Unless and until mitigation is implemented, the impact remains potentially significant.

Changes in Water Supply

Reduced Sacramento/Delta Supply to Agriculture and Refuges

Regulatory Pathway

Changes in water supply could benefit some special-status plants and wildlife and negatively affect other special-status wildlife species that rely on Sacramento/Delta water supplied to wildlife refuges and certain agricultural lands. Changes in water supply under the regulatory pathway would result in reduced Sacramento/Delta surface water supply for agricultural use, particularly in regions that

rely heavily on Sacramento/Delta supplies, that could negatively affect special-status wildlife species that rely on water supplied to certain agricultural lands and wildlife refuges. Changes in Sacramento/Delta surface water supplies to wildlife refuges could result in a reduction in the amount of wetland habitat flooded in a given year and could over time result in changes to vegetation communities. The regulatory pathway under the revised proposed Plan amendments would have similar effects to those evaluated in Section 7.6.1; however, as described in Section 13.4, under the starting point for the regulatory pathway reductions in Sacramento/Delta water supply from implementation of the regulatory pathway would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Section 7.6.1 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. The effects of reduced Sacramento/Delta water supply on habitat at wildlife refuges and crop acreage used by special-status species under the starting point of the regulatory pathway would be less than evaluated in Section 7.6.1. However, because the water supply adjustments could be modified after initial implementation, flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

Voluntary Agreement Pathway

Changes in water supply under the VA pathway would also result in reductions in Sacramento/Delta surface water supply; these reductions would primarily affect agricultural uses and could negatively affect special-status wildlife species that rely on Sacramento/Delta water supplied to certain agricultural lands. There would be no expected change in water supply for wildlife refuge uses. Effects on habitat for special-status species would be very similar to those described in Section 9.7.6.1. The Sacramento Water Allocation Model (SacWAM) results indicate that the overall reduction in agricultural water supply under the VA pathway would be less than the reduction under the starting point for the regulatory pathway (see Section 13.4). Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion

Changes in water supply could benefit some special-status plants and wildlife and negatively affect other special-status wildlife species that rely on Sacramento/Delta water supplied to wildlife refuges and certain agricultural lands, including but not limited to, giant gartersnake, tricolored blackbird, Swainson's hawk, northern harrier (*Circus hudsonius*), black tern (*Chlidonias niger*), fulvous whistling duck (*Dendrocygna bicolor*), white-tailed kite, greater sandhill crane (*Grus canadensis tabida*), lesser sandhill crane (*Grus canadensis canadensis*), western burrowing owl, western red bat (*Lasiurus blossevillii*), and yellow-headed blackbird (*Xanthocephalus xanthocephalus*).

Changes in Sacramento/Delta surface water supplies to wildlife refuges could result in a reduction in the amount of wetland habitat flooded in a given year and could over time result in changes to vegetation communities. As discussed in Section 13.4, SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario show limited changes for all water year types that would be assumed to be negligible and are within the expected

precision of the model. These changes are very similar to those for the flow scenarios generated using SacWAM version 2025.08.28 and presented in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*, and are less than those generated using SacWAM version 2023.06.12 and evaluated in Chapter 6 and Chapter 7 for the flow scenarios. As discussed in Section 13.4, refuge priorities were increased relative to other senior demands to reflect provisions of the December 2025 revised draft Bay-Delta Plan intended to prioritize refuge water supplies. However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario and flow scenarios could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past practice of reducing water supplies to Central Valley Project Improvement Act (CVPIA) wildlife refuges when it reduces allocations to Sacramento River settlement contractors and San Joaquin River exchange contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges could at times be larger than indicated by the modeling.

There would be no expected change in Sacramento/Delta water supply for wildlife refuge uses under the VA pathway.

Changes in water supply could negatively affect special-status wildlife species that rely on Sacramento/Delta water supplied to certain agricultural lands. Table 13.7.6.1-1 presents SacWAM estimates for regional changes in the amount of Sacramento/Delta water supplied to agricultural users under the starting point for the regulatory pathway (55 w/WSAs scenario) and under the VA pathway (VA scenario).

Table 13.7.6.1-1. Change from Baseline Conditions: Annual Average Sacramento/Delta Supply for Agricultural Use by Region and Pathway (thousand acre-feet per year)

Region	Annual Average Total Agricultural Supply	Sacramento/ Delta Supply	Change from Baseline	
			55 w/WSAs Scenario	VA Scenario
Sacramento River watershed, Delta eastside tributaries, Delta (Sacramento/Delta)	8,782	5,940	-220	-98 to -211
San Joaquin Valley	16,803	2,445	-60	+48 to -65
San Francisco Bay Area, Central Coast, Southern California	6,055	79	-4	+1
Total	31,640	8,464	-284	-162

Sources: Historical water deliveries data (see Section 2.8, *Existing Water Supply*) and SacWAM results (see Section 13.4, *Changes in Hydrology and Water Supply*).
VA = voluntary agreement; WSAs = water supply adjustments

The estimates presented in Table 13.7.6.1-1 show that under existing conditions Sacramento/Delta surface water is supplied for agriculture use primarily in the Sacramento/Delta and in the San Joaquin Valley, although a smaller amount of Sacramento/Delta surface water is also supplied to agriculture in the San Francisco Bay Area (Bay Area), Central Coast, and Southern California. These estimates show that changes in flow requirements could result in reductions in agricultural water supply to all regions under the starting point for the regulatory pathway (55 w/WSAs). These reductions in supply would be much lower compared to the 55 flow scenario analyzed in Chapter 7. Based on the SacWAM results presented in Table 13.7.6.1-1, changes in Sacramento/Delta water

supply to agricultural use under the 55 w/WSAs scenario would be more similar to those under the Low Flow Alternative (35 and 45 scenarios) due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.6.1.

The VA pathway would also result in a total average annual reduction in Sacramento/Delta surface water supply to agriculture for the term of the VA pathway as shown above in Table 13.7.6.1-1, although the effects of these changes would vary by region. For the Sacramento/Delta watershed and San Joaquin Valley regions, Table 13.7.6.1-1 shows a range for the possible change in agricultural water supply from baseline under the VA pathway to reflect the potential sources of water provided through unspecified water purchases. Unspecified water purchases could be provided from willing sellers in the Sacramento/Delta watershed or from export reductions. Unspecified water purchases could also be provided through a combination of willing sellers in the Sacramento/Delta watershed and from export reductions. The actual change from baseline would be within the range above. Because it is assumed that unspecified water purchases would not be provided from users in the Bay Area, Central Coast, and Southern California regions, the results for these regions are not reflected as a range.

The overall reduction in agricultural water supply under the VA pathway would be less than the reduction under the starting point for the regulatory pathway. Reductions in agricultural water supply under the VA pathway would be very similar to those described in Chapter 9. Under the VA pathway, most of the reductions in Sacramento/Delta surface water supply to agriculture would occur for users within the Sacramento/Delta watershed. The SacWAM results show that Sacramento/Delta water supplies to the Bay Area, Central Coast, and Southern California could increase slightly on average when compared to baseline. The VA pathway could result in a change in total Sacramento/Delta supplies to the San Joaquin Valley region. The overall effect would be dependent on the sources of the unspecified water purchases, which are not fully known at this time.

Reductions in Sacramento/Delta surface water supplies to agriculture could lead to changes in distribution of crop types and acreage and conversion of important farmland to nonagricultural use, which could also affect special-status terrestrial species that use certain agricultural lands as habitat. In the analysis presented in Section 7.4 and Section 9.7.4, *Agriculture and Forest Resources*, growers' response to changes in water supply in the valley floor portion of the Sacramento/Delta and San Joaquin Valley regions are estimated using the Statewide Agricultural Production (SWAP) model. The analysis in Section 13.7.4 discusses that changes in crop acreage under the 55 w/WSAs scenario would be similar to the SWAP model results for change in crop acreage under the Low Flow Alternative identified in Section 7.4 due to water supply adjustments, and change in crop acreage under the VA pathway would be similar to the SWAP model results for changes in crop acreage presented in Section 9.7.4. The SWAP model results are referenced in the species discussions below where appropriate.

The species with the greatest potential to be adversely affected by changes in water supply, based on their rarity and dependence on specific crops and wetland habitat at wildlife refuges, are giant gartersnake, Swainson's hawk, greater sandhill crane, tricolored blackbird, and California black rail (*Laterallus jamaicenses coturniculus*).

Giant Gartersnake

Giant gartersnakes could be affected by changes in rice acreage resulting from reduced Sacramento/Delta water supplies to agriculture. The giant gartersnake uses agricultural areas dominated by rice production, which provide alternative habitat in the absence of wetlands. Giant gartersnakes also use wetland habitat on wildlife refuges and wildlife areas and could be affected by decreased Sacramento/Delta water supplies to wildlife refuges in the Sacramento River watershed and San Joaquin Valley regions.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed and San Joaquin Valley presented above in Table 13.7.6.1-1 and in Sections 7.4 and 13.7.4, each titled *Agriculture and Forest Resources*, the 55 w/WSAs scenario could also lead to a reduction in rice acreage, but with a much smaller decrease in acreage than under the 55 scenario as compared to baseline. As discussed in Section 13.7.4, changes in crop acreage under the 55 w/WSAs scenario would be expected to be comparable to changes in crop acreage under the Low Flow Alternative due to water supply adjustments. The SWAP model results presented in Section 7.4 (Tables 7.4-17 and 7.4-18) suggest that the potential change in rice crop acreage in the Sacramento/Delta watershed would decrease under the Low Flow Alternative by 9,100–14,300 acres (2–3 percent) in average years and 23,600–36,300 acres (4–6 percent) in dry years. The SWAP model results presented in Section 7.4 (Tables 7.4-21 and 7.4-22) suggest that the potential change in rice crop acreage in the San Joaquin Valley would decrease under the Low Flow Alternative by approximately 0–100 acres (0–1 percent) in average years and 0 acres (0 percent) in dry years. These results are also shown in Figure 7.6.1-2. These effects would be less if replacement groundwater pumping is used as a substitute for reduced Sacramento/Delta water supply. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario show limited changes for all water year types that would be assumed to be negligible and are within the expected precision of the model. This suggests that effects on giant gartersnake would also be limited. However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario and flow scenarios could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past practice of reducing water supplies to CVPIA wildlife refuges when it reduces allocations to Sacramento River settlement contractors and San Joaquin River exchange contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges under the 55 w/WSAs scenario could at times be larger than indicated by the modeling.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed and San Joaquin Valley presented above in Table 13.7.6.1-1 and in Section 9.7.4, the VA pathway could also lead to a reduction in rice acreage. The SWAP model results presented in Section 9.7.6.1 (Table 9.7-5) suggest that the potential change in rice crop acreage in the Sacramento/Delta watershed and San Joaquin Valley could decrease by 6,700 acres (1.2 percent) in average years and 5,600 acres (1.0 percent) in dry years. These effects would be less if replacement groundwater pumping is used as a substitute for reduced Sacramento/Delta water

supply. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

The effects of the VA pathway on crop acreage could vary from modeled outcomes. For example, the SWAP model estimates the source of unspecified water purchases based on economic related assumptions. However, the unspecified water purchases would be provided from willing sellers that choose to participate in the water purchase program, and outcomes would likely differ to some extent from modeled outcomes.

There would be no expected change in Sacramento/Delta water supply for wildlife refuge uses under the VA pathway or expected effect on giant gartersnake.

Swainson's Hawk

Changes in Sacramento/Delta water supplies could result in a decrease in the amount of agricultural foraging habitat available to Swainson's hawks. These crop types include alfalfa, irrigated pasture, and other field-grass hay. Changes in Sacramento/Delta water supplies could also potentially result in a reduction in nesting habitat in wildlife refuges.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed and San Joaquin Valley presented above in Table 13.7.6.1-1 and in Sections 7.4 and 13.7.4, each titled *Agriculture and Forest Resources*, the 55 w/WSAs scenario could also lead to a reduction in crops used as Swainson's hawk foraging habitat, but with a much smaller decrease in acreage than under the 55 scenario as compared to baseline. As discussed in Section 13.7.4, changes in crop acreage under the 55 w/WSAs scenario would be expected to be comparable to changes in crop acreage under the Low Flow Alternative due to water supply adjustments. The SWAP model results presented in Appendix A3 suggest that the potential change in acreage of crops that are used as Swainson's hawk habitat in the Sacramento/Delta watershed would decrease under the Low Flow Alternative by 12,100–25,300 acres (3–6 percent) in average years and 24,400–33,700 acres (6–8 percent) in dry years. The SWAP model results presented in Appendix A3 suggest that the potential change in acreage of crops that are used as Swainson's hawk habitat in the San Joaquin Valley would decrease under the Low Flow Alternative by 3,100–14,500 acres (0–1 percent) in average years and 3,900–11,200 acres (0–1 percent) in dry years. These results are also shown in Figure 7.6.1-3. These effects would be less if replacement groundwater pumping is used as a substitute for reduced Sacramento/Delta water supply. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario show limited changes for all water year types that would be assumed to be negligible and are within the expected precision of the model. This suggests that effects on Swainson's hawk would also be limited. However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario and flow scenarios could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past practice of reducing water supplies to CVPIA wildlife refuges

when it reduces allocations to Sacramento River settlement contractors and San Joaquin River exchange contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges under the 55 w/WSAs scenario could at times be larger than indicated by the modeling.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed and San Joaquin Valley presented above in Table 13.7.6.1-1 and in Section 9.7.4, the VA pathway could also lead to a reduction in crops used as foraging habitat for Swainson's hawk. The SWAP model results presented in Section 9.7.6.1 (Table 9.7-6) suggest that the potential change in acreage of crops that are used as Swinson's hawk foraging habitat in the Sacramento/Delta watershed and San Joaquin Valley could decrease by 24,900 acres (1.6 percent) in average years and 24,400 acres (1.7 percent) in dry years. These effects would be less if replacement groundwater pumping is used as a substitute for reduced Sacramento/Delta water supply. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

The effects of the VA pathway on crop acreage could vary from modeled outcomes. For example, the SWAP model estimates the source of unspecified water purchases based on economic related assumptions. However, the unspecified water purchases would be provided from willing sellers that choose to participate in the water purchase program, and outcomes would likely differ to some extent from modeled outcomes.

There would be no expected change in Sacramento/Delta water supply for wildlife refuge uses under the VA pathway or expected effect on Swainson's hawk.

Greater Sandhill Crane

Changes in Sacramento/Delta water supplies could result in a decrease in the amount of agricultural foraging habitat available to greater sandhill cranes. These crop types include: alfalfa, corn, corn silage, grain, irrigated pasture, rice, and other field-grass hay. In addition, changes in Sacramento/Delta water supplies to wildlife refuges in the Sacramento River watershed and San Joaquin Valley regions could result in a reduction in greater sandhill crane foraging and wintering habitat over time.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed and San Joaquin Valley presented above in Table 13.7.6.1-1 and in Sections 7.4 and 13.7.4, each titled *Agriculture and Forest Resources*, the 55 w/WSAs scenario could also lead to a reduction in crops used as greater sandhill crane habitat, but with a much smaller decrease in acreage than under the 55 scenario as compared to baseline. As discussed in Section 13.7.4, changes in crop acreage under the 55 w/WSAs scenario would be expected to be comparable to changes in crop acreage under the Low Flow Alternative due to water supply adjustments. The SWAP model results presented in Appendix A3 suggest that the potential change in acreage of crops that are used as greater sandhill crane habitat in the Sacramento/Delta watershed would decrease under the Low Flow Alternative by approximately 12,600–31,900 acres (1–2 percent) in average years and 47,700–70,900 acres (4–5 percent) in dry years. The SWAP model results presented in Appendix A3 suggest that the potential change in acreage of crops that are used as greater sandhill

crane habitat in the San Joaquin Valley would decrease under the Low Flow Alternative by approximately 6,000–31,800 acres (0–2 percent) in average years and approximately 6,800–31,500 acres (0–2 percent) in dry years. These results are also shown in Figure 7.6.1-4. These effects would be less if replacement groundwater pumping is used as a substitute for reduced Sacramento/Delta water supply. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario show limited changes for all water year types that would be assumed to be negligible and are within the expected precision of the model. This suggests that effects on greater sandhill crane would also be limited. However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario and flow scenarios could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past practice of reducing water supplies to CVPIA wildlife refuges when it reduces allocations to Sacramento River settlement contractors and San Joaquin River exchange contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges under the 55 w/WSAs scenario could at times be larger than indicated by the modeling.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed and San Joaquin Valley presented above in Table 13.7.6.1-1 and in Section 9.7.4, the VA pathway could also lead to a reduction in crops used as habitat for greater sandhill crane. The SWAP model results presented in Section 9.7.6.1 (Table 9.7-7) suggest that the potential change in acreage of crops that are used as greater sandhill crane habitat in the Sacramento/Delta watershed and San Joaquin Valley could decrease by 28,300 acres (0.9 percent) in average years and 31,100 acres (1.0 percent) in dry years. These effects would be less if replacement groundwater pumping is used as a substitute for reduced Sacramento/Delta water supply. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

The effects of the VA pathway on crop acreage could vary from modeled outcomes. For example, the SWAP model estimates the source of unspecified water purchases based on economic related assumptions. However, the unspecified water purchases would be provided from willing sellers that choose to participate in the water purchase program, and outcomes would likely differ to some extent from modeled outcomes.

There would be no expected change in Sacramento/Delta water supply for wildlife refuge uses under the VA pathway or expected effect on greater sandhill crane.

Tricolored Blackbird

Tricolored blackbird populations have become dependent on agricultural lands for nesting and foraging habitat due to a loss of native marsh nesting and nearby feeding habitat. Changes in Sacramento/Delta water supplies could result in a decrease in the amount of nesting and foraging

habitat available to tricolored blackbirds on agricultural lands and wildlife refuges. The crop types used by tricolored blackbird include alfalfa, corn, corn silage, grain irrigated pasture, and rice.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed and San Joaquin Valley presented above in Table 13.7.6.1-1 and in Sections 7.4 and 13.7.4, each titled *Agriculture and Forest Resources*, the 55 w/WSAs scenario could also lead to a reduction in crops used as tricolored blackbird habitat, but with a much smaller decrease in acreage than under the 55 scenario as compared to baseline. As discussed in Section 13.7.4, changes in crop acreage under the 55 w/WSAs scenario would be expected to be comparable to changes in crop acreage under the Low Flow Alternative due to water supply adjustments. The SWAP model results presented in Appendix A3 suggest that the potential change in acreage of crops that are used as tricolored blackbird habitat in the Sacramento/Delta watershed would decrease under the Low Flow Alternative by 12,800–31,800 acres (1–2 percent) in average years and 47,100–69,900 acres (4–6 percent) in dry years. The SWAP model results presented in Appendix A3 suggest that the potential change in acreage of crops that are used as tricolored blackbird habitat in the San Joaquin Valley would decrease under the Low Flow Alternative by 5,900–31,600 acres (0–2 percent) in average years and 6,600–30,900 acres (0–2 percent) in dry years. These results are also shown in Figure 7.6.1-5. These effects would be less if replacement groundwater pumping is used as a substitute for reduced Sacramento/Delta water supply. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario show limited changes for all water year types that would be assumed to be negligible and are within the expected precision of the model. This suggests that effects on tricolored blackbird would also be limited. However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario and flow scenarios could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past practice of reducing water supplies to CVPIA wildlife refuges when it reduces allocations to Sacramento River settlement contractors and San Joaquin River exchange contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges under the 55 w/WSAs scenario could at times be larger than indicated by the modeling.

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture in the Sacramento/Delta watershed and San Joaquin Valley presented above in Table 13.7.6.1-1 and in Section 9.7.4, the VA pathway could also lead to a reduction in crops used as habitat for tricolored blackbird. The SWAP model results presented in Section 9.7.6.1 (Table 9.7-8) suggest that the potential change in acreage of crops that are used as tricolored blackbird habitat in the Sacramento/Delta watershed and San Joaquin Valley could decrease by 28,700 acres (0.9 percent) in average years and 30,600 acres (1.2 percent) in dry years. These effects would be less if replacement groundwater pumping is used as a substitute for reduced Sacramento/Delta water supply. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those

under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

The effects of the VA pathway on crop acreage could vary from modeled outcomes. For example, the SWAP model estimates the source of unspecified water purchases based on economic related assumptions. However, the unspecified water purchases would be provided from willing sellers that choose to participate in the water purchase program, and outcomes would likely differ to some extent from modeled outcomes.

There would be no expected change in Sacramento/Delta water supply for wildlife refuge uses under the VA pathway or expected effect on tricolored blackbird.

California Black Rail

It is possible that reduced Sacramento/Delta water supplies could affect wetland habitat for the Sierra Nevada population of the California black rail. SacWAM modeling does not provide quantitative specificity on how crop acreage may change in the Sierra Nevada foothills; however, agricultural water supplies to the Sierra Nevada foothills could be reduced under both the 55 w/WSAs scenario and the VA scenario, which could include some of the pasture and alfalfa hay fields that are served by open irrigation ditches. As discussed above, under the 55 w/WSAs scenario, reductions in Sacramento/Delta water supply to agriculture would be less than under the 55 scenario analyzed in Section 7.6.1 and more similar to the Low Flow Alternative due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1. Reductions in Sacramento/Delta water supply to agriculture in the Sacramento/Delta watershed under the VA scenario would be less than under the 55 w/WSAs scenario.

Impact Conclusion

Overall, reductions in Sacramento/Delta water supply to agriculture under the revised proposed Plan amendments could lead to changes in crop acreages and, as a result, could reduce habitat for giant gartersnake, Swainson's hawk, greater sandhill crane, and tricolored blackbird over time. In addition, possible reductions in irrigation water in the Sierra Nevada foothills could reduce habitat for the California black rail. If groundwater substitution is used to supplement reductions in surface water supplies, changes in crop acreage could be reduced. Nonetheless, these impacts would be potentially significant.

Under the regulatory pathway, the proposed Bay-Delta Plan program of implementation allows for and encourages local cooperative solutions that would facilitate a combination of flow and non-flow actions to promote habitat restoration to amplify the ecological benefit of new and existing flows. Local cooperative solutions with proven effective habitat restoration may also allow flow requirements lower in the range, therefore reducing the potential impacts associated with reduced Sacramento/Delta water supply to refuges and agriculture and associated impacts on terrestrial species. Local cooperative solutions are required to include measures to avoid or minimize impacts on terrestrial species of concern.

In addition, potentially significant impacts on terrestrial species resulting from habitat loss from reduced Sacramento/Delta water supply to refuges and agriculture could be avoided or reduced through implementation of Mitigation Measures MM-TER-a: 2 through 4. The revised proposed Plan amendments are intended to be implemented in an integrated fashion with habitat restoration and other non-flow measures that would provide benefits for both aquatic and terrestrial species, including actions identified in the program of implementation. Specifically, the proposed program of implementation identifies habitat restoration actions through EcoRestore and other efforts, as well as other non-flow actions that others should take to protect fish and wildlife. In addition, the program of implementation includes a provision for terrestrial species management that specifies the State Water Board's support for species management efforts and federal and state species recovery actions as appropriate, and that the State Water Board will exercise its discretionary authorities to minimize and avoid possible redirected impacts on special-status terrestrial species from actions to implement the Bay-Delta Plan and other actions within the State Water Board's purview, to the extent possible.

Mitigation Measure MM-TER-a: 2.iii identifies a wildlife refuge provision that would provide for the Executive Director of the State Water Board to approve exceptions to curtailment for CVPIA and other wildlife refuge in implementing the numeric flow requirements. This provision could reduce impacts associated with changes in water supply to wildlife refuges. Mitigation Measure MM-TER-a: 2.iv provides State Water Board support for State and federal resources agencies to continue to develop, refine, and implement species recovery plans to protect special-status terrestrial species, including giant gartersnake, Swainson's hawk, greater sandhill crane, tricolored blackbird, and California black rail. A provision for terrestrial species management specifies that the State Water Board will exercise its discretionary authorities to minimize and avoid possible redirected impacts on special-status terrestrial species from actions to implement the Bay-Delta Plan and other actions within the State Water Board's purview, to the extent possible.

In addition, management measures exist that agricultural water users can implement to avoid or minimize impacts on special-status species. While the State Water Board has some authority to ensure that mitigation is implemented for some actions, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the revised proposed Plan amendments. Accordingly, the State Water Board cannot guarantee that measures will always be adopted or applied to fully mitigate potential impacts on terrestrial species. Unless and until the mitigation is fully implemented, these impacts remain potentially significant.

Reduced Sacramento/Delta Supply to Municipal Use

Regulatory Pathway

Reductions in water supply to municipalities, as well as increased water recycling and indoor conservation, could alter the flow and chemical constituent concentrations of wastewater treatment plant (WWTP) influent and subsequently could affect WWTP effluent discharges to receiving waters. In locations where WWTP operators are unable to implement proper adjustments to their facilities, changes in WWTP discharges could result in effects on water quality and flow that could affect special-status terrestrial species occurring in association with streams or riparian and emergent marsh habitat in these streams. Additionally, reduced urban runoff and the dilution of contaminants in that runoff could affect special-status terrestrial species.

The regulatory pathway would have similar effects as those that were evaluated in Section 7.6.1; however, under the starting point for the regulatory pathway changes in hydrology and water supply would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries impacts could also be as high as those identified in Section 7.6.1.

Voluntary Agreement Pathway

Changes in water supply under the VA pathway would also result in reductions in Sacramento/Delta surface water supplies; these reductions would primarily affect agricultural uses with effects that would be very similar to those described in Section 9.7.6.1. The reductions in Sacramento/Delta water supply under the VA pathway would be from voluntary reductions in water supplies that would be largely or entirely from agricultural land fallowing or from reservoir reoperations or based on groundwater substitution that would not be expected to result in any significant municipal supply reductions. Any water supply reductions to municipal water users would be very small and would not be expected to affect flow and chemical constituent concentrations of WWTP influent and subsequently WWTP effluent discharges to receiving waters, or result in effects on special-status plant and wildlife species. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

In locations where WWTP operators are unable to implement proper adjustments to their facilities, changes in WWTP discharges could result in effects on water quality and flow that could affect special-status terrestrial species occurring in association with streams or riparian and emergent marsh habitat in these streams. Affected special-status species could include watershield, grass alisma, bristly sedge, woolly rose-mallow, slough thistle (*Cirsium crassicaule*), silky cryptantha (*Cryptantha crinite*), California satintail (*Imperata brevifolia*), Sanford's arrowhead (*Sagittaria sanfordii*), marsh skullcap (*Scutellaria galericulata*), Brazillian watermeal (*Wolffia brasiliensis*), Wright's trichocoronis (*Trichocoronis wrightii* var. *wrightii*), Horn's milk-vetch (*Astragalus hornii* var. *hornii*), Peruvian dodder (*Cuscuta obtusiflora* var. *glandulosa*), San Diego marsh-elder (*Iva hayesiana*), mud nama (*Nama stenocarpa*), marsh sandwort (*Arenaria paludicola*), La Graciosa thistle (*Cirsium scariosum* var. *loncholepis*), California saw-grass (*Cladium californicum*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), foothill yellow-legged frog (*Rana boylii*), arroyo toad (*Anaxyrus californicus*), California red-legged frog (*Rana draytonii*), western pond turtle, two-striped gartersnake (*Thamnophis hammondii*), South Coast gartersnake (*Thamnophis sirtalis* ssp. *infernalis*), vermillion flycatcher (*Pyrocephalus rubinus)*, western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), northern harrier (*Circus hudsonius*), white-tailed kite, least bittern (*Ixobrychus exilis*), willow flycatcher (*Empidonax traillii*), southwestern willow flycatcher (*Empidonax traillii extimus*), bald eagle (*Haliaeetus leucocephalus*), yellow warbler (*Dendroica petechia*), least Bell's vireo (*Vireo bellii pusillus*), and western red bat.

In addition, reduction in Sacramento/Delta water supply for municipal uses could also ultimately reduce urban runoff. Water quality in some streams may improve due to reduced pollutant loading associated with urban runoff. In some circumstances, however, reductions in flows could reduce the dilution of local sources of contaminants, particularly in streams with low flows that are dominated by relatively high-quality WWTP effluent and have local input of poor-quality water. Additionally, in some situations, reductions of municipal discharges could negatively affect riparian and wetland communities.

Overall, changes in water supply for municipal uses could have effects on terrestrial biological resources ranging from no impact for the term of the VA pathway to potential reductions in the volume and timing of WWTP discharges and urban runoff under the regulatory pathway. The effects of a reduction in municipal discharge related to flow for special-status species, associated riparian and wetland habitat, and sensitive natural communities would likely be beneficial in some locations. In other locations, however, some special-status species and riparian and wetland habitat may now be reliant on these now perennial systems and could be affected by reduced dilution capacity that worsens water quality in these streams. The impacts could be potentially significant.

Implementation of Mitigation Measures MM-TER-a: 5 and 6 will reduce potential violations of waste discharge requirements that could alter instream flows or water quality conditions affecting special-status species. Mitigation Measure MM-TER-a: 5 incorporates Mitigation Measure MM-SW-a,f: 1 for regulation of waste discharges that is accomplished primarily through the State Water Board and regional water board waste discharge permits, including NPDES permits for point-source discharges. A variety of funding programs provide loans and grants for capital improvements to WWTPs. The State Water Board and regional water boards will continue to regulate waste discharges and will continue to promote and support future funding sources as appropriate. Additionally, to avoid or minimize impacts associated with reduced wastewater instream, when processing wastewater change petitions pursuant to Water Code section 1211, the State Water Board will ensure that the change in wastewater discharge does not affect instream flows or water quality for special-status species. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Impact TER-b: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service

Impact TER-c: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marshes, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means

The analyses of effects on sensitive natural communities including riparian habitat and federally protected wetlands are closely related and are therefore combined and addressed together under Impact TER-b and Impact TER-c. As these natural communities may serve as habitat for sensitive terrestrial species, the discussions below may also reiterate analyses made in Impact TER-a.

Changes in Hydrology

Regulatory Pathway

Changes in hydrology under the revised proposed Plan amendments would generally result in riverine flows in the Sacramento/Delta that are similar to or greater than baseline flows during spring. These changes could help support natural processes and potentially improve functions and services of existing wetlands, and could benefit freshwater marshes and tidal marshes in the Delta and Suisun Bay. However, changes in hydrology from implementation of the regulatory pathway would result in changes to reservoir levels, including lower reservoir levels at times in some locations, which could affect associated riparian and wetland habitat. The regulatory pathway would have similar effects as evaluated in Section 7.6.1; however, as described in Section 13.4, under the starting point for the regulatory pathway changes in reservoir levels would be expected to be smaller than under the 55 scenario and more similar to the Low Flow Alternative than those evaluated in Section 7.6.1 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reservoir levels under the starting point for the regulatory pathway generally would remain at higher elevations more frequently than evaluated in Section 7.6.1 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1. Cold water habitat provisions in the Bay-Delta Plan would provide flexibility for reservoir operators to manage temperature, flow, and carryover storage in a coordinated manner, which could reduce the magnitude of the effects on riparian and wetland habitat.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway could also help support natural processes and potentially improve functions and services of existing wetlands; however, could result at times in changes in water levels at some reservoirs on the tributaries with HRL commitments which could affect associated riparian and wetland habitat, very similar to the effects described in Section 9.7.6.1. Flows under the VA pathway for the revised proposed Plan amendments would generally be lower on tributaries with HRL commitments than under the regulatory pathway, so the impact on reservoir levels, including export reservoirs, would be less than under the regulatory pathway for the term of the VA pathway. Actual operation could vary to some degree from modeled outcomes and there could be additional changes in reservoir levels beyond the modeled changes. Changes in hydrology, including changes in reservoir levels, with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat greater, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Changes in hydrology under the revised proposed Plan amendments would generally result in riverine flows in the Sacramento/Delta that are similar to or greater than baseline flows during spring. These changes could help support natural processes such as sediment deposition, marsh

accretion, nutrient transport, seed dispersal, and flow-related disturbance. These changes would also potentially improve functions and services of existing wetlands, such as sediment retention, nutrient uptake, and supporting biological productivity. Increases in Delta inflows and Delta outflows could benefit freshwater marshes and tidal marshes in the Delta and Suisun Bay.

Increased inundated floodplain habitat in the Sacramento/Delta during the wet season months would likely benefit riparian and wetland habitat served by flow-related ecosystem processes such as seasonal increases in groundwater recharge beneath inundated floodplain areas.

Changes in Delta inflows and Delta outflows could benefit freshwater marshes and tidal marshes in the Delta and Suisun Bay. The SacWAM results indicate that average total annual Delta inflow under both the 55 w/WSAs scenario and VA scenario would increase compared to baseline (see Section 13.4). The SacWAM results also indicate that average total annual Delta outflow under both the 55 w/WSAs scenario and VA scenario would increase compared to baseline (see Section 13.4). Changes in Delta inflow and Delta outflow that more closely resemble the natural flow regime to which native species have adapted could benefit wetlands and natural communities in the Delta and Suisun Marsh. Special-status species that use tidal marsh habitat could also benefit.

Changes in hydrology may result in changes to reservoir levels. Overall, changes in water levels at some reservoirs could negatively affect associated riparian and wetland habitats under both the regulatory pathway and the VA pathway. Reservoir levels fluctuate from season to season and between wet and dry years; therefore, any riparian and wetland habitat around reservoirs are subject to fluctuations in reservoir storage levels. As discussed in Section 13.4, SacWAM results for the 55 w/WSAs scenario indicate less fluctuation compared to baseline, but some reservoirs show increased fluctuation under the 55 w/WSAs scenario. Under the VA scenario, most reservoirs experience no change in fluctuation compared to baseline. Historical observations of storage in export reservoirs during periods of lower Sacramento/Delta supplies show lower storage for some reservoirs. Many reservoirs are constructed in steep terrain, and many contain bedrock shorelines, which are not conducive to the establishment of riparian and wetland vegetation. However, some reservoirs do contain shallow shorelines with associated riparian vegetation and wetlands. These impacts would be potentially significant.

Under the regulatory pathway, reservoir operations in the plan area would be addressed through implementation of the cold water habitat objective and other provisions in the program of implementation, such as the ability for several tributaries to work together to meet flow objectives and cold water habitat; however, it is not certain what specific actions reservoir operators and other parties would take to implement the objectives and whether it will be possible to fully mitigate potential impacts on associated riparian habitat and wetlands in all affected areas.

Implementation of Mitigation Measure MM-TER-b,c: 1 will reduce or avoid potential impacts on riparian and wetland habitat. Reservoir operators in the Sacramento/Delta will be required to avoid or reduce impacts on riparian and wetland habitat resources in their long-term strategies and annual operations plans for cold water habitat objective implementation. In addition, Mitigation Measure MM-TER-b,c: 1.ii incorporates Mitigation Measures MM-AQUA-a,d: 1.i-ii. All reservoir owners and operators are subject to existing regulatory requirements that protect water quality in reservoirs and streams below reservoirs, including export reservoirs. In exercising its regulatory authorities, the State Water Board will consider terrestrial biological resources needs and ensure

that impacts are avoided or minimized. However, unless and until the mitigation is implemented, any impacts from changes in reservoir levels on riparian and wetland habitat remain potentially significant.

Changes in Water Supply

Reduced Sacramento/Delta Supply to Refuges and Agriculture

Regulatory Pathway

Changes in water supply could result in reduced Sacramento/Delta water supplies to wildlife refuges and reduced Sacramento/Delta water supplies to agriculture. Decreased supplies could result in a decrease in wetland area over time, and could affect water quality in managed wetlands if those lands receive some or all of their supply from the Sacramento/Delta. The regulatory pathway would have similar effects to those evaluated in Section 7.6.1; however, as described in Section 13.4, modeled changes in water supply to wildlife refuges under the starting point for the regulatory pathway would be smaller than those under the Low Flow Alternative evaluated in Chapter 7 and changes in water supply to agriculture under the starting point for the regulatory pathway would be expected to be smaller and more similar to the Low Flow Alternative than those evaluated in Section 7.6.1 due to addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. Section 13.4 shows the SacWAM results for the starting point for the regulatory pathway (55 w/WSAs scenario) on changes in surface water supply for agriculture and municipal use. Overall, the effects of reduced Sacramento/Delta water supply to wildlife refuges and agriculture and resulting effects on managed wetlands would be less than evaluated in Section 7.6.1. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

Voluntary Agreement Pathway

Changes in water supply under the VA pathway could also affect water quality in managed wetlands if those lands receive some or all of their water supply from the Sacramento/Delta either directly or indirectly and could result in a decrease in wetland area over time. Reductions in water would primarily affect agricultural uses with effects on managed wetlands that would be very similar to those described in Section 9.7.6.1. The memorandum of understanding (MOU) proposing HRL commitments indicates that no flow assets would come from refuge supplies, although wetlands could theoretically experience some indirect effects. It is possible that reductions in agricultural supply could cause reductions in agricultural drainage. The reductions in Sacramento/Delta supplies under the VA pathway could affect water quality in managed wetlands if those lands receive some or all of their water supply from the Sacramento/Delta either directly or indirectly. The total change in Sacramento/Delta water supplies to wildlife refuges and agriculture would be smaller under the VA pathway compared to the starting point for the regulatory pathway (Section 13.4). Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat greater, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

As described under Impact TER-a, changes in water supply could result in reduced Sacramento/Delta water supplies to wildlife refuges in the Sacramento River watershed and San Joaquin Valley regions, which support sensitive wetland vegetation communities. These changes could also result in a decrease of wetland areas over time.

Reductions in Sacramento/Delta supplies could affect water quality in managed wetlands if those lands receive some or all of their water supply from the Sacramento/Delta. Managed wetlands can include many of the wetlands maintained by national wildlife refuges and state wildlife areas; privately owned wetlands such as those managed by duck clubs; and some agricultural croplands that are managed for multiple uses, including waterfowl habitat. The effect is likely to be more substantial in the San Joaquin Valley region, where water quality is already poor. For example, the extensive and ecologically important areas within the Grasslands Ecological Area are fed by a combination of surface water imports, groundwater, and agricultural drainage. Reductions in Sacramento/Delta agricultural supply could cause reductions in agricultural drainage and lowering of groundwater levels. With less Sacramento/Delta supply, the remaining inflow from agricultural drainage and groundwater could become more degraded, and dilution of this low-quality water with fresh surface water supplies could be reduced.

SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario show limited changes for all water year types that would be assumed to be negligible and are within the expected precision of the model. These changes are very similar to those for the flow scenarios generated using SacWAM version 2025.08.28 and presented in Appendix H1a3, and are less than those generated using SacWAM version 2023.06.12 and evaluated in Chapter 6 and Chapter 7 for the flow scenarios. However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past practice of reducing water supplies to CVPIA wildlife refuges when it reduces allocations to Sacramento River settlement contractors and San Joaquin River exchange contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges could at times be larger than indicated by the modeling. There would be no expected change in Sacramento/Delta water supply for wildlife refuge uses under the VA pathway.

Changes in Sacramento/Delta water supply to agricultural use under the 55 w/WSAs scenario would be lower compared to the 55 flow scenario analyzed in Chapter 7 and more similar to those under the Low Flow Alternative (35 and 45 scenarios). The overall reduction in agricultural water supply under the VA pathway would be less than the reduction under the starting point for the regulatory pathway due to water supply adjustments. As a result, under the VA pathway, managed wetlands are unlikely to experience substantial reductions in water supply or water quality due to reductions in agricultural drainage or groundwater levels associated with the VA pathway.

Overall, the effects of changes in Sacramento/Delta water supply to wildlife refuges and agriculture on water quality in managed wetlands could range from less than significant under the VA pathway to potentially significant under the regulatory pathway.

Implementation of Mitigation Measure MM-TER-a: 2 will ensure that habitat protection and restoration actions are implemented to reduce the impact of decreased Sacramento/Delta supplies

to wildlife refuges. Mitigation Measure MM-TER-a: 2.iii identifies a wildlife refuge provision that would provide for the Executive Director of the State Water Board to approve exceptions to curtailment for CVPIA and other wildlife refuges in implementing the numeric flow requirements. Mitigation Measure MM-TER-a: 2.iv provides State Water Board support for State and federal resource agencies to continue to develop, refine, and implement species recovery plans to protect special-status terrestrial species, including giant gartersnake, Swainson's hawk, greater sandhill crane, tricolored blackbird, and California black rail. A provision for terrestrial species management specifies that the State Water Board will exercise its discretionary authorities to minimize and avoid possible redirected impacts on special-status terrestrial species from actions to implement the Bay-Delta Plan and other actions within the State Water Board's purview, to the extent possible. Additionally, implementation of Mitigation Measure MM-TER-a: 5 and Mitigation Measures MM-TER-b,c: 2 and 3 will reduce the impacts from changes in water supply to streams and wetlands that receive agricultural and municipal discharges. Mitigation Measure MM-TER-a: 5 incorporates Mitigation Measure MM-SW-a,f: 1 for regulation of waste discharges, which is accomplished primarily through State Water Board and regional water board waste discharge permits. Mitigation Measure MM-TER-b,c: 2 incorporates Mitigation Measures MM-GW-b: 1 through 7 to reduce impacts of lowered groundwater levels (from reduced agricultural discharge) on riparian and wetland habitat. Mitigation Measure MM-TER- b,c: 3 incorporates Mitigation Measure MM-SW-a,f: 7 to ensure ongoing implementation of actions to address poor-quality agricultural discharges. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Reduced Sacramento/Delta Supply to Agriculture and Municipal Use

Regulatory Pathway

Changes in water supply under the regulatory pathway could result in reduction in supply to municipal and agricultural uses, which could affect sensitive riparian and wetland habitat and other natural communities where agricultural and municipal discharges incidentally supplement flow. In some waterbodies that receive agricultural and municipal discharges, changes in water supply could result in decreased flows. While effects in some locations would be beneficial, some riparian and wetland habitat may now be reliant on these now perennial systems. These habitats also could be affected by reduced dilution capacity that worsens water quality in these streams.

The regulatory pathway under the revised proposed Plan amendments would have similar effects as those that were evaluated in Section 7.6.1; however, as described in Section 13.4, changes in water supply under the starting point for the regulatory pathway would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Section 7.6.1 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. The effects of reductions in water supply under the starting point of the regulatory pathway generally would be lower than evaluated in Section 7.6.1 due to those refinements. However, because water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

Voluntary Agreement Pathway

Changes in water supply from implementation of the VA pathway could also result in reductions in Sacramento/Delta surface water supply. Reductions in agricultural and municipal supply could affect sensitive riparian and wetland habitat and other natural communities where incidental discharge can supplement flow. Sacramento/Delta water supply reductions under the VA pathway would be based on voluntary measures including agricultural land fallowing, reservoir reoperations, and groundwater substitution that would not be expected to result in any significant municipal supply reductions, similar to the effects described in Section 9.7.6.1. SacWAM results also indicate that the overall reduction in agricultural water supply under the VA pathway would be less than the reduction under the starting point for the regulatory pathway (see Section 13.4). Reductions in water supply to municipalities and agriculture would not be large enough to potentially alter the flow and chemical constituent concentrations of WWTP influent and subsequently affect WWTP effluent discharges to receiving waters in a manner that would affect sensitive riparian and wetland habitat or native vegetation. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat greater, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Overall, changes in water supply to municipal and agricultural uses could affect sensitive riparian and wetland habitat and other natural communities where agricultural and municipal discharges incidentally supplement flow. These impacts could range from less than significant under the VA pathway to potentially significant impacts under the regulatory pathway.

The effects of a reduction in agricultural and municipal discharge related to flow for riparian and wetland habitat and sensitive natural communities would likely be beneficial in some locations. Some riparian and associated wetland communities could benefit from the flow requirements and associated changes in Sacramento/Delta supply, which could provide for a more natural flow regime to which these natural communities have adapted. However, in other locations, some riparian and wetland habitat may be reliant on these now perennial systems and could be affected by reduced dilution capacity that worsens water quality in these streams. This would be a potentially significant impact.

Implementation of Mitigation Measure MM-TER-a: 5 and Mitigation Measure MM-TER-b,c: 2 and 3 will reduce the impacts from changes in water supply to streams and wetlands that receive agricultural and municipal discharges. Mitigation Measure MM-TER-a: 5 incorporates Mitigation Measure MM-SW-a,f: 1 for regulation of waste discharges, which is accomplished primarily through the State Water Board and regional water board waste discharge permits. Mitigation Measure MM-TER-b,c: 2 incorporates Mitigation Measure MM-GW-b to reduce impacts of lowered groundwater levels (from reduced agricultural discharge) on riparian and wetland habitat. Mitigation Measure MM-TER-b,c: 3 incorporates Mitigation Measure MM-SW-a,f: 7 to ensure ongoing implementation of actions to address poor-quality agricultural discharges. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Groundwater-Dependent Natural Communities

Regulatory Pathway

As discussed in more detail in Section 7.12.2, *Groundwater*, lower groundwater levels could occur as a result of increased groundwater pumping in response to reduced Sacramento/Delta supply, and less incidental recharge from excess applied irrigation water in some locations. Potential changes in groundwater levels could affect riparian and wetland habitat, sensitive groundwater-dependent natural communities, and wetlands in some locations. The regulatory pathway would have similar effects as those that were evaluated in Section 7.6.1; however, as described in Section 13.4, under the starting point for the regulatory pathway changes in water supply would be expected to be smaller than the 55 scenario and more similar to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, the likelihood of effects on native species due to lower groundwater levels would be less due to these refinements at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

Voluntary Agreement Pathway

The VA pathway would result in a total average annual reduction in Sacramento/Delta surface water supply and could also lead to increased groundwater pumping in response to reduced Sacramento/Delta supplies, and a reduction in incidental groundwater recharge from excess irrigation. These conditions could affect riparian and wetland habitats and sensitive groundwater-dependent natural communities similar to the effects described in Section 9.7.6.1. Changes in water supply under the VA pathway would generally be less than under the regulatory pathway, and changes in groundwater and potential effects on riparian and wetland habitat, and sensitive groundwater-dependent natural communities and wetlands would be less under the VA pathway than under the regulatory pathway for the term of the VA pathway. Changes in hydrology and water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Overall, reduced Sacramento/Delta supply under the revised proposed Plan amendments could result in increased groundwater pumping and reduced incidental groundwater recharge associated with the over-application of agricultural and municipal irrigation water, both of which would result in decreased groundwater levels, particularly in localized areas.

Changes in groundwater levels could affect groundwater-dependent communities. Sensitive perennial wetland communities, such as fens, bogs, seeps, and marshes could be affected by increased groundwater pumping, particularly in localized areas if additional groundwater pumping occurs in close proximity to wetlands. Some perennial wetlands could be affected by lower groundwater levels and could convert from perennial to seasonal wetlands, particularly in localized areas close to groundwater. There could be instances where lowered groundwater levels from

increased groundwater pumping could affect groundwater-dependent ecosystems, including riparian and wetland habitat and sensitive natural communities. Impacts could be potentially significant.

The regulatory pathway provides for local cooperative solutions that would be required to include measures to coordinate implementation with groundwater management activities, including implementation of the Sustainable Groundwater Management Act (SGMA). In addition, local cooperative solutions may allow flow requirements lower in the range if complementary measures are implemented to provide equivalent protection that reduces potential impacts associated with decreased consumptive water uses, including impacts on groundwater, subject to the requirements of SGMA.

Implementation of Mitigation Measure MM-TER-b,c: 2 will also reduce impacts of lowered groundwater levels on groundwater-dependent ecosystem habitat for both the regulatory and VA pathways. Mitigation Measure MM-TER-b,c: 2 incorporates Mitigation Measure MM-GW-b to ensure oversight and management of actions that could affect groundwater levels. Groundwater impacts and associated impacts on wetlands and sensitive groundwater-dependent natural communities could be reduced by sustainable groundwater management, groundwater storage and recovery, increased use of water recycling from existing facilities, and agricultural and municipal conservation measures. However, unless and until the mitigation is fully implemented, impacts caused by reduced groundwater levels on riparian and wetland habitat and sensitive natural communities remain potentially significant.

Impact TER-d: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites

Changes in Hydrology

Regulatory Pathway

Changes in hydrology are expected to provide a more natural flow regime that generally would benefit riverine and associated wetland and riparian habitat and natural communities in the Sacramento/Delta, which could also benefit associated wildlife. However, changes in water supply for wildlife refuges and agricultural lands under the regulatory pathway could decrease the amount of habitat available for resident and migratory waterfowl and shorebirds. The regulatory pathway would have similar effects as those that were evaluated in Section 7.6.1; however, as discussed in Section 13.4, under the starting point for the regulatory pathway changes in water supply would be expected to be smaller than the 55 scenario and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Section 7.6.1 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These adjustments include both watershed-wide adjustments and tributary-specific adjustments. As such, reductions in supply for wildlife refuges and agricultural lands under the starting point of the regulatory pathway for the revised proposed Plan amendments generally would be lower than evaluated in Section 7.6.1 due to those refinements. However, because water supply adjustments could be modified after initial implementation and flows could be higher

in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.1.

Voluntary Agreement Pathway

Changes in hydrology from increased flows under the VA pathway could also generally benefit riverine and associated wetland and riparian habitat and natural communities in the Sacramento/Delta, which could also benefit associated wildlife. However, changes in water supply from implementation of the VA pathway would also result in reductions in Sacramento/Delta surface water supplies; these reductions would primarily affect agricultural uses and could decrease the amount of habitat available for resident and migratory waterfowl and shorebirds. These effects would be very similar to those described in Section 9.7.6.1. Sacramento/Delta water supply reductions under the VA pathway would be based on voluntary measures, including groundwater substitution. As discussed in Section 13.7.4, SacWAM results indicate that the overall reduction in agricultural water supply under the VA pathway would be less than the reduction under the starting point for the regulatory pathway (see Section 13.4). Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Changes in hydrology from increases flows under the regulatory pathway and VA pathway could generally benefit riverine and associated wetland and riparian habitat and natural communities in the Sacramento/Delta. Native resident and migratory wildlife that use these habitats as migratory corridors or nursery sites could also benefit.

Changes in refuge water supplies could affect resident and migratory waterfowl and shorebirds. Reductions in refuge water supplies would result in decreased amounts of wetland habitat flooded for migratory waterfowl and shorebirds as well as reduced breeding habitat for resident waterfowl and shorebirds over time. In addition, changes in agricultural land use patterns from reduced Sacramento/Delta water supplies to agriculture could affect the movement of migratory waterfowl and shorebirds during migration through the Pacific Flyway. Changes in water supply could result in a decrease in the acreage of agricultural crops that provide foraging habitat for waterfowl. Changes in water supply also could result in decreased acreage of post-harvest flooding of rice fields, which provide wetland habitat for migratory waterfowl and shorebirds.

As discussed in Section 13.4, SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario show limited changes for all water year types that would be assumed to be negligible and are within the expected precision of the model. These changes are very similar to those for the flow scenarios generated using SacWAM version 2025.08.28 and presented in Appendix H1a3, and are less than those generated using SacWAM version 2023.06.12 and evaluated in Chapter 6 and Chapter 7 for the flow scenarios. As discussed in Section 13.4, refuge priorities were increased relative to other senior demands to reflect provisions of the December 2025 revised draft Bay-Delta Plan intended to prioritize refuge water supplies. However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to

wildlife refuges under the 55 w/WSAs scenario and flow scenarios could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past practice of reducing water supplies to CVPIA wildlife refuges when it reduces allocations to Sacramento River settlement contractors and San Joaquin River exchange contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges could at times be larger than indicated by the modeling.

There would be no expected change in Sacramento/Delta water supply for wildlife refuge uses under the VA pathway.

Table 13.7.6.1-1 under Impact TER-a presents SacWAM estimates for regional changes in the amount of Sacramento/Delta water supplied to agricultural users under the starting point for the regulatory pathway (55 w/WSAs scenario) and under the VA pathway (VA scenario). These estimates show that changes in flow requirements could result in reductions in agricultural water supply to all regions under the starting point for the regulatory pathway (55 w/WSAs). These reductions in supply would be much lower compared to the 55 flow scenario analyzed in Chapter 7. Based on the SacWAM results presented in Table 13.7.6.1-1, changes in Sacramento/Delta water supply to agricultural use under the 55 w/WSAs scenario would be more similar to those under the Low Flow Alternative (35 and 45 scenarios). However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.6.1.

The VA pathway would also result in a total average annual reduction in Sacramento/Delta surface water supply to agriculture for the term of the VA pathway as shown in Table 13.7.6.1-1, although the effects of these changes would vary by region as discussed further under Impact TER-a. The overall reduction in agricultural water supply under the VA pathway would be less than the reduction under the starting point for the regulatory pathway. Reductions in agricultural water supply under the VA pathway would be very similar to those described in Chapter 9. Under the VA pathway, most of the reductions in Sacramento/Delta surface water supply to agriculture would occur for users within the Sacramento/Delta watershed. The SacWAM results show that Sacramento/Delta water supplies to the Bay Area, Central Coast, and Southern California could increase slightly on average when compared to baseline. The VA pathway could result in a change in total Sacramento/Delta supplies to the San Joaquin Valley region. The overall effect would be dependent on the sources of the unspecified water purchases, which are not fully known at this time.

Overall, changes in Sacramento/Delta water supply to wildlife refuges and agriculture could have effects on migratory waterfowl and shorebirds that range from no impact under the VA pathway for the term of the VA pathway to potentially significant impacts under the regulatory pathway.

Under the regulatory pathway, the proposed Bay-Delta Plan program of implementation allows for and encourages local cooperative solutions to comply with the applicable Sacramento/Delta inflow and cold water habitat requirements that may utilize the adaptive implementation provisions described in the Plan in combination with other complementary ecosystem protection measures including habitat restoration that provide comparable benefits as would be expected absent the local cooperative solution while reducing the potential impacts associated with reduced

Sacramento/Delta water supply. Local cooperative solutions could reduce impacts on agriculture and associated impacts on terrestrial species.

In addition to local cooperative solutions, implementation of Mitigation Measure MM-TER-a: 2 will minimize the effects on terrestrial species resulting from habitat loss from reduced water supply to refuges and agriculture. Mitigation Measure MM-TER-a: 2 identifies habitat protection and restoration actions that could minimize impacts on terrestrial species. Habitat restoration in the Sacramento/Delta and areas that receive Sacramento/Delta water supplies will reduce potential impacts on terrestrial species associated with reduced Sacramento/Delta water supplies. In addition, refuge managing agencies can and should continue to enhance and maintain habitat at wildlife refuges for special-status terrestrial species. The program of implementation also includes a wildlife refuge provision that would provide for the Executive Director of the State Water Board to approve exceptions to curtailment for CVPIA and other wildlife refuges in implementing the numeric flow requirements. In addition, Mitigation Measure MM-TER-a: 2.iv provides State Water Board support for State and federal resource agencies to continue to develop, refine, and implement species recovery plans to protect special-status terrestrial species. A provision for terrestrial species management specifies that the State Water Board will exercise its discretionary authorities to minimize and avoid possible redirected impacts on special-status terrestrial species from actions to implement the Bay-Delta Plan and other actions within the State Water Board's purview, to the extent possible. However, unless and until the mitigation is fully implemented, impacts remain potentially significant.

13.7.6.2 Aquatic Biological Resources

This section describes the potential impacts on aquatic biological resources that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes impact conclusions from previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

The revised proposed Plan amendments were developed to improve flow and water quality conditions over a large geographic area, and particularly for fish and wildlife beneficial uses in the Sacramento River watershed, Delta eastside tributaries, and Delta regions (Sacramento/Delta). Implementation of the revised proposed Plan amendments is expected to improve watershed functions and to provide associated benefits to the aquatic ecosystem and biological resources within the tributaries, the Delta, and the Bay. For the most part, the revised proposed Plan amendments would have beneficial effects on aquatic biological resources, including native fish species, and where potential impacts may occur, those impacts would be less than significant. However, while the purpose of the project is to protect native aquatic species, some potentially significant impacts are possible to aquatic species due to circumstances not directly due to the revised proposed Plan amendments.

Those impacts include impacts due to construction and operations of reservoirs and Delta export facilities that interact with the revised proposed Plan amendments. Specifically, as described in more detail below, the construction of reservoirs throughout the Plan area has resulted in loss of access by cold water fish species to upstream cold water habitat making those fish species dependent on cold

water releases from reservoirs. While the revised proposed Plan amendments include measures to provide for temperature protection, it is still possible that there will be temperature increases at some times below some reservoirs that are considered significant because of the existing degraded environmental conditions on those streams.

It is also possible that there will be increases in exports at some times compared to baseline that could increase negative Old and Middle River (OMR) flows and associated entrainment impacts to native fish species, including fish species not listed under the State or federal endangered species acts. However, these increases in exports are driven by changes to other regulatory requirements that have occurred after the baseline for this project was established that are not directly the result of this project, as described further in this section and in Section 13.7.21, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes*.

Recent changes to requirements for operations of the CVP and SWP that are described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, could interact with changes in Sacramento/Delta tributary flows, Delta inflows, Delta outflows, and interior Delta flows under the regulatory and VA pathways, which may affect aquatic biological resources as described below in *Water Temperature*, *Interior Delta Flows*, and *Delta Inflows and Outflows*. The effects of the 2025 LTO ROD and 2025 CDFW ITP (collectively, 2025 ROD/ITP) are evaluated by comparing SacWAM results for changes in hydrology under the starting point for the regulatory pathway and under the VA pathway in combination with the 2025 ROD/ITP (55 w/WSAs + 2025 ROD/ITP and VA + 2025 ROD/ITP scenarios) with results for the 55 w/WSAs scenario and VA scenario and baseline. For the water temperature analysis, the effects of the 2025 ROD/ITP are evaluated by comparing temperature modeling using the SacWAM results for the 55 w/WSAs + 2025 ROD/ITP and VA + 2025 ROD/ITP scenarios with the results for the 55 w/WSAs scenario and VA scenario. As discussed in Section 13.4, *Changes in Hydrology and Water Supply*, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results.

Impact Analysis

Impact AQUA-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service

Impact AQUA-d: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites

The discussion of Impact AQUA-a and Impact AQUA-d is combined because fish migration is integral to the discussion of effects on special-status species generally.

Changes in Hydrology

Changes in Stream Flows

Regulatory Pathway

Changes in hydrology under the regulatory pathway of the revised proposed Plan amendments would alter flows and the timing of flows on Sacramento/Delta tributaries, which would generally result in higher winter and spring flows and a more natural flow regime that would benefit native aquatic species adapted to these hydrologic conditions. These changes would be expected to benefit multiple native fish species including but not limited to Sacramento splittail, Chinook salmon, and steelhead. Increased frequency and duration of floodplain inundation during late winter through spring months also would contribute to production of benthic macroinvertebrate prey and other food supplies that support native fish species. The regulatory pathway would have similar effects as those evaluated in Section 7.6.2, *Aquatic Biological Resources*; however, under the starting point for the regulatory pathway changes would be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, beneficial effects could also be as high as those identified in Section 7.6.2. Increased flows during the winter and spring would be expected to improve ecosystem functions on the tributaries, including by supporting juvenile salmonid rearing within the tributaries and outmigration, including connectivity of flows from tributaries to the Delta.

Voluntary Agreement Pathway

Implementation of the VA pathway could result in changes in hydrology, including changes in streamflow in the tributaries with HRL commitments compared to baseline. Increases in streamflows would generally occur during the spring months, although increases in streamflows could also occur at other times for some tributaries. The VA pathway could also result in reductions in streamflows at times, generally during the fall or early winter months due to refilling of reservoirs, particularly where reservoir reoperations are the source for HRL flow commitments versus land fallowing and groundwater substitution. The changes in streamflow would be smaller than the changes that would occur under the regulatory pathway. As discussed in Chapter 9, *Proposed Voluntary Agreements*, actual operation could vary to some degree from modeled outcomes and there could be additional changes in streamflows beyond the modeled changes. If increased flows on tributaries with HRL commitments are concentrated during winter and spring months, these increases in flow would be expected to benefit native aquatic species, including Chinook salmon and steelhead. Flows at other times of year could also benefit native species. Changes in flows with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Overall, the effects of changes in hydrology in Sacramento/Delta tributaries of the revised proposed Plan amendments and associated impacts on aquatic biological resources, including fish, would be

beneficial or less than significant, consistent with determinations included in Chapters 7 and 9. The revised proposed Plan amendments include a provision that would require the U.S. Bureau of Reclamation (Reclamation) to ensure that implementation of the Bay-Delta Plan, including HRL flow commitments under the VA pathway, does not result in redirected impacts to native fish and wildlife resources in the Trinity River watershed, including temperature and instream flow impacts. Therefore, there would be no impacts to the Trinity River.

Water Temperature

Water temperature is a key factor in defining habitat suitability for aquatic organisms. Exposure of Chinook salmon and steelhead populations to elevated water temperature is a major factor contributing to their decline (see Chapter 4, *Other Aquatic Ecosystem Stressors*). Historically, Chinook salmon and steelhead had access to higher elevation habitat, which more consistently provided colder water temperatures suitable for successful spawning and juvenile rearing. With the widespread construction of dams and reservoirs, this access is now blocked, making these species dependent on cold water releases below reservoirs during warmer periods, particularly the summer and fall. The ability to maintain cold water below reservoirs during the summer and fall is affected by reservoir storage levels and releases. Higher storage levels going into the late spring and through the fall generally help to maintain cold water releases during the warmer summer and fall months for different runs of salmonids that are in the system at these times. The volume of releases affects how quickly cold water reserves are expended and the extent of cold water habitat provided downstream of the dams. Physical and operational measures, including temperature control devices (TCDs) and seasonal storage management, are employed at some reservoirs within the Sacramento/Delta watershed to help to manage cold water discharges during critical summer and fall spawning and rearing periods for some salmonids. However, as discussed in Section 7.6.2, even with these measures most tributaries with reservoirs have existing temperature management concerns at certain times under baseline conditions that will interact with the revised proposed Plan amendments as described further below.

Regulatory Pathway

Changes in flow and reservoir storage from implementation of the regulatory pathway under the revised proposed Plan amendments could alter water temperature in the Sacramento/Delta watershed and in export reservoir watersheds in a manner similar to what is described in Section 7.6.2; however, as described in Section 13.4, *Changes in Hydrology and Water Supply,* changes in hydrology would be smaller in magnitude and closer to the Low Flow Alternative (35 and 45 scenarios) under the starting point for the regulatory pathway due to water supply adjustments. Accordingly, results of the analysis of water temperature effects on fish under the starting point for the regulatory pathway (55 w/WSAs scenario) described below are generally similar to the results for the Low Flow Alternative (35 and 45 scenarios) for the Feather and American Rivers and generally similar to the results for the 55 scenario for the Sacramento River as presented in Section 7.6.2. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts and benefits could also be as high as those identified in Section 7.6.2.

Voluntary Agreement Pathway

Changes in flow and reservoir storage under the VA pathway could affect stream temperatures and the availability of cold water storage to protect anadromous salmonids and other native fishes. However, changes in flows and reservoir storage under the VA pathway would generally be smaller and closer to baseline conditions than under the regulatory pathway on the tributaries with HRL commitments (see Section 13.4); therefore, temperature effects would be less (closer to baseline) than under the regulatory pathway for the term of the VA pathway. As discussed in Section 9.7.6.2, *Aquatic Biological Resources*, the HRL commitments are in part intended to avoid temperature impacts and include a cold water provision, although the VA pathway would not contribute to the regulatory pathway cold water habitat implementation requirements. An additional water demand reduction program known as the Drought Protection Program is an agreement between Reclamation and the Sacramento River Settlement Contractors that could produce temperature benefits in low storage years by reserving up to 500 TAF in Shasta Reservoir as carryover storage. During the term of the VA pathway, changes in water temperatures and temperature effects on fish would be expected to be similar to those under the VA pathway alone, even with the additional flows and cold water habitat implementation actions taken by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion

Sacramento/Delta Regulated Tributaries

On regulated tributaries, the inflow requirements under the regulatory pathway would generally result in higher spring flows compared to baseline conditions. While higher spring flows that more closely resemble the natural hydrologic regime would benefit native anadromous salmonids and other native species, higher spring flows also could result in reductions in reservoir storage at the end of spring and a smaller cold water volume in summer and fall months.

Regulated tributaries may also experience some reductions in summer and fall flows relative to baseline conditions because the existing flow regime on regulated tributaries can include substantially elevated flows above required flow levels and above unimpaired conditions (i.e., greater than 100 percent unimpaired flow) in summer and fall to supply downstream water diversions. In order to meet instream flow requirements and the cold water habitat objective, and to retain more water in storage for cold water habitat protection, water suppliers may reduce summer water deliveries that are conveyed instream, which could reduce flows on some tributaries at times. Reductions in instream flow can increase the travel time of water, which means that cold reservoir releases can reach equilibrium with warmer air temperatures, and thus result in less instream cold water habitat.

In Section 7.6.2, the HEC-5Q water temperature model was used to simulate water temperatures in three regulated tributaries (the Sacramento, Feather, and American Rivers). Water temperature modeling was repeated for the Sacramento, Feather, and American Rivers and water temperature modeling for the Yuba River was added for this analysis of the revised proposed Plan amendments. Simulated water temperatures at multiple river locations were compared with a suite of temperature indices for riverine life stages of special-status cold water fish. The magnitude of estimated effects on fish varied greatly by species, life stage, and river (see Appendix H1b, *Water*

Temperature Modeling and Fish Assessment for the Sacramento, Feather, American, and Yuba Rivers). This analysis is referred to throughout this section as the water temperature effects analysis.

Chapter 9 describes potential water temperature-related biological effects in several tributaries with HRL commitments, including the Sacramento, American, and Feather Rivers. Updated results for the VA pathway for the Sacramento, American, Feather, and Yuba Rivers are presented in Appendix H1b and described below. Actual operation could vary to some degree from modeled outcomes and there could be additional changes in streamflows, reservoir levels, and water temperatures beyond the modeled changes. For example, the HRL flow commitments include flexibility in the timing of flow, so streamflows and reservoir levels could deviate to some degree from modeled results. In addition, the VA pathway tributary inflow analyses do not assume any additional inflows from unspecified water purchases given the unknown origin of these water purchases. Additional inflows from unspecified water purchases could result in greater temperature effects than described below.

The water temperature effects analysis, including methods used, are summarized in Section 7.6.2, *Aquatic Biological Resources*, and Chapter 9. Additional methods used for Chapter 13 are described in Appendix H1b, *Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, American, and Yuba Rivers*. As described in Appendix H1a, *Sacramento Water Allocation Model Methods,* inputs to SacWAM were modified and updated to create new model runs for the baseline, 35 to 65 scenarios, and the VA scenario. These represent new versions of the scenarios modeled for Chapters 7 and 9. The 55 w/WSAs scenario for the regulatory pathway starting point was also run from this updated version of SacWAM (version 2025.08.28).

Results from these SacWAM runs were used to simulate water temperatures in the Sacramento, Feather, American, and Yuba Rivers. Sacramento, Feather, and American River temperatures had previously been simulated with the SacWAM results for Chapter 7 (SacWAM version 2023.06.12), but the Yuba River temperature model is new. A description of the Yuba River temperature model, the new temperature model results, and fish assessment tables are provided in Appendix H1b*, Water Temperature Modeling and Fish Assessment for the Sacramento, Feather, American, and Yuba Rivers.*

The percentage of time that water temperatures exceed temperature indices for key fish life stages, and the average magnitude of exceedance above the temperature indices, were used to estimate whether there could be unfavorable effects of changes in water temperature on each life stage (see Appendix H1b). In this analysis, many fish temperature indices were used to analyze results for 98 years of simulated temperatures. Results are summarized below as the percent of month-water year type combinations with "favorable" and "unfavorable" effects, with results combined by life stage if more than one temperature index was used for an individual species' or Chinook salmon run's life stage. A "favorable" effect is defined as a month-water year type combination meeting the following criteria: (1) frequency of exceedance above the temperature index under the 55 w/WSAs or VA scenario was >5 percent lower than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index under the 55 w/WSAs or VA scenario was >0.5 degrees Fahrenheit (°F) lower than the exceedance under the baseline. An "unfavorable effect" is defined as a month-water year type combination meeting the following criteria: (1) frequency of exceedance above the temperature index under the 55 w/WSAs or VA scenario was >5 percent higher than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index under the 55 w/WSAs or VA scenario was >0.5°F higher than the exceedance under the baseline.

The temperature model results for the Sacramento, Feather, and American Rivers for Chapter 13 have some differences from the temperature simulations presented in Chapter 7 due to differences between SacWAM versions (described in Appendix H1a) and changes in the HEC-5Q model (described in Appendix H1b). Many of the changes in water temperature are relatively small with no pattern. The most notable changes are warmer reservoir release temperatures for the American River during February through September and cooler reservoir release temperatures for the American and Feather Rivers in December under all scenarios.

In the Sacramento, Feather, and American Rivers, results of the water temperature effects analysis on fish that compare the 35 to 65 scenarios to baseline using output from SacWAM version 2025.08.28 (Appendix H1b) are generally similar to or more favorable to fish than the results using SacWAM version 2023.06.12 runs for the 35 to 65 scenarios presented in Chapter 7. Therefore, the results for water temperature effects on fish for the flow scenarios presented in Chapter 7 are largely consistent with results for the flow scenarios presented in Appendix H1b using output from the most recent version of SacWAM.

This section summarizes the quantitative results of the temperature-related effects analysis on native anadromous fish in the Sacramento, American, Feather, and Yuba Rivers using the water temperature model results for all scenarios, which are presented in Appendix H1b. The analysis includes winter-, spring-, and fall-/late fall-run Chinook salmon; Central Valley steelhead; and green sturgeon. The water temperature index values used to evaluate effects on different life stages are provided in Appendix H1b. Analysis results for all scenarios, as well as summaries, are provided in Appendix H1b.

Sacramento River

A summary of potential temperature-related effects of the regulatory pathway and VA pathway on all races of Chinook salmon in the Sacramento River is provided in Table 13.7.6.2-1. For all races of Chinook salmon, the frequency of favorable and unfavorable effects under the starting point for the regulatory pathway (55 w/WSAs scenario) is similar to the Low Flow Alternative (35 and 45 scenarios) or 55 scenario for adult immigration and adult holding life stages depending on index evaluated (Appendix H1b, Table H1b-69, Table H1b-91, Table H1b-109, Table H1b-110). For the spawning, egg incubation, alevins and fry and juvenile rearing and emigration life stages, there would generally be a higher frequency of favorable effects and lower frequency of unfavorable effects under the 55 w/WSAs scenario compared to the Low Flow Alternative or 55 scenario, depending on index evaluated.

Under the 55 w/WSAs scenario, relatively frequent favorable temperature effects (>8 percent occurrence) are expected for multiple life stages of winter-, spring-, and fall-run Chinook salmon. Unfavorable effects are expected to occur less frequently, with the largest percent (3.3 percent) occurring for fall-run Chinook salmon adult holding (Table 13.7.6.2-1).

For all races, results show that the frequencies of favorable and unfavorable effects under the VA pathway are more similar to baseline than under the regulatory pathway (Table 13.7.6.2-1).

Table 13.7.6.2-1. Summary of Potential Effects of 55 w/WSAs and VA Scenarios on All Races of Chinook Salmon on the Sacramento River

	Winter-Run		Spring-Run		Fall-Run		Late Fall-Run	
Life Stage	55 w/WSAs Scenario	VA Scenario	55 w/WSAs Scenario	VA Scenario	55 w/WSAs Scenario	VA Scenario	55 w/WSAs Scenario	VA Scenario
Adult Immigration								
[a] Favorable	0.0%	0.0%	1.9%	0.0%	2.2%	0.0%	0.0%	0.0%
[b] Unfavorable	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Adult Holding								
Favorable	3.3%	0.0%	8.9%	0.0%	13.3%	0.0%	N/A	N/A
Unfavorable	1.7%	0.0%	2.2%	1.1%	3.3%	0.0%	N/A	N/A
Spawning, Egg Incubation, and Alevins								
Favorable	14.9%	0.7%	21.6%	0.0%	20.0%	0.0%	1.1%	1.1%
Unfavorable	1.7%	0.3%	0.0%	0.0%	0.0%	0.0%	2.3%	0.6%
Fry and Juvenile Rearing and Emigration								
Favorable	11.1%	0.0%	9.4%	0.6%	1.9%	1.0%	9.1%	0.6%
Unfavorable	1.7%	0.3%	1.1%	0.3%	1.0%	0.0%	0.6%	0.0%

Presented as the percent of month-water year type combinations with favorable and unfavorable effects of the 55 w/WSAs or VA scenario compared with baseline at all locations combined.

[a] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% lower than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5 degree Fahrenheit (°F) lower than the exceedance under the baseline.

[b] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% higher than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5°F higher than the exceedance under the baseline.

A summary of potential temperature-related effects of the regulatory pathway and the VA pathway on Central Valley steelhead and green sturgeon in the Sacramento River is provided in Table 13.7.6.2-2. For Central Valley steelhead, the frequency of favorable and unfavorable effects under the starting point for the regulatory pathway (55 w/WSAs scenario) is similar to the Low Flow Alternative (35 and 45 scenarios) or 55 scenario for all life stages depending on index evaluated, except adult holding, for which the 55 w/WSAs scenario is most similar to the 55 scenario (Appendix H1b, Table H1b-142). The frequency of favorable and unfavorable effects on green sturgeon for the 55 w/WSAs scenario is similar to the Low Flow Alternative or 55 scenario for all life stages, depending on index evaluated (Appendix H1b, Table H1b-193).

For the 55 w/WSAs scenario, there is a 30 percent occurrence of favorable effects for steelhead adult holding. Green sturgeon effects, both favorable and unfavorable, occur around 5 percent of the time (Table 13.7.6.2-2).

For both Central Valley steelhead and green sturgeon, results show that the frequencies of favorable and unfavorable effects under the VA pathway are more similar to baseline than under the regulatory pathway (Table 13.7.6.2-2).

Table 13.7.6.2-2. Summary of Potential Effects of 55 w/WSAs and VA Scenarios on Central Valley Steelhead and Green Sturgeon on the Sacramento River

Life Stage	55 w/WSAs Scenario	VA Scenario
(A) Central Valley Steelhead		
Adult Immigration		
[a] Favorable	0.8%	0.0%
[b] Unfavorable	0.0%	0.0%
Adult Holding		
Favorable	30.0%	0.0%
Unfavorable	0.0%	1.7%
Spawning, Egg Incubation, and Alevins		
Favorable	3.7%	0.7%
Unfavorable	0.0%	0.0%
Kelt Emigration		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
Juvenile Rearing		
Favorable	2.2%	0.0%
Unfavorable	0.0%	0.0%
Smoltification		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
Smolt emigration (excluding migrant parr)		
Favorable	0.0%	0.0%
Unfavorable	0.5%	0.0%

Life Stage	55 w/WSAs Scenario	VA Scenario
(B) Green Sturgeon		
Spawning, Egg Incubation, and Alevins		
Favorable	1.3%	1.3%
Unfavorable	5.3%	0.0%
Non-Spawning Adult Presence		
Favorable	3.6%	0.3%
Unfavorable	1.5%	0.0%
Larval and Juvenile Rearing and Emigration		
Favorable	4.6%	0.4%
Unfavorable	1.7%	0.0%

Presented as the percent of month-water year type combinations with favorable and unfavorable effects of the 55 w/WSAs or VA scenario compared with baseline at all locations combined.
[a] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% lower than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5 degree Fahrenheit (°F) lower than the exceedance under the baseline.
[b] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% higher than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5°F higher than the exceedance under the baseline.

American River

A summary of potential temperature-related effects of the regulatory pathway and VA pathway on winter-run and fall-run Chinook salmon and Central Valley steelhead in the American River is provided in Table 13.7.6.2-3. The frequency of favorable and unfavorable effects on winter-run and fall-run Chinook salmon under the starting point for the regulatory pathway (55 w/WSAs scenario) is more similar to the Low Flow Alternative (35 and 45 scenarios) than to the 55 scenario (Appendix H1b, Table H1b-210, Table H1b-212). The frequency of favorable and unfavorable effects on Central Valley steelhead for the 55 w/WSAs scenario is most similar to the 55 scenario (Appendix H1b, Table H1b-223).

For the 55 w/WSAs scenario, the most noticeable effects are a 9.3 and 10.0 percent occurrence of unfavorable effects for steelhead rearing and smolt emigration, respectively (Table 13.7.6.2-3). However, there are some favorable effects for winter-run and fall-run Chinook salmon.

For all three species and races, results show that the frequencies of favorable and unfavorable effects under the VA pathway are more similar to baseline than under the regulatory pathway (Table 13.7.6.2-3).

Table 13.7.6.2-3. Summary of Potential Effects of 55 w/WSAs and VA Scenarios on Winter-Run and Fall-Run Chinook Salmon and Central Valley Steelhead on the American River

Life Stage	55 w/ WSAs Scenario	VA Scenario
(A) Winter-run Chinook salmon		
Non-Natal Rearing		
[a] Favorable	2.0%	0.0%
[b] Unfavorable	0.0%	0.0%

Life Stage	55 w/ WSAs Scenario	VA Scenario
(B) Fall-run Chinook Salmon		
Adult Immigration		
Favorable	0.0%	0.0%
Unfavorable	8.3%	0.0%
Adult Holding		
Favorable	0.0%	0.0%
Unfavorable	6.2%	0.0%
Spawning, Egg Incubation, and Alevins		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
Fry and Juvenile Rearing and Emigration		
Favorable	4.0%	0.0%
Unfavorable	2.0%	0.0%
(C) Central Valley Steelhead		
Adult Immigration		
Favorable	0.7%	0.0%
Unfavorable	0.7%	0.0%
Adult Holding		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
Spawning, Egg Incubation, and Alevins		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
Kelt Emigration		
Favorable	1.3%	0.0%
Unfavorable	0.0%	0.0%
Juvenile Rearing		
Favorable	1.0%	0.0%
Unfavorable	9.3%	1.0%
Smoltification		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
Smolt emigration (excluding migrant parr)		
Favorable	2.9%	0.0%
Unfavorable	10.0%	0.0%

Presented as the percent of month-water year type combinations with favorable and unfavorable effects of the 55 w/WSAs or VA scenario compared with baseline at all locations combined.

[a] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% lower than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5 degree Fahrenheit (°F) lower than the exceedance under the baseline.

[b] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% higher than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5°F higher than the exceedance under the baseline.

Feather River

A summary of potential temperature-related effects of the regulatory pathway and the VA pathway on winter-run, spring-run, and fall-run Chinook salmon in the Feather River is provided in Table 13.7.6.2-4. For winter-run Chinook salmon, there would generally be a higher frequency of favorable effects and lower frequency of unfavorable effects under the starting point for the regulatory pathway (55 w/WSAs scenario) compared to the Low Flow Alternative (35 and 45 scenarios) and 55 scenario, depending on index evaluated (Appendix H1b, Table H1b-247, Table H1b-250, Table H1b-259). For both spring-run and fall-run Chinook salmon, the frequency of favorable and unfavorable effects for the 55 w/WSAs scenario is similar to the Low Flow Alternative (35 and 45 scenarios) or 55 scenario for adult immigration and fry and juvenile rearing and emigration life stages, depending on index evaluated. For the adult holding and spawning and egg incubation life stages, there would generally be a higher frequency of favorable effects and lower frequency of unfavorable effects under the 55 w/WSAs scenario compared to the Low Flow Alternative or 55 scenario, depending on index evaluated.

For the 55 w/WSAs scenario, the most pronounced effect among salmonids is an 8.3 percent occurrence of favorable effects for spring-run Chinook salmon adult holding (Table 13.7.6.2-4).

For all three races of Chinook salmon, results show that the frequencies of favorable and unfavorable effects under the VA pathway are more similar to baseline than under the regulatory pathway (Table 13.7.6.2-4).

Table 13.7.6.2-4. Summary of Potential Effects of 55 w/WSAs and VA Scenarios on Winter-Run, Spring-Run, and Fall-Run Chinook Salmon on the Feather River

	Winter-Run		Spring-Run		Fall-Run	
Life Stage	55 w/WSAs Scenario	VA Scenario	55 w/WSAs Scenario	VA Scenario	55 w/WSAs Scenario	VA Scenario
Non-Natal Rearing						
[a] Favorable	2.2%	0.0%	N/A	N/A	N/A	N/A
[b] Unfavorable	2.2%	0.0%	N/A	N/A	N/A	N/A
Adult Immigration						
Favorable	N/A	N/A	0.0%	0.0%	0.0%	0.0%
Unfavorable	N/A	N/A	0.0%	0.0%	0.0%	0.0%
Adult Holding						
Favorable	N/A	N/A	8.3%	0.0%	4.0%	0.0%
Unfavorable	N/A	N/A	0.0%	1.7%	0.0%	0.0%
Spawning, Egg Incubation, and Alevins						
Favorable	N/A	N/A	3.3%	0.0%	4.0%	0.0%
Unfavorable	N/A	N/A	6.7%	0.0%	6.0%	0.0%
Fry and Juvenile Rearing and Emigration						
Favorable	N/A	N/A	2.5%	0.0%	2.9%	0.0%
Unfavorable	N/A	N/A	0.0%	0.0%	0.0%	0.0%

Presented as the percent of month-water year type combinations with favorable and unfavorable effects of the 55 w/WSAs or VA scenario compared with baseline at all locations combined.

[a] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% lower than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5 degree Fahrenheit (°F) lower than the exceedance under the baseline.

[b] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% higher than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5°F higher than the exceedance under the baseline.

A summary of potential temperature-related effects of the regulatory pathway and the VA pathway on Central Valley steelhead and green sturgeon in the Feather River is provided in Table 13.7.6.2-5. The frequency of favorable and unfavorable effects on Central Valley steelhead under the starting point for the regulatory pathway (55 w/WSAs scenario) is similar to the Low Flow Alternative (35 and 45 scenarios) and 55 scenario depending on index evaluated for all life stages except adult holding (Appendix H1b, Table H1b-268, Table H1b-289). For the adult holding life stage, the frequency of favorable effects is higher, and the frequency of unfavorable effects is lower under the 55 w/WSAs scenario compared to the Low Flow Alternative and 55 scenario. The frequency of favorable and unfavorable effects on green sturgeon under the 55 w/WSAs scenario is similar to the Low Flow Alternative or 55 scenario for all life stages, depending on index evaluated.

For the 55 w/WSAs scenario, the most noticeable effect for Central Valley steelhead is a 6.7 percent occurrence of favorable effects for adult holding and smoltification (Table 13.7.6.2-5). The most noticeable effect for green sturgeon is a 5.3 percent occurrence of unfavorable effects for spawning, egg incubation, and alevins.

For both Central Valley steelhead and green sturgeon, results show that the frequencies of favorable and unfavorable effects under the VA pathway are more similar to baseline than under the regulatory pathway (Table 13.7.6.2-5).

Table 13.7.6.2-5. Summary of Potential Effects of 55 w/WSAs and VA Scenarios on Central Valley Steelhead and Green Sturgeon on the Feather River

Life Stage	55 w/WSAs Scenario	VA Scenario
(A) Central Valley Steelhead		
Adult Immigration		
[a] Favorable	0.0%	0.0%
[b] Unfavorable	0.0%	0.0%
Adult Holding		
Favorable	6.7%	0.0%
Unfavorable	0.0%	0.0%
Spawning, Egg Incubation, and Alevins		
Favorable	5.0%	0.0%
Unfavorable	3.3%	0.0%
Kelt Emigration		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
Juvenile Rearing		
Favorable	2.1%	0.0%
Unfavorable	2.9%	0.8%
Smoltification		
Favorable	6.7%	0.0%
Unfavorable	3.3%	0.0%
Smolt emigration (excluding migrant parr)		
Favorable	2.9%	0.0%

Unfavorable	0.0%	0.0%
(B) Green Sturgeon		
Spawning, Egg Incubation, and Alevins		
Favorable	1.3%	1.3%
Unfavorable	5.3%	0.0%
Non-Spawning Adult Presence		
Favorable	3.6%	0.3%
Unfavorable	1.5%	0.0%
Larval and Juvenile Rearing and Emigration		
Favorable	4.6%	0.4%
Unfavorable	1.7%	0.0%

Presented as the percent of month-water year type combinations with favorable and unfavorable effects of the 55 w/WSAs or VA scenario compared with baseline at all locations combined.
[a] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% lower than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5 degree Fahrenheit (°F) lower than the exceedance under the baseline.
[b] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% higher than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5°F higher than the exceedance under the baseline.

Yuba River

A summary of potential temperature-related effects of the regulatory pathway and the VA pathway on spring-run and fall-run Chinook salmon in the Yuba River is provided in Table 13.7.6.2-6 and a summary of potential effects on Central Valley steelhead and green sturgeon is provided in Tables 13.7.6.2-7. For all four species and races, the frequency of favorable and unfavorable effects under the starting point for the regulatory pathway (55 w/WSAs scenario) is similar to the Low Flow Alternative (35 and 45 scenarios) for all life stages (Appendix H1b, Table H1b-305, Table H1b-319, Table H1b-332, Table H1b-373).

For the 55 w/WSAs scenario, occurrences of favorable and unfavorable effects are less than 3 percent for nearly all life stages of all species (Table 13.7.6.2-6, Table 13.7.6.2-7). The most noticeable effect is a 4.3 percent occurrence of favorable effects for Central Valley steelhead smoltification.

Results for the VA scenario for all four species and races show that the frequencies of favorable and unfavorable effects under the VA pathway are more similar to baseline than under the regulatory pathway (Table 13.7.6.2-6, Table 13.7.6.2-7).

Table 13.7.6.2-6. Summary of Potential Effects of 55 w/WSAs and VA Scenarios on Spring-Run and Fall-Run Chinook Salmon on the Yuba River

	Spring-Run		Fall-Run	
Life Stage	55 w/WSAs Scenario	VA Scenario	55 w/WSAs Scenario	VA Scenario
Adult Immigration				
[a] Favorable	2.0%	2.0%	2.5%	2.5%
[b] Unfavorable	1.0%	0.0%	0.0%	0.0%
Adult Holding				
Favorable	0.0%	0.0%	0.0%	0.0%
Unfavorable	2.7%	0.0%	0.0%	0.0%
Spawning, Egg Incubation, and Alevins				
Favorable	0.0%	0.0%	0.0%	0.0%
Unfavorable	0.0%	0.0%	0.0%	0.0%
Fry and Juvenile Rearing and Emigration				
Favorable	0.0%	0.0%	0.0%	0.0%
Unfavorable	2.1%	0.0%	2.5%	2.5%

Presented as the percent of month-water year type combinations with favorable and unfavorable effects of the 55 w/WSAs or VA scenario compared with baseline at all locations combined.

[a] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% lower than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5 degree Fahrenheit (°F) lower than the exceedance under the baseline.

[b] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% higher than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5°F higher than the exceedance under the baseline.

Table 13.7.6.2-7. Summary of Potential Effects of 55 w/WSAs and VA Scenarios on Central Valley Steelhead and Green Sturgeon on the Yuba River

Life Stage	55 w/WSAs Scenario	VA Scenario
(A) Central Valley Steelhead		
Adult Immigration		
[a] Favorable	0.6%	0.6%
[b] Unfavorable	0.0%	0.0%
Adult Holding		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
Spawning, Egg Incubation, and Alevins		
Favorable	1.7%	0.0%
Unfavorable	4.2%	0.0%
Kelt Emigration		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
Juvenile Rearing		
Favorable	0.2%	0.2%

Life Stage	55 w/WSAs Scenario	VA Scenario
Unfavorable	0.4%	0.0%
Smoltification		
Favorable	4.3%	1.4%
Unfavorable	0.0%	0.0%
Smolt emigration (excluding migrant parr)		
Favorable	0.0%	0.0%
Unfavorable	0.0%	0.0%
(B) Green Sturgeon		
Spawning, Egg Incubation, and Alevins		
Favorable	0.0%	0.0%
Unfavorable	2.0%	0.0%
Non-Spawning Adult Presence		
Favorable	0.0%	0.0%
Unfavorable	1.0%	0.0%
Larval and Juvenile Rearing and Emigration		
Favorable	0.0%	0.0%
Unfavorable	1.7%	0.0%

Presented as the percent of month-water year type combinations with favorable and unfavorable effects of the 55 w/WSAs or VA scenario compared with baseline at all locations combined.

[a] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% lower than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5 degree Fahrenheit (°F) lower than the exceedance under the baseline.

[b] The following criteria are met: (1) frequency of exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >5% higher than the frequency of exceedance under the baseline, and (2) average daily exceedance above the temperature index value under the 55 w/WSAs or VA scenario was >0.5°F higher than the exceedance under the baseline.

The temperature effects of the 55 w/WSA scenarios are generally similar to the temperature results presented in Appendix H1b for the Low Flow Alternative for the Yuba River. For the Sacramento, American, and Feather Rivers, the comparative effects of the 55 w/WSAs scenario to the Low Flow Alternative and 55 scenario are more variable. The 55 w/WSAs scenario is most similar to the Low Flow Alternative for some species and life stages and similar to the 55 scenario for others with no straightforward trend. Expected temperature effects of the 55 w/WSAs scenario on fish relative to baseline are variable, with favorable and unfavorable effects varying by river, species, and life stage. For all rivers, species, and life stages, results for the VA scenario are similar to the baseline.

Temperature-related effects in Sacramento/Delta regulated tributaries without temperature model results are expected to be similar to those that were modeled based on a qualitative interpretation of SacWAM reservoir storage and flow results. In the spring, increased releases from rim dams could reduce downstream temperatures and improve cold water habitat. In the late summer and early fall, reduced carryover storage and lower flows could reduce cold water habitat and affect special-status fish species in the reaches below these reservoirs, similar to the results presented above for tributaries with temperature modeling.

The regulatory pathway would require implementation of the narrative cold water habitat objective, and the flexibility built into the inflow requirements would be expected to improve water

temperature conditions for native cold water fish. However, it is possible that there would be some instances on some streams where temperatures could increase. In particular, while the specific cold water habitat implementation measures are being refined, there may be challenges with meeting suitable temperatures on some tributaries at some times while meeting the flow requirements of the regulatory pathway and water deliveries, particularly for those tributaries with significant water diversions and smaller reservoir storage capacity.

Under the VA pathway, changes in streamflows and reservoir levels would be less compared to the regulatory pathway, and model results for the American, Feather, Yuba, and Sacramento Rivers indicate that water temperature conditions under the VA pathway would be similar to baseline. The HRL commitments include flexibility in the timing of flow assets, which could reduce or avoid possible temperature-related effects. However, it is possible that there could be some instances on some streams where temperatures could increase. Because the sources of the unspecified water purchases are not fully known at this time but could include inflow sources within the Sacramento/Delta watershed, it is possible that there could be additional changes in water temperature on the American, Feather, Sacramento, and Yuba Rivers or other Sacramento/Delta tributaries beyond the changes that were modeled and analyzed.

Unregulated Tributaries

SacWAM results presented in Section 13.4 show that under the regulatory pathway, unregulated tributaries in the Sacramento/Delta with significant spring through fall diversions (e.g., Mill, Deer, and Antelope Creeks) would be expected to have higher streamflows during the spring through fall irrigation season under the starting point for the regulatory pathway (55 w/WSAs scenario) compared with baseline. These changes include increased flows during key anadromous salmonid migration periods, which would improve passage conditions at critical riffles and other low-flow passage impediments. Increased streamflows during anadromous salmonid migration periods also could provide temperature-related benefits, particularly in the lower watersheds of these tributaries. On unregulated tributaries such as Mill and Deer Creeks, salmonid migration is potentially impeded by warm water temperatures exacerbated by stream diversions. Overall, on unregulated tributaries, the regulatory pathway would be expected to improve flow and temperature conditions during critical migration periods for adult and juvenile Chinook salmon and steelhead, which would benefit these species.

None of the unregulated tributaries is the subject of an HRL proposal. As a result, the VA pathway is not expected to affect streamflows or temperatures on unregulated tributaries.

Sacramento/Delta Upper Watershed

The revised proposed Plan amendments could result in changes in streamflows in some locations in the upper watersheds above the valley floor. As discussed in Section 7.6.2, higher spring flows in the upper watersheds could benefit aquatic biological resources, including fish. However, similar to the valley floor below rim reservoirs, higher spring flows could result in reductions in reservoir storage at the end of spring and a smaller cold water volume in summer and fall months in some upper watershed reservoirs. These changes could affect aquatic biological resources, including some special-status fish species that occur in some upper watershed streams (e.g., hardhead, California roach, riffle sculpin). Additional fish species such as rainbow trout and speckled dace also occur in

some upper watershed locations and could be affected by changes in upper watershed reservoir levels and changes in downstream water temperatures.

Under the VA pathway, changes in streamflows and reservoir levels would be less compared to the regulatory pathway and could be similar to baseline conditions; however, it is possible that there could be some instances on some streams where temperatures could increase. The sources of the unspecified water purchases are not fully known at this time but could include inflow sources from the Sacramento/Delta upper watersheds which could affect water temperatures.

Streams below Export Reservoirs

Aquatic biological resources, including fish, occur in the export reservoirs, and downstream reaches and some fish species could be affected by changes in cold water habitat availability below these reservoirs. Under the regulatory pathway, Sacramento/Delta supplies to the Southern California, San Francisco Bay Area, and Central Coast regions would be reduced, which could result in lower reservoir storage in export reservoirs. Changes in reservoir storage in export reservoirs under the starting point for the regulatory pathway would generally be less than under the 55 scenario and more similar to the Low Flow Alternative (35 and 45 scenarios), as shown in Appendix H1a2. There is uncertainty in how reservoir operators may respond to changes in Sacramento/Delta supplies, and it is possible that streamflows below export reservoirs receiving Sacramento/Delta supplies could be reduced, and water temperatures could increase.

While Millerton Reservoir on the San Joaquin River does not directly receive Sacramento/Delta supply, similar temperature effects could be experienced by the Friant Division if calls on Friant are made by the San Joaquin River exchange contractors in response to reduced Sacramento/Delta supply under the regulatory pathway. Calls on Friant water from the San Joaquin River and Millerton Lake would effectively shift water supply from Friant Division, which uses Millerton Lake water for agricultural and municipal use, to the exchange contractors.

Increased releases from Millerton Lake to the San Joaquin River for use downstream by the exchange contractors could occur during the irrigation season and would initially have the effect of keeping the river cool for greater distances downstream of Millerton Lake than under existing conditions. However, these extra releases from Millerton Lake for the exchange contractors could cause early depletion of cold water in Millerton Lake under conditions of low lake storage because the elevation of the river outlet (380 feet) is substantially below the elevation of the intakes for the Madera and Friant-Kern Canals where the Friant Division diverts its water (446 and 464 feet, respectively) (SJRRP 2008). Increased use of the river outlet potentially could lead to depletion of cold water in Millerton Lake by the fall, which could affect spawning by the experimental population of spring-run Chinook salmon reintroduced to the San Joaquin River.

Under the VA pathway, changes in Sacramento/Delta supplies could potentially affect reservoir levels in export reservoirs that receive Sacramento/Delta supplies, but these changes are expected to be small. As discussed in Section 13.4.4, *Changes in Surface Water Supply*, the SacWAM results indicate that the VA pathway could potentially result in a slight increase in Sacramento/Delta supplies to other regions, so export reservoir levels would likely be similar to or could be slightly higher compared to baseline. However, the VA pathway could also result in reduced Delta exports as a result of additional HRL flow commitments from unspecified water purchases. If these flows are

provided through additional water purchases from south of Delta sellers, Delta exports could be reduced, which could result in slight reductions in export reservoir levels.

Impact Conclusion

Implementation of the cold water habitat objective would be expected to minimize potential temperature-related impacts on aquatic biological resources in the Sacramento/Delta watershed tributaries subject to the regulatory pathway. However, identifying and taking the appropriate actions to meet the cold water habitat objective in some locations may not result in immediate improvements, and temperature concerns could occur until the tributary is in full compliance with the objective. As described in Section 7.6.2.2, *Environmental Setting*, and in Chapter 5, *Proposed Changes to the Bay-Delta Plan for the Sacramento/Delta*, existing temperature protections are in place for some stream reaches and reservoirs, but legal requirements are applied unevenly and, in many locations, not at all. Implementation of the proposed cold water habitat objective is intended to address these conditions, to ensure that salmonids have access to cold water habitat at critical times, and that adequate water is available for minimum instream flow purposes downstream of reservoirs. Cold water habitat conditions, species needs, and the measures for best implementing the narrative objective will vary among the tributaries.

Ultimately, management of cold water habitat must be based on further analysis that considers times of year that various life stages of anadromous fish are present, locations in the river that are utilized by anadromous fish, and the flow and storage required to maintain suitable water temperatures far enough downstream to protect sensitive life stages from adverse temperature effects. It is expected that additional information will become available as tributaries submit long-term strategies and annual operation plans for major reservoirs. Future investigations could reveal that the actual storage level for a given reservoir may need to be higher or could be lower than that modeled to protect cold water habitat. Implementation of the cold water habitat objective will be adaptively adjusted as needed based on new findings.

To comply with the cold water habitat objective, reservoir operators would be required develop and submit long-term strategies and annual operations plans for approval by the State Water Board. Parties may develop operational measures that reduce the reservoir drawdown effects currently reflected in the modeling scenarios. Specific implementation measures may include a combination of cold water storage provisions, TCDs, flow provisions, fish passage to cold water habitat, power bypasses (this would be minimized to prevent early depletion of the cold water available below power intakes and to prevent substantial reduction in hydropower generation during periods of peak demand), and other measures. Long-term strategies would be required to identify temperature targets and locations where those targets will be measured. Long-term strategies are described in more detail in Section 13.3.3.3, *Cold Water Habitat*.

Section 7.21, *Habitat Restoration and Other Ecosystem Projects*, discusses and evaluates the potential environmental impacts, including construction impacts, of habitat restoration and other ecosystem measures such as the use of TCDs, including reservoir outlet shutters and thermal curtains, and fish passage improvement projects that entities may undertake toward achieving the overall goal of improving conditions for fish and wildlife in the Sacramento/Delta watershed.

Upstream water users would be required to participate in development of long-term strategies to the extent that their operations affect achievement of requirements below the rim reservoirs. As

determined by the Executive Director of the State Water Board, upstream reservoir operators may also be required to develop their own strategies if their reservoir operations would affect achievement of the narrative objective for stream segments above the rim reservoirs.

Additionally, the program of implementation identifies habitat restoration measures, including through EcoRestore and other efforts, as well as other complementary ecosystem measures to protect fish and wildlife. The revised proposed Plan amendments allow for and encourage local cooperative solutions that would facilitate a combination of flow and other ecosystem measures to promote habitat restoration to amplify the ecological benefit of new and existing flows that could allow flow requirements to be lower in the range. Under a lower range of flows, the potential impacts associated with reductions in storage and/or lower flows in summer and fall would be reduced.

During implementation under the VA pathway, HRL water rights would not be required to contribute to the regulatory pathway cold water habitat implementation requirements. However, there is a cold water provision included under the VA pathway, and, to some degree, habitat restoration measures of the VA pathway could help offset temperature impacts by expanding habitat in areas that have cooler temperatures.

Although the proposed cold water habitat objective would generally be expected to maintain or improve temperature conditions in the Sacramento/Delta under the regulatory pathway, uncertainties exist regarding temperature impacts that may result from implementation of the revised proposed Plan amendments independently or in combination with temperature management issues resulting from existing dams and diversions and their ongoing impacts on fisheries. It is possible that there could be some instances on some streams where water temperatures could increase, particularly while the specific cold water habitat implementation measures are refined. Changes in flow and reservoir storage under the revised proposed Plan amendments could affect stream temperatures and could affect the availability of cold water to protect anadromous salmonids and other native fishes. Because the potential exists that in some instances on some streams the temperatures could increase, changes in water temperatures could affect native fish species; this impact would be potentially significant. While this impact is more likely with the regulatory pathway, it could also occur with the VA pathway.

The cold water habitat objective would not apply outside the Sacramento/Delta watershed. Export reservoirs (including Friant Dam) and downstream reaches could be affected by reduced Sacramento/Delta supply, resulting in changes in cold water habitat availability below reservoirs, that could impact aquatic biological resources.

Implementation of Mitigation Measures MM-AQUA-a,d: 1 and 2 will reduce or avoid temperature-related impacts on native cold water species in reservoirs, including reservoirs not subject to the cold water habitat objective, and downstream waterways. Reservoirs are subject to existing regulatory requirements independent of the Bay-Delta Plan, such as California Fish and Game Code section 5937, Federal Energy Regulatory Commission (FERC) license requirements, and federal Endangered Species Act (ESA) and California Endangered Species Act (CESA), including National Marine Fisheries Service (NMFS) biological opinion (BiOp) requirements. Reservoirs and streams below reservoirs may also be subject to future changes that could result from the issuance of new water right orders or decisions, FERC licenses, and other future regulatory requirements. In

exercising its regulatory authorities, the State Water Board will consider temperature needs and ensure that any temperature impacts are avoided or reduced. In addition, temperature effects can be minimized through habitat planning and restoration efforts under the federal ESA and CESA. Implementation of relevant NMFS species recovery plans may also help to protect listed cold water species and provide suitable water temperatures downstream of export reservoirs. State and federal resource agencies should continue to develop, refine, and implement species recovery plans to protect aquatic biological resources, including special-status fish species, and the instream flows they require.

Temperature impacts can be minimized for both the regulatory and VA pathways with Mitigation Measures MM-AQUA-a,d: 1 and 2. However, because there is some uncertainty regarding the precise implementation of these measures (including decisions regarding tradeoffs between flows and cold water supplies), it is possible that, in limited instances, temperature impacts could still occur prior to effective implementation of these measures. Therefore, temperature impacts on special-status fish species from changes in flows and reservoir levels remain potentially significant.

2025 ROD and 2025 ITP

Possible effects of the 2025 ROD/ITP on water temperatures were simulated using the SacWAM results for the starting point for the regulatory pathway with the 2025 ROD/ITP (55 w/WSAs + 2025 ROD/ITP scenario) and VA pathway with the 2025 ROD/ITP (VA + 2025 ROD/ITP scenario) for the Sacramento, Feather, Yuba, and American Rivers (see Section H1a6.6, *Changes in Water Temperature* in Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*). Changes in temperature associated with the 2025 ROD/ITP (evaluated by comparing the 55 w/WSAs + 2025 ROD/ITP scenario to the 55 w/WSAs scenario and comparing the VA + 2025 ROD/ITP scenario to the VA scenario) could occur due to the removal of fall X2 requirements and associated changes in reservoir storage, streamflow, reservoir release target temperatures associated with changes in storage, and changes in the triggering of the power bypass in Oroville Reservoir. However, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, there is uncertainty in the SacWAM results, and as a result, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results.

Most of the effects of the 2025 ROD/ITP on the temperature distributions presented in Section H1a6.6, *Changes in Water Temperature*, are less than or equal to 0.5 °F, and for the Yuba River there are no expected changes in water temperature associated with the 2025 ROD/ITP because the 2025 ROD/ITP does not affect the Yuba River, although water temperature modeling results are presented in Appendix H1a6 for the Yuba River for completeness. The 2025 ROD/ITP could result in limited instances of temperature increases greater than 0.5 °F, with the largest effects occurring in the Feather River. The 2025 ROD/ITP is not expected to affect other (non-Project) tributaries beyond what is described above (see *Impact Discussion* and *Impact Conclusion*).

The largest expected changes in water temperature associated with the 2025 ROD/ITP that may be of most importance to fish are changes in the 90th percentile values of more than 0.5 °F in reaches accessible to anadromous fish. On the Sacramento and American Rivers, such changes only occur for the starting point for the regulatory pathway with the 2025 ROD/ITP and are limited in extent (occurring only at the Sacramento River below Keswick and American River at Watt), time

(occurring only in June), and magnitude (all changes are 0.7 °F or less) and are associated with changes in storage and flow.

Compared with the Sacramento and American Rivers, the Feather River model results show larger changes in water temperature associated with the 2025 ROD/ITP. The modeling indicates that higher storage in September and October with the 2025 ROD/ITP could lead to cooler release temperatures from Oroville Reservoir for the 55 w/WSAs comparison (55 w/WSAs + 2025 ROD/ITP scenario versus 55 w/WSAs scenario), although temperatures could increase further downstream due to decreases in streamflow. The modeling indicates warmer temperatures could occur for the VA comparison (VA + 2025 ROD/ITP scenario versus VA scenario) primarily during September of wet and above normal years as a result of decreases in reservoir releases and decreases in streamflow. Occasionally, reduction in reservoir release temperatures could occur for the VA comparison under drier conditions due to increases in power bypass through Oroville Reservoir. Oroville Reservoir release temperatures have a greater effect on water temperatures below the reservoir (see Table H1a6-107 for modeled temperatures in the Feather River below Oroville Reservoir) than on water temperatures further downstream where temperatures are more influenced by streamflow. As a result, decreases in flow in September could result in increases in temperature during the cooler range of conditions (10^{th} percentile) that are more typical of wet and above normal water years that would be affected by removal of the fall X2 requirements. As shown in Table H1a6-109, water temperature could increase by 1.9 °F for the Feather River below Gridley for the 55 w/WSAs + 2025 ROD ITP relative to the 55 w/WSAs (55 w/WSAs + 2025 ROD ITP scenario minus the 55 w/WSAs scenario), and by 2.2 °F for the VA + 2025 ROD ITP scenario relative to the VA scenario (VA + 2025 ROD ITP scenario minus the VA scenario).

The changes in water temperature with the 2025 ROD/ITP would generally be small and would not be expected to translate into large changes in the fish assessment results presented above. Overall, the changes in water temperature associated with the 2025 ROD/ITP are expected to have small effects on fish, and these effects would be limited to the Project tributaries and would be the result of actions outside of the updates to the Bay-Delta Plan as part of this project.

As described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, the new LTO baseflow balancing provision that would apply under the VA pathway of the revised proposed Plan amendments requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The analyses presented here evaluate the effects of not having the LTO baseflow balancing provision. However, the LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway, which could also reduce changes in streamflows on Project tributaries that could affect water temperature. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the narrative interior Delta flow objective. During annual and periodic reviews, the State Water Board will assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

Interior Delta Flows

Water diversions at the SWP and CVP (collectively Projects) export facilities (in combination with other conditions) can cause changes in interior Delta flows, including OMR flows and net flows in the San Joaquin River at Jersey Point (QWEST). The major freshwater source in the Delta, the Sacramento River, enters on the northern side of the Delta while the two major pumping facilities, the SWP and CVP, are in the south near the confluence of the San Joaquin River with the Delta. Pumping at the Project export facilities can cause a net movement of flows across the Delta in a north-south direction along a web of channels including Old and Middle Rivers instead of the more natural pattern from east to west or from land to sea, particularly when exports are high and San Joaquin River flows are low. A negative value, or a reverse flow, indicates a net water movement across the Delta and OMR channels to the export facilities. Net reverse flows can have several negative ecological consequences. First, net reverse flows draw fish, especially the weaker swimming larval and juvenile forms, within the influence of reverse flow effects into the interior Delta where fish can be subject to direct entrainment at the SWP and CVP export facilities or indirect mortality from poor habitat conditions in the interior Delta. Second, net reverse flows can reduce spawning and rearing habitat for native species, like Delta smelt. Third, net reverse flows result in a confusing environment for migrating juvenile salmonids leaving the San Joaquin River basin that can result in predation and other impacts that result in or contribute to mortality. Finally, net reverse flows also alter the natural water quality gradients that native fish species rely upon for homing and other functions by drawing Sacramento River water across and into the interior Delta instead of out to the Bay and ocean (see Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*).

Impacts analyses are presented for changes in flows during December through June, which is considered the primary period of concern for interior Delta flow conditions most strongly impacting the abundance and survival of salmonids and native estuarine fish species (see Chapter 3, Tables 3.4-7, 3.5-1, and 3.8-1).

Regulatory Pathway

Changes in hydrology under the regulatory pathway could result in changes to interior Delta flows which could affect native fish species residing in or migrating through the Delta. As mentioned in previous sections, the analysis of effects of the revised proposed Plan amendments on interior Delta flows presented in this chapter are complicated by recent changes in regulatory conditions affecting CVP exports that have occurred since the baseline for this project was established.

In particular, the baseline for this project assumes interior Delta flow constraints that existed at the time the 2023 draft Staff Report was released, including limitations on exports based on a ratio of San Joaquin River inflows to exports referred to as the inflow to export ratio or I:E. Specifically, the baseline assumes that I:E constraints to provide spring Delta outflows included in the 2020 California Department of Fish and Wildlife (CDFW) ITP for the SWP apply to both the SWP and the CVP consistent with then-applicable regulatory requirements and court orders. These constraints are largely the same as requirements that had been in place since 2009 (with the inclusion of offramps in very wet conditions) limiting exports during the entire April and May time period to 4:1 in wetter conditions and 1:1 in drier conditions and 3:1 and 2:1 in intermediate hydrological conditions.

With the completion of an updated LTO ROD in December of 2024, the CVP is no longer subject to the more stringent I:E constraints beginning in April of 2025 with the only remaining I:E constraints on CVP exports being the much less stringent conditions from D-1641 that only limit Project exports to 1:1 during a 31-day period during parts of April and May.

While the proposed Plan amendments identified in the 2023 draft Staff Report included adding the more stringent I:E requirements from the 2020 ITP to the Bay-Delta Plan for both the SWP and CVP absent VAs being implemented, consistent with Alternative 4a (Exclusion of Interior Delta Flow and Fall Delta Outflow Related Amendments), the revised proposed Plan amendments do not include any specific additional I:E requirements for either the CVP or the SWP beyond what is required by D-1641. Based on these circumstances, the regulatory pathway for the revised proposed Plan amendments does not include the more stringent I:E requirements for the CVP but retains the more stringent I:E requirements for the SWP, though not as a Bay-Delta Plan requirement but an assumed ITP requirement (see Section 13.4 for further description of the I:E assumptions for baseline and the 55 w/WSAs scenario). However, because it is possible that if the regulatory pathway is implemented for the SWP and the inflow-based Delta outflow requirements are in effect for the SWP to meet spring Delta outflow contributions, that the I:E requirements from the SWP ITP would be removed. Appendix H1a5, *Sacramento Water Allocation Model Results for Export Constraint Sensitivity Analysis*, includes sensitivity modeling results for this possibility.

Generally, increased Delta outflow requirements under the inflow-based Delta outflow requirements of the regulatory pathway would result in decreased exports at the Project export facilities and associated decreases in negative OMR flows compared to conditions without the inflow-based Delta outflow requirements. The higher the Delta outflow requirements, the greater the effect. Accordingly, while the starting point for the regulatory pathway (55 w/WSAs) still has the effect of lowering negative OMR flows compared to conditions without that requirement, the effect is lower due to the water supply adjustments that reduce Delta outflow requirements and associated limitations on diversions, including Project exports. And while the inflow-based Delta outflow requirements help to reduce negative OMR flows, combined with the elimination of the I:E constraints on the CVP, overall increases in negative OMR flows would be expected along with the possibility for impacts to native fish species, including both listed and non-listed species.

SacWAM results described in Section 13.4 show that removing the I:E restrictions on CVP exports results in increased CVP exports in April and May and a higher frequency of months with net negative OMR flows, comparable with what was analyzed in Section 7.24.5.1, *Exclusion of Interior Delta Flow and Fall Delta Outflow Related Amendments Alternative (Alternative 4a)*. SacWAM results for the 55 w/WSAs scenario show increases in exports in April and May, decreases in June through December, and minimal departures from baseline in January through March. Total January through June south of Delta exports under the 55 w/WSAs scenario could increase in all water year types except dry and critical years, as opposed to decreases in all water-year types under the 45 and 55 scenarios, and decreases in dry and below normal years under the 35 scenario (see Chapter 6, Table 6.4-3).

As a result of increases in exports, QWEST could decrease during April. Under the 55 w/WSAs scenario, OMR net flows would be less negative than baseline in the driest approximately two-thirds of conditions because exports are reduced to meet higher Delta outflow requirements. In the wettest one-third of conditions, OMR flows could be more negative than baseline. OMR net flows would be

expected to be less negative than the Low Flow Alternative (35 and 45 scenarios) in the driest approximately two-thirds of conditions but more negative than under the 55 scenario (see Table A1-114 and Table A1-115 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). Net negative OMR flows between 0 and -1,250 cubic feet per second (cfs) could occur with greater frequency under the 55 w/WSAs scenario. However, the frequency of net flows more negative than -2,500 cfs would not be expected to increase under the 55 w/WSAs scenario. These increases in OMR reverse flows are due to the difference in CVP I:E assumptions between baseline and the 55 w/WSAs scenario resulting in more CVP exports during the spring in the wettest conditions as described above.

Voluntary Agreement Pathway

In addition to elimination of the I:E for the CVP discussed above, under the VA pathway, the more stringent I:E constraints would also not apply to the SWP consistent with provisions of the 2024 ITP which replaces the I:E constraints with the SWP HRL commitments for export reductions. Because the HRL reductions in exports are generally less than the export reductions that would result from the more stringent I:E requirements, the SacWAM modeling indicates that there would be higher exports and more negative OMR flows under the VA pathway.

Specifically, under the VA pathway, exports would be expected to increase for both the SWP and CVP and the frequency of associated OMR reverse (net negative) flows would be expected to increase during April and May compared with baseline. As described in Section 13.4, SacWAM results show that annual average south of Delta exports for the VA scenario would be higher in April and May and lower in March. During January through June, south of Delta exports could increase in all water year types except critical years under the VA pathway. As a result of increases in exports, QWEST could decrease during April and May. Net negative OMR flows between 0 and -2,500 cfs could occur with greater frequency under the VA pathway, primarily due to increases in exports in April and May. However, the frequency of net flows more negative than -5,000 cfs would not be expected to increase under the VA pathway. This increase in spring exports and OMR reverse flows results from the differences in I:E requirements for the CVP and SWP between baseline and the VA pathway as described above.

Impact Discussion and Conclusion

Modeling indicates that under the revised proposed Plan amendments, increases in exports during April and May would increase the frequency of net negative OMR flows in the interior Delta compared to baseline. While these effects are driven by changes in other non-State Water Board regulatory requirements (and not by the revised proposed Plan amendments themselves) and those changes have been determined to be consistent with ESA and CESA requirements, from the conservative perspective of the environmental impact assessment of this Staff Report it is still possible that these changes could have potentially significant impacts on candidate, sensitive, or special-status species and could interfere with the movement of native resident or migratory fish in the Delta at times even if those impacts would not be inconsistent with ESA and CESA requirements. SacWAM results in Section 13.4 show that the removal of the more stringent I:E CVP export constraints and inclusion of Alternative 4a would be expected to result in a higher frequency of net negative OMR flows and lower Delta outflows during the spring under the regulatory pathway (consistent with the analysis of Alternative 4a in Section 7.24.5.1). Similarly, as a result of the

removal of the more stringent I:E export constraints for the CVP, as well as removal for the SWP with implementation of the HRL export reductions, the VA pathway would also be expected to result in a higher frequency of net negative OMR flows.

More negative OMR flows increase risks of outmigrating juvenile salmonids straying into the interior Delta where they experience poor habitat conditions, including higher predation, and are more likely to be entrained into the SWP and CVP pumping facilities. Net negative flows in the San Joaquin River at Jersey Point (QWEST) could also potentially decrease the survival of fall-run Chinook salmon smolts migrating through the lower San Joaquin River in April and May. Positive QWEST and OMR flows less negative than -5,000 during April and May have been found to be more protective of Chinook salmon populations than more negative flows (see Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, Table 3.4-7). Longfin smelt juveniles are also at risk of entrainment at the CVP and SWP pumping facilities due to OMR reverse flows during April and May. Higher salvage of longfin smelt juveniles occurs at negative OMR flows, and OMR flows between -1,250 and -5,000 cfs during April and May have been identified as needed for protection of longfin smelt (see Table 3.5-1 and Figure 3.5-6). In addition, Delta smelt may be entrained by OMR reverse flows when larvae migrate downstream to the low salinity zone in late spring. OMR flows more negative than -1,250 cfs are associated with greater salvage of Delta smelt, and OMR flows between -1,250 and -5,000 cfs during April and May have been identified as needed for protection of Delta smelt (see Table 3.8-1).

The revised proposed Plan amendments include a narrative objective for interior Delta flows to maintain water quality conditions, including flow conditions in the interior Delta, together with other measures in the watershed, sufficient to support and maintain the natural production of viable native fish populations. (see Section 13.3.6, *Interior Delta Flows*). The program of implementation for this objective identifies that this objective is implemented through compliance by SWP and CVP with the numeric interior Delta flow objectives and implementation measures included in the Bay-Delta Plan and required pursuant to CESA and ESA for the operations of the CVP and SWP export facilities. The program of implementation identifies that as appropriate, during the annual or periodic review of the Bay-Delta Plan and its implementation, the State Water Board will evaluate the effectiveness of the interior Delta flow objectives and implementation actions and any needed changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses. These provisions can reduce impacts of changes in interior Delta flows resulting from other regulatory requirements if the State Water Board determines it is appropriate for the reasonable protection of fish and wildlife, including considerations regarding water supply effects.

Operations to comply with CESA and ESA are expected to avoid jeopardy to listed species, including provisions for real-time decision making to manage SWP and CVP operations in a way that reduces impacts on listed species. These provisions may reduce the potential impacts of changes in interior Delta flows on native fish species under the regulatory and VA pathways. In addition, the VA pathway includes other measures that may mitigate these impacts, including unspecified water purchases that could come from export reductions during April and May (see Section 9.5.3.9, *Delta Inflows, Exports, Interior Delta Flows, and Delta Outflow Results*). These possible export reductions are reflected in the VA High Export Cuts scenario evaluated in Chapter 9 and could have similar effects on exports and interior Delta flows as the I:E constraint included in baseline. If the unspecified water purchases come from reduced exports, as shown in the VA High Export Cuts scenario, differences in

exports and interior Delta flows between the VA scenario and the baseline are expected to be relatively small. In addition, the VA pathway includes non-flow habitat restoration commitments that could potentially help mitigate these impacts. Habitat restoration in the Delta may reduce the potential impacts associated with net negative flows in the interior Delta by improving other environmental conditions that could support populations of native estuarine and anadromous fish species, including through potentially increasing physical habitat, improving water quality, and increasing food supply (see Appendix G2, *Final Draft Scientific Basis Report Supplement*).

Implementation of Mitigation Measures MM-AQUA-a,d: 2, 3, 7, 9, and 10 can avoid or reduce impacts of changes in interior Delta flows on native anadromous and estuarine fish species residing in or migrating through the Delta that could occur as a result of implementing the revised proposed Plan amendments. Mitigation Measure MM-AQUA-a,d: 2 includes implementing habitat protection and restoration actions to protect native fish species, including expanding management efforts for special-status aquatic species and coordination between the State Water Board and State and federal resource agencies to support restoration activities. Mitigation Measure MM-AQUA-a,d: 3 includes special-status species management measures to minimize and avoid impacts on special-status species to encourage the protection, restoration, and management of habitat. Mitigation Measure MM-AQUA-a,d: 7 states that water users can and should diversify their water supply portfolios to the extent possible in an environmentally responsible manner and in accordance with the law to reduce reliance on the Sacramento/Delta. Mitigation Measure MM-AQUA-a,d: 9 includes oversight and approval of water transfers by the State Water Board to ensure that the transfer would not result in unreasonable effects on fish and wildlife, and states that when processing transfers, DWR and Reclamation should require the transferor to show that the transfer would not result in unreasonable effects on fish and wildlife or other instream beneficial uses in the source area. Mitigation Measure MM-AQUA-a,d: 10 includes implementing existing laws to protect and mitigate fisheries impacts from changes in interior Delta flows. CVP and SWP operations are subject to existing regulatory requirements that are intended to avoid jeopardy to species listed under the ESA and CESA. Consistent with existing CESA and ESA requirements, it is expected that limits on negative OMR flows will continue to be implemented to reduce impacts to listed species. In addition, additional CESA or ESA actions may be implemented in the future to protect native fish species migrating through or inhabiting the Delta from potential changes in interior Delta flows. In exercising its regulatory authorities, the State Water Board may also develop and require specific water right conditions in individual water right proceedings to implement the narrative interior Delta flows objective to ensure protection of native fish species, including non-listed species, if it is determined that additional actions are needed. However, unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Section 13.4.2.5, *Export Constraint Sensitivity Analysis*, evaluates the possibility that in the future under the regulatory pathway, the more stringent I:E requirements (2024 CDFW ITP spring Delta outflow requirements) applied to the SWP could be removed from the CDFW ITP, which could result in further increases in exports and net negative OMR flows during the spring. The potential effects could be similar to the effects evaluated for the Low Flow Alternative in Section 7.24, *Alternatives Analysis*. The possible effects that removing the spring Delta outflow requirement for the SWP could have on changes in hydrology are modeled in Appendix H1a5, *Sacramento Water Allocation Model Results for Export Constraint Sensitivity Analysis*. The potential environmental impacts of removing

the spring Delta outflow requirement are further analyzed in Section 13.7.21, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes.*

2025 ROD and 2025 ITP

With the 2025 ROD/ITP, changes to OMR flow restrictions could affect interior Delta flows, including causing greater net flows toward south Delta Project pumping facilities during December through June, which could result in more net negative OMR flows during this period under the starting point for the regulatory pathway (55 w/WSAs + 2025 ROD/ITP scenario compared to the 55 w/WSAs scenario and baseline) and VA pathway (VA + 2025 ROD/ITP scenario compared to the VA scenario and baseline) (see Section 13.4.6, *Sensitivity Analysis for 2025 Record of Decision and 2025 Incidental Take Permit*). In addition, OMR flows could become more net negative during September of wet and above normal years due to removal of the fall X2 requirements and possible increases in exports (see Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*). Modeling results presented in Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*, and H1a7 suggest that the incremental changes in OMR flows would not be substantial during September or December through June. However, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, there is uncertainty in the SacWAM results, and as a result, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results, and as a result, there could be increases in exports and negative OMR flows beyond what was modeled (see Section 13.4.6). In addition, SacWAM results are reported on a monthly timescale and may mask short-term effects of operational changes on fish populations in the Delta. Some of the operational changes under the 2025 ROD/ITP, such as the First Flush Action and Turbidity Bridge Avoidance, occur over shorter temporal periods than the monthly time step used in the modeling. As a result, effects of operational changes with the 2025 ROD/ITP could be magnified temporally and spatially during sensitive fish life stages when species distributions are concentrated near areas affected by SWP and CVP exports in the Delta. However, these changes are not the result of the Sacramento/Delta Update to the Bay-Delta Plan as part of this project**.**

As described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, the new LTO baseflow balancing provision that would apply under the VA pathway of the revised proposed Plan amendments requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The analyses presented here evaluate the effects of not having the LTO baseflow balancing provision. However, the LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway, which could also reduce changes in OMR flows. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the narrative interior Delta flow objective. During annual and periodic reviews, the State Water Board will assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

Delta Inflows and Outflows

To evaluate the effects of changes in Delta inflows and outflows, two time periods are evaluated: January through June and July through December. Consistent with the natural hydrograph to which native species have adapted, generally increases in flows during the wetter months of January through June (winter and spring) are expected to have greater beneficial effects on anadromous and estuarine fish species than increases in flows during the typically drier months of July through December (summer and fall). However, there can still be benefits to increases in flows during July through December, particularly those that follow the natural hydrograph, such as first-flush precipitation events during late fall and early winter that can cue migration events (see Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*). For example, Delta smelt spawning migrations occur starting in late December during first-flush periods when inflow and turbidity increase. During the winter-spring period, flows support juvenile Chinook salmon and Central Valley steelhead migrating through the Delta from the Sacramento River Basin and rearing in the Delta. In addition, January through June flows support adult spring-run, winter-run, and late fall-run Chinook salmon, as well as Central Valley steelhead migrating through the Delta upstream to the Sacramento and San Joaquin River spawning tributaries. Delta outflow during January through June also supports native estuarine fish species (see Chapter 3, Table 3.14-1).

Regulatory Pathway

Changes in hydrology under the regulatory pathway of the revised proposed Plan amendments would result in changes to Delta inflows and outflows, which could benefit native fish species that inhabit the Delta and migrate through the Delta. The regulatory pathway would have similar effects as those that were evaluated in Section 7.6.2, *Aquatic Biological Resources*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in hydrology would be expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. Section 13.4 shows the SacWAM results for the starting point for the regulatory pathway (55 w/WSAs scenario) on changes in Delta inflows and outflows compared to baseline. Total Delta inflows under the 55 w/WSAs scenario would increase on average compared to baseline in January through June and decrease in July through December in all water year types. Monthly Delta inflows would follow these seasonal patterns in all months except for February, when average monthly Delta inflows could decrease slightly. On an annual basis, average total Delta inflow would be expected to increase in all water year types except critical years due to increased tributary inflow and inflow-based Delta outflow requirements. The decrease in critical year inflow would occur during the July through December period due largely to reductions in flows being provided for export at the SWP and CVP pumping facilities. Due to water supply adjustments, average total annual Delta inflow under the 55 w/WSAs scenario would be similar to the Low Flow Alternative (see the 35 and 45 scenarios in Table 6.3-1 in Chapter 6) in dry, below normal, and above normal years; would be lower than the Low Flow Alternative in critical years; and would be more similar to the 55 scenario in wet years (Table 6.3-1 in Chapter 6). Overall, these increases in spring inflows and decreases in summer inflows would more closely resemble a natural flow regime expected to benefit native fish species. As described in Chapter 2, *Hydrology and Water*

Supply, water development under existing conditions has resulted in reduced spring inflows and artificially high summer inflows compared with unimpaired conditions.

As described in Section 13.4, SacWAM results show that total Delta outflow under the 55 w/WSAs scenario would increase over the January through June time period during all water year types and averaged across all water year types. For the July through December period Delta outflows would increase slightly to modestly in wet, dry, and critical years and decrease slightly in above normal and below normal years, with overall small increases in outflow on average. Average total annual Delta outflow under the 55 w/WSAs scenario would be similar to the Low Flow Alternative (see the 35 and 45 scenarios in Table 6.3-2 in Chapter 6) in all water year types. However, changes in Delta outflow could differ from these average seasonal patterns during certain water year types and months. Average monthly Delta outflow would be expected to increase during October and November, January, and March through June and decrease slightly during July through September, December, and February across all water year types. Overall, these changes in Delta inflows and outflows under the starting point for the regulatory pathway would be less than evaluated in Section 7.6.2.4 due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flows, changes in Delta inflows and outflows could be as high as those identified in Section 7.6.2.4.

Voluntary Agreement Pathway

Implementation of the VA pathway would result in increases in average total January through June Delta inflow and decreases in average total July through December Delta inflow compared to baseline across all water year types (see Section 13.4). SacWAM results show that total annual Delta inflow would be expected to decrease during critical and wet years under the VA pathway. Monthly mean Delta inflow would be expected to increase in March through May and decrease in June through February. Delta outflow under the VA pathway also would be expected to increase in the January through June period, except during wet years, when Delta outflow would be expected to decrease. Delta outflow would be expected to decrease in the July through December period, except during dry years, when Delta outflow would be expected to increase. Annual average total Delta outflow would be expected to increase in all water year types except wet years under the VA pathway. As described in Section 13.4, SacWAM results for monthly mean Delta outflow under the VA scenario show the largest increases in March and April and smaller changes in other months, with decreases during September through December, February, and May. Changes in Delta outflows with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, increases in Delta inflows and outflows during January through June under the revised proposed Plan amendments would more closely resemble a natural flow regime to which native species have adapted. Native anadromous and estuarine fish species, including but not limited to, Chinook salmon, steelhead, green and white sturgeon, Sacramento splittail, Delta smelt, and longfin smelt, would benefit from these changes. Decreases in Delta inflows and outflows during July through December would have less than significant impacts on aquatic species, because changes in

inflow and outflow during this period are relatively small and less influential on candidate, sensitive, or special-status anadromous and estuarine fish species than changes during January through June, when inflows and outflows would increase. As described above, changes in inflow and outflow would differ somewhat from these general seasonal patterns of increasing spring flows and decreasing summer-fall flows, depending on month and water year type. The effects of these changes on native fish species are discussed further below.

As discussed above, under the regulatory pathway, there would be expected decreases in inflow during the July through December period due to decreases in water supply releases for export at the SWP and CVP pumping facilities in the Delta that exceed increases in inflow during January through June, which could decrease total annual average Delta inflow during critical years. Delta inflow could also decrease slightly on average across water year types in February under the regulatory pathway. Under the regulatory pathway, high flows resulting from storms that cause first-flush events during the fall would be somewhat more protected than under baseline, which could provide benefits to native estuarine fish species like Delta smelt in the form of higher Delta inflows and increased turbidity during the July through December period. These potential benefits of the regulatory pathway are not evident in modeling results because of the monthly time-step used by SacWAM.

Under the VA pathway, inflows could also decrease during July through December, and these decreases would be expected to be slightly greater than increases in inflow during January through June, which overall could result in a slight decrease in total annual average Delta inflow during critical and wet years. Overall, because decreases in inflow are expected to be limited to July to December or limited to small decreases in January and February, these changes in Delta inflow under the revised proposed Plan amendments would have less than significant impacts on candidate, sensitive, or special-status fish species and would not interfere substantially with the movement of any native resident or migratory fish in the Delta. Changes in inflow during July through December are less likely to impact spawning, rearing, and migration conditions of candidate and listed species, and these changes in inflows are also accompanied by decreases in SWP and CVP exports and related impacts (see Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*).

Implementation of the revised proposed Plan amendments would increase Delta outflows during the January through June period compared to baseline in all water year types except wet years under the VA pathway and in all months except February under the regulatory pathway and February and May under the VA pathway. July through December Delta outflow would decrease under the VA pathway during all water year types except for dry years and under the regulatory pathway in below normal and above normal years. The changes in wet year January through June Delta outflows under the VA pathway represent less than 1 percent of total Delta outflow (see Section 13.4) and would have less than significant impacts on estuarine fish species based on flow-abundance relationships, in which species abundances are expected to decrease by less than 1 percent in wet years under the VA pathway due to changes in Delta outflow (see Section 13.5, *Beneficial Environmental Effects*). In addition, Delta outflow conditions are generally good for fish during wet years, so small changes in Delta outflow during wet years are less impactful than under dry conditions. Similarly, small decreases in Delta outflow in February under the regulatory pathway and February and May under the VA pathway represent less than 1 percent of total Delta outflow (see Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*) and would have less than

significant impacts on estuarine fish species (abundance indices of native estuarine species are expected to increase under the 55 w/WSAs scenario in all water year types and in the VA scenario in all water year types except for wet years; see Section 13.5). Changes in July through December Delta outflow would be very small and would have less than significant impacts to aquatic species because outflow during this period is less influential on candidate, sensitive, or special-status anadromous and estuarine fish species.

Higher winter and spring Delta inflows and outflows would improve Delta and estuarine flow and habitat conditions needed to support key ecosystem functions and life stage needs of native anadromous, estuarine, and resident fish species in the Bay-Delta watershed. Delta inflows in January through June support migratory conditions for emigrating juvenile salmonids and other anadromous and estuarine fishes that migrate through the Delta and the lower reaches of the Sacramento and San Joaquin Rivers and provide attraction and homing cues for adult salmon, steelhead, sturgeon, and other species migrating upstream. The expected benefits of increased winter and spring Delta inflows include, but would not be limited to, improved juvenile Chinook salmon survival and reduced juvenile salmonid entrainment into the interior Delta during emigration. As discussed in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, Sacramento River at Rio Vista flows of approximately 20,000 cfs and higher from April through June correspond to increasing abundance of fall-run Chinook salmon smolts exiting the Delta. In addition, Sacramento River at Rio Vista flows of approximately 20,000 cfs and higher during February through April correspond to increasing abundance of winter-run Chinook salmon entering and exiting the Delta. As discussed in Section 13.5, *Beneficial Environmental Effects*, flows at Wilkins Slough exceeding 10,712 cfs during mid-March to mid-June have been shown to increase outmigration survival for fall-run Chinook salmon, and flows of at least 17,657 cfs, and 26,500 cfs, at Freeport are associated with higher presence and catch (given presence), respectively, of fall, winter, and spring-run Chinook salmon fry. The frequency of flows exceeding each of these thresholds would be expected to increase under the regulatory pathway (see Section 13.5). The frequency of Sacramento River at Rio Vista flows exceeding 20,000 cfs during February through April and flows exceeding 17,657 cfs and 26,500 cfs at Freeport could increase slightly under the VA pathway (see Section 13.5). These changes in inflows should increase the survival of juvenile Chinook salmon during key emigration periods.

Increased Delta outflows during winter and spring months would benefit estuarine fishes (e.g., longfin smelt, Delta smelt) that use the Bay-Delta estuary for migration, spawning, and rearing. As described in Section 13.5, mean daily outflows exceeding flow thresholds that are protective of longfin smelt and Delta smelt would increase under the regulatory pathway (see Section 13.5). Additional flows from the lower San Joaquin River watershed could further enhance benefits. Implementation of the Lower San Joaquin River (LSJR) flow objectives from the 2018 Bay-Delta Plan in parallel with implementation of the revised proposed Plan amendments would result in further increases in Delta outflow in all water year types, and implementation of the Tuolumne HRL commitments could increase Delta outflow to some degree in all year types except wet years (see Section 13.4). As shown in Section 13.5, implementing the LSJR flow objectives from the 2018 Bay-Delta Plan in combination with the regulatory pathway or VA pathway generally would increase the frequency of exceeding important ecological flow thresholds and would be expected to increase abundance indices of native estuarine species in all water year types. Implementing the Tuolumne

HRL flow commitments in combination with the regulatory pathway could slightly increase abundance indices of some native estuarine species during some water year types.

As described in Section 13.3.4.2, Section 4.4.9.1 of the revised proposed Plan amendments includes provisions for *Protection of Base Flows* to protect the base inflows and outflows that HRL flow commitments are added to under the VA pathway applicable to new water supply projects. Specifically, to help ensure that water quality conditions, including existing flows, together with other measures in the watershed, continue to support and maintain natural production of viable native fish populations, in future water right actions the State Water Board will consider imposing requirements, based on the record established during the administrative proceeding, including any hearing, to ensure that the use of water is consistent with and supports the salmon protection, fish viability, inflow, inflow-based Delta outflow, and interior Delta flow objectives (see the *2025 ROD and 2025 ITP* subsection below for additional discussion of the LTO baseflow balancing provision included in Section 4.4.9.1 of the revised proposed Plan amendments). In addition, as described in Section 4.4.2.2 of the revised proposed Plan amendments, new water supply projects that would increase diversions from the Delta and decrease Delta outflows would be subject to the regulatory pathway without water supply adjustments unless and until the Bay-Delta Plan is updated based on supporting scientific and environmental documentation. While these provisions are expected to reduce possible impacts of new water supply projects on Delta outflow, it remains possible that in the future, new water supply projects could reduce some of the benefits of increasing Delta outflows under the VA pathway. New water supply projects could also reduce the frequency of high flows exceeding Delta outflows resulting from the flow requirements under the regulatory pathway, particularly with water supply adjustments for existing water rights. Section 13.7.21, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes* includes a discussion of the possible impacts of new water supply projects on Delta outflow.

In addition to evaluating changes in Delta outflows, the effects of the revised proposed Plan amendments on the low salinity zone, referred to as X2, were evaluated. The importance of high winter-spring (January through June) outflows (or X2 position) for native fishes, including native estuarine fishes, is further explained in Chapter 3 (see Section 3.2.2, *Freshwater Flow and Estuarine Resources*). Generally, the further X2 is located downstream of the confluence of the confined deep channels of the Sacramento and San Joaquin Rivers (and the effects of the SWP and CVP export facilities) and downstream into the broad, shallow, cool channels of Suisun Marsh and Suisun Bay, the better fish and other species respond. Figure 13.7.6.2-1a shows the frequency of meeting an X2 position between Collinsville (81 kilometers [km]) and Port Chicago (64 km) under baseline and the 55 w/WSAs scenario, including without and with the additional contributions to Delta outflow that would result from implementing the LSJR flows objectives of the 2018 Bay-Delta Plan (55 w/WSAs w/40uf) and from implementing the Tuolumne HRL (55 w/WSAs w/Tuol). The January through June median position of X2 during critical water years is expected to shift from 79 km under baseline conditions downstream to 78 km under the 55 w/WSAs or 55 w/WSAs w/Tuol scenarios. The position of X2 would further shift downstream to 77 km in critical years under the 55 w/WSAs w/40uf scenario. The median position of X2 under all water year types combined also is expected to shift downstream from 69 km under baseline conditions to 68 km under the 55 w/WSAs or 55 w/WSAs w/Tuol scenarios and to 67 km under the 55 w/WSAs w/40uf scenario. These results indicate that the regulatory pathway would provide benefits to native fish species through changes to the position of X2.

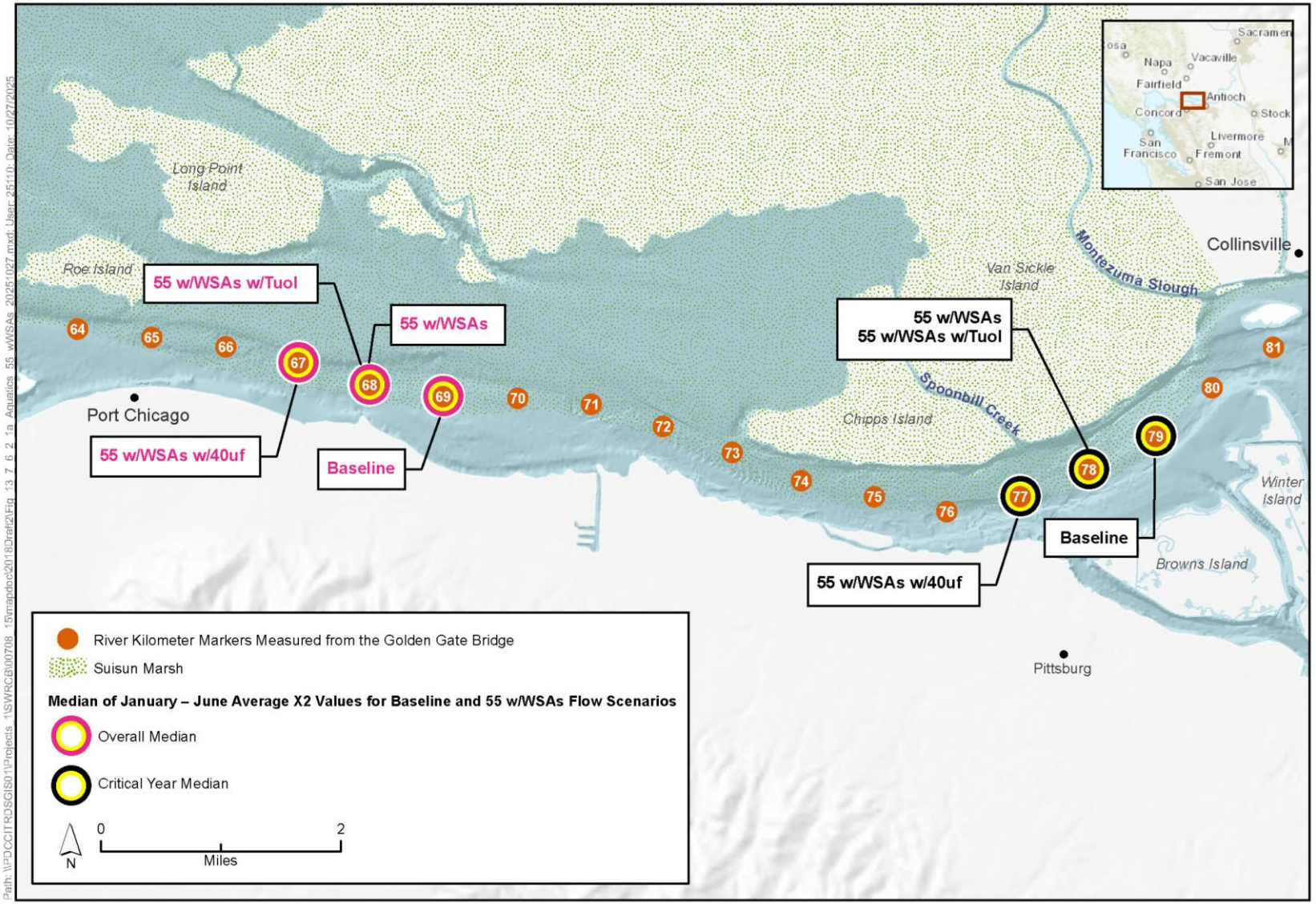


Figure 13.7.6.2-1a

X2 Position for Baseline and 55 w/WSAs Scenarios Presented as Median of the January through June Average and Critical Year Values

Figure 13.7.6.2-1b shows the frequency of meeting an X2 position between Collinsville (81 km) and Port Chicago (64 km) under baseline and the VA scenario, including without and with the additional contributions to Delta outflow that would result from implementing the LSJR flows objectives included in the 2018 Bay-Delta Plan (VA w/40uf) and from implementing the Tuolumne HRL commitments (VA w/Tuol). The January through June median position of X2 during critical water years would remain at 79 km under baseline conditions and the VA and VA w/Tuol scenarios. The position of X2 would shift downstream to 78 km in critical years under the VA w/40uf scenario. The median position of X2 under all water year types combined would remain at 69 km under baseline conditions, the VA, the VA w/Tuol, and the VA w/40uf scenarios. These results indicate that the VA pathway would have less-than-significant impacts on native fish species through changes to the position of X2.

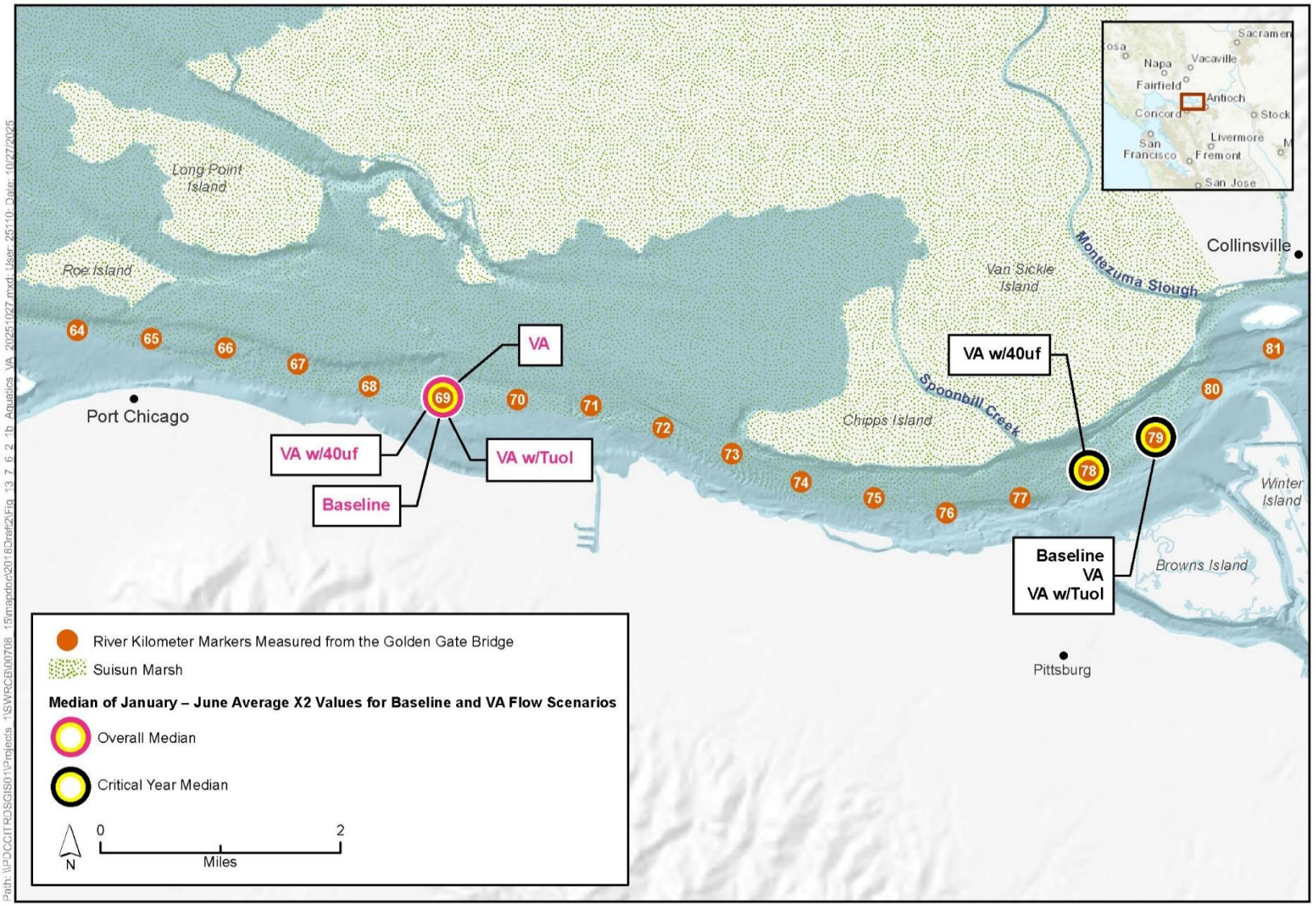


Figure 13.7.6.2-1b

X2 Position for Baseline and VA Scenarios Presented as Median of the January through June Average and Critical Year Values

2025 ROD and 2025 ITP

With the 2025 ROD/ITP, Delta inflows and outflows could decrease during the July through December period, primarily during September and October, in above normal and wet years due to removal of the fall X2 requirements under the starting point for the regulatory pathway (55 w/WSAs + 2025 ROD/ITP scenario compared to the 55 w/WSAs scenario and baseline) and VA pathway (VA + 2025 ROD/ITP scenario compared to the VA scenario and baseline) (Section 13.4.6, *Sensitivity Analysis for 2025 Record of Decision and 2025 Incidental Take Permit and* Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*). However, SacWAM results show that with the 2025 ROD/ITP, Delta inflows and outflows would be expected to increase in above normal and wet years during the January through June period compared to baseline under both pathways due to increased reservoir spill, except for small decreases in outflows during wet years under the VA pathway (see Section 13.4.6). However, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, there is uncertainty in the SacWAM results, and as a result, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results. Overall, increases in inflows and outflows during January through June would be expected to have beneficial effects on native fish species migrating through or inhabiting the Delta. Small decreases in outflows during wet years under the VA pathway would not be expected to have additional effects on native fish species beyond what is described above (see *Impact Discussion and Conclusion*).

Reduced Delta inflows and outflows during September could shift the low-salinity zone upstream and decrease the extent of low-salinity habitat available to Delta smelt and longfin smelt. Longfin smelt typically collect in the Delta in late fall as they prepare to migrate upstream (see Section 3.5, *Longfin Smelt* [*Spirinchus thaleichthys*]). The upstream shift in salinity conditions could also compress habitat into narrower areas of the estuary, potentially increasing exposure to predation, harmful algal blooms, and other stressors. Additionally, lower fall outflows could reduce foodweb support and habitat suitability within the low-salinity zone, although the 2025 ITP amendments include requirements for habitat and food actions that could ameliorate negative effects on the food web and habitat suitability. Migrating adult anadromous fish species could be affected because higher fall flows associated with the fall X2 requirements may contribute to upstream migration conditions and environmental cues for adult fish movement. Upstream migration for steelhead and salmon is often triggered by pulse flows (see Section 3.4.5, *Flow Effects on Salmonids*). Peak upstream migration for adult fall-run Chinook salmon and Central Valley steelhead occurs in the fall, including September, with salmonids relying on sufficient flows to cue their migration (see Table 3.4-4 in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendation*). Fall is also an important reproductive period, as spring-run spawn in the mainstem Sacramento River, and fall-run begin spawning during September (see Section 3.4.3 *Life History, Distribution, and Abundance Trends over Time*).

As described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, the new LTO baseflow balancing provision that would apply under the VA pathway of the revised proposed Plan amendments requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The analyses presented here evaluate the effects of not having the LTO baseflow balancing provision. However, the

LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the narrative interior Delta flow objective. During annual and periodic reviews, the State Water Board will assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

Reduced Sacramento/Delta Supply to Agriculture

Regulatory Pathway

Implementation of the revised proposed Plan amendments would result in reduced Sacramento/Delta supply for irrigation use (see Section 13.7.4, *Agriculture and Forest Resources*). These conditions could adversely affect special-status fish species that depend in part on Sacramento/Delta water supply for habitat.

The regulatory pathway under the revised proposed Plan amendments would have similar effects as those that were evaluated in Section 7.6.2; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in hydrology and water supply would be expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.2.

Voluntary Agreement Pathway

Flows under the VA pathway would generally be lower than the regulatory pathway on the tributaries with HRL commitments, so the reductions in Sacramento/Delta water supplies would be less (see Section 13.4). As described in Chapter 9, *Proposed Voluntary Agreements*, Sacramento/Delta water supply reductions would be based on voluntary measures, and it is unlikely that flow assets would be provided from sources already committed for the specific purpose of providing water for a special-status species or their habitat. During the term of the VA pathway, changes in water supply would be expected to be similar to those under the VA pathway alone, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, the effect of reduced Sacramento-Delta supply to agricultural use on special-status species ranges from no impact for the term of the VA pathway to potentially significant under the regulatory pathway. The regulatory pathway under the revised proposed Plan amendments is intended to be implemented in an integrated fashion with habitat restoration and other non-flow measures that would provide benefits for both aquatic and terrestrial species, including actions identified in the program of implementation. Specifically, the proposed program of implementation identifies habitat restoration actions, including through California EcoRestore and other efforts, as well as other non-flow actions that others should take to protect fish and wildlife. The revised proposed Plan

amendments also allow for and encourage local cooperative solutions that would facilitate a combination of flow and non-flow actions to promote habitat restoration to amplify the ecological benefit of new and existing flows. Local cooperative solutions with proven effective habitat restoration may also allow flow requirements lower in the range, and therefore reduce the potential impacts associated with reduced Sacramento/Delta water supply, such as impacts on agriculture and associated impacts on aquatic species. Local cooperative solutions are required to include measures to avoid or minimize impacts on aquatic species of concern.

Potential impacts on aquatic species could be avoided or reduced through implementation of Mitigation Measures MM-AQUA-a,d: 2 and MM-AQUA-a,d: 3. Mitigation Measure MM-AQUA-a,d: 2 identifies habitat protection and restoration actions that are being and should continue to be implemented to protect aquatic species. Mitigation Measure MM-AQUA-a,d: 3 provides generally for management actions to protect special-status species dependent on Sacramento/Delta water that has been used for irrigation. In addition, management measures exist that agricultural water users can implement to avoid or minimize impacts on special-status species. While the State Water Board has some authority to ensure that mitigation is implemented for some actions, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the revised proposed Plan amendments. Accordingly, the State Water Board cannot guarantee that measures will always be adopted or applied to fully mitigate potential impacts on aquatic species. Therefore, unless and until the mitigation is fully implemented, the impacts remain potentially significant.

Reduced Sacramento/Delta Supply to Municipal Use

Regulatory Pathway

As described in Section 7.12.1, *Surface Water*, reductions in water supply to municipalities, as well as increased water recycling and indoor conservation, could alter the flow and chemical constituent concentrations of wastewater treatment plant (WWTP) influent and subsequently could affect WWTP effluent discharges to receiving waters. In locations where WWTP operators are unable to implement proper adjustments to their facilities, changes in WWTP discharge volume and timing could result in changes in water quality and flow in receiving waters that could affect special-status aquatic species occurring in these streams. The regulatory pathway under the revised proposed Plan amendments would have similar effects as those that were evaluated in Section 7.6.2; however, as described in Section 13.4, under the starting point for the regulatory pathway changes in hydrology and water supply would be expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.2.

Voluntary Agreement Pathway

Under the VA pathway, there would be only a very small reduction in water supply for municipal use (see Section 13.4). Sacramento/Delta water supply reductions would be based on voluntary measures that would be largely or entirely from agricultural supplies or based on groundwater

substitution. Any changes to municipal water supplies would be small and would not be large enough to potentially affect flow and chemical constituent concentrations of WWTP influent and subsequently WWTP effluent discharges to receiving waters, and there would be no effect on aquatic biological resources. During the term of the VA pathway, changes in water supply and resulting effects on WWTP effluent would be expected to be similar to those under the VA pathway alone, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, changes in water supply could have effects ranging from no impact for the term of the VA pathway to potential changes in WWTP effluent discharge volumes and timing under the regulatory pathway. In locations where WWTP operators are unable to implement proper adjustments to their facilities, changes in WWTP discharges could result in effects on water quality and flow that could affect special-status aquatic species occurring in these streams. This could affect adult and juvenile salmonids (e.g., fish health, spawning migration delays for adults, lower egg-to-fry survival, and lower outmigration survival for juveniles). These effects would be potentially significant.

Implementation of Mitigation Measures MM-AQUA-a,d: 4 and 5 will reduce potential violations of waste discharge requirements that could alter instream flows or water quality conditions affecting special-status species. Mitigation Measure MM-AQUA-a,d: 4 incorporates Mitigation Measure MM-SW-a,f: 1 for regulation of waste discharges that is accomplished primarily through the State Water Board and regional water board waste discharge permits, including National Pollutant Discharge Elimination System permits for point-source discharges. A variety of funding programs provide loans and grants for capital improvements to WWTPs. The State Water Board and regional water boards will continue to regulate waste discharges and will continue to promote and support future funding sources as appropriate. Additionally, to avoid or minimize impacts associated with reduced wastewater instream, when processing wastewater change petitions pursuant to Water Code section 1211, the State Water Board will ensure that the change in wastewater discharge does not affect instream flows or water quality for special-status species. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Changes in Groundwater

Regulatory Pathway

As discussed in more detail in Section 7.12.2, *Groundwater*, lower groundwater levels could occur as a result of increased groundwater pumping in response to reduced Sacramento/Delta supply, and less incidental recharge from excess applied irrigation water in some locations in the Sacramento/Delta watershed and other regions. Potential changes in groundwater levels could affect stream-aquifer interactions (i.e., streambed seepage) in some locations and negatively affect some of the special-status fish species identified in Table 7.6.2-1.

The regulatory pathway would have similar effects as those that were evaluated in Section 7.6.2; however, as described in Section 13.4, under the starting point for the regulatory pathway changes in hydrology and water supply would be expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments. As such, the likelihood of effects on native species due to lower groundwater levels would be less due to these refinements

at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.6.2.

The regulatory pathway provides for local cooperative solutions that would be required to include measures to coordinate implementation of the revised proposed Plan amendments with groundwater management activities, including implementation of the Sustainable Groundwater Management Act (SGMA). In addition, local cooperative solutions may allow flow requirements lower in the range if complementary measures are implemented to provide equivalent protection that reduces potential impacts associated with decreased consumptive water uses, including impacts on groundwater, subject to the requirements of SGMA.

Voluntary Agreement Pathway

As discussed in Chapter 9 and Section 13.3, the VA pathway includes groundwater substitution as a source of HRL flow commitments. In addition, the VA pathway would result in a total average annual reduction in Sacramento/Delta surface water supply and could also lead to increased groundwater pumping in response to reduced Sacramento/Delta supplies, and a reduction in incidental groundwater recharge from excess irrigation. Groundwater substitution under the HRL commitments would be limited in quantity and water supply reductions under the VA pathway would generally be lower than under the regulatory pathway on the tributaries with HRL commitments; therefore, changes in groundwater, and potential effects on stream-aquifer interactions that could affect native species would be expected to be less under the VA pathway than under the regulatory pathway. During the term of the VA pathway, changes in Sacramento/Delta supply and possible effects on groundwater would be expected to be similar to those under the VA pathway alone, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Under existing conditions, flow in some streams is already affected by high levels of groundwater pumping, including in areas where declining groundwater levels have been observed. For example, in the Cosumnes River watershed, high levels of groundwater pumping are known to affect flows during fall months and have converted the Cosumnes River to a losing reach in the lower watershed. In recent years, the entire lower river has frequently remained dry throughout most of the fall-run Chinook salmon adult migration period of October through December (Fleckenstein et al. 2004). In the lower Cosumnes River and other locations where flows are already affected by groundwater overdraft, actions taken by water users in response to reduced Sacramento-Delta supply, including increased groundwater pumping and changes in incidental recharge, could exacerbate the effects of groundwater overdraft on streamflows.

Implementation of the revised proposed Plan amendments could result in changes in groundwater levels that could affect stream-aquifer interactions (i.e., streambed seepage) in some locations and negatively affect some special-status fish species. Native fish species such as anadromous salmonids can be affected by even short-term, localized disruptions in flow to provide suitable conditions for completion of their freshwater life cycle. The potential for changes in groundwater levels to affect stream-aquifer interactions in any given stream can vary by stream reach and depends on several

factors such as the underlying geology, proximity and connectivity of groundwater wells to the stream, the rate and duration of groundwater pumping, and groundwater recharge rates. These impacts would be potentially significant.

It is state policy to reduce reliance on the Delta, improve regional self-reliance, and address numerous groundwater management issues, including subsidence. SGMA addresses numerous groundwater management issues, including subsidence. However, these policies and other actions to increase groundwater levels could take many years to implement.

Implementation of Mitigation Measures MM-AQUA-a,d: 6 through 8 will reduce or avoid potential impacts on aquatic biological resources resulting from changes in stream-aquifer interactions from lower groundwater levels. These measures incorporate groundwater mitigation measures to reduce lowering of groundwater levels. SGMA could reduce or eliminate impacts, particularly in medium- and high-priority groundwater basins. In developing and implementing a groundwater sustainability plan, groundwater sustainability agencies are required to avoid undesirable results, including depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses.

In addition, the State Water Board has several authorities that are independent of SGMA, including authority to act to prevent waste, unreasonable use, unreasonable method of use, and unreasonable method of diversion of water. The State Water Board may exercise this authority through quasi-adjudicative or quasi-legislative proceedings as appropriate and necessary to minimize potential impacts on special-status aquatic species from changes in groundwater and surface water supplies. The State Water Board could also act under its public trust authority to regulate depletion of interconnected surface water by groundwater pumping.

More generally, water users can and should diversify their water supply portfolios in an environmentally responsible manner and in accordance with the law to mitigate groundwater impacts and possible changes in stream-aquifer interactions that could affect aquatic biological resources. This includes sustainable use of groundwater and groundwater storage and recovery and conjunctive use, water transfers, water conservation and efficiency upgrades, and recycled water. The State Water Board will continue efforts to encourage and promote environmentally sound recharge projects that use surplus surface water, increased use of recycled water, sustainable water transfers, and conservation. While the State Water Board has some authority to ensure that mitigation is implemented for some actions, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the revised proposed Plan amendments. The State Water Board cannot guarantee that measures will always be adopted or applied in a manner that fully mitigates the impact. Therefore, unless and until the mitigation is fully implemented, impacts of changes in groundwater levels and stream-aquifer interactions on aquatic biological resources remain potentially significant.

13.7.7 Cultural Resources

This section describes the potential impacts on cultural resources that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes impact conclusions from previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed

Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

13.7.7.1 Impact Analysis

Impact CUL-a: Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5

Impact CUL-b: Cause a substantial adverse change in the significance of an archaeological resource as defined in Section 15064.5

The analyses of historical and archaeological resources are closely related and are therefore combined and addressed together under Impact CUL-a and Impact CUL-b.

Changes in Hydrology

Regulatory Pathway

Changes in hydrology from implementation of the regulatory pathway would result in changes in water levels at some reservoirs, which could expose previously inundated cultural resources and/or significant historical or archaeological resources to increased wave action, erosion, and human activity (e.g., looting). The regulatory pathway would have similar effects as evaluated in Section 7.7, *Cultural Resources*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in reservoir levels would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reservoir levels under the starting point for the regulatory pathway generally would remain at higher elevations more frequently than evaluated in Section 7.7 due to these refinements. SacWAM results show that average annual changes in water surface elevations in reservoirs would generally be smaller under the 55 w/WSAs scenario (see Section 13.4 and Table H1a2-136 in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*) than under the 55 scenario and more similar to the changes under the Low Flow Alternative (35 and 45 scenarios) presented in Appendix A1 (see Table A1-145 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.7. Cold water habitat provisions in the Bay-Delta Plan would provide flexibility for reservoir operators to manage temperature, flow, and carryover storage in a coordinated manner, which would be expected to reduce the magnitude of the effects.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway would also result at times in changes in water levels at some reservoirs on tributaries with HRL commitments, which could expose previously inundated cultural resources and/or significant historical or archaeological resources to increased wave action, erosion, and human activity similar to the effects described in Section 9.7.7, *Cultural Resources*. Flows under the VA pathway would generally be lower on tributaries with HRL

commitments than under the regulatory pathway, so the impact on reservoir levels would be less than under the regulatory pathway for the term of the VA pathway. SacWAM results show that the average annual change in water surface elevation under the VA pathway would be the same as or similar to baseline (see Section 13.4 and Appendix H1a2, Table H1a2-136). Actual operation could vary to some degree from modeled outcomes and there could be additional changes in reservoir levels beyond the modeled changes. Changes in hydrology, including changes in reservoir levels, with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, changes in water levels at some reservoirs could be large enough to expose previously inundated cultural resources to increased wave action, erosion, and human activity. Surface water elevations for reservoirs normally fluctuate throughout the year and from year to year. Under the revised proposed Plan amendments, the primary potential effect on cultural resources would be associated with potential reservoir drawdown that increases exposure. Most of the changes in reservoir elevations would be within the historical ranges; however, elevations could be lower more frequently than under baseline for some reservoirs. As flow requirements increase, additional releases from reservoirs in the winter and spring are larger, potentially leading to greater changes in reservoir levels relative to baseline. Because flows under the VA pathway would generally be lower than the regulatory pathway, the magnitude of this impact would be less during the term of the VA pathway. These impacts could be potentially significant.

Implementation of Mitigation Measure MM-CUL-a,b: 1–3 will reduce or avoid impacts on historical and archaeological impacts associated with changes in reservoir levels, including export reservoirs. Reservoir operators in the Sacramento/Delta will be required to avoid or reduce impacts on cultural resources in their long-term strategies and annual operations plans for cold water habitat objective implementation. In addition, under the revised proposed Plan amendments, all reservoir owners and operators are subject to existing regulatory requirements that protect water quality in reservoirs and streams below reservoirs (Mitigation Measure MM-AQUA-a,d: 1). In exercising its regulatory authorities, the State Water Board will consider cultural resources and ensure that any cultural resources impacts are avoided or reduced. Reservoirs also may already be subject to resource management plans, independent of the Bay-Delta Plan, that contain cultural resource protection measures for previously recorded sites, as well as procedures to implement in the event of an unanticipated discovery, that could reduce potentially significant impacts to a less-than-significant level. Cultural resources mitigation measures are commonly employed on a variety of projects and, in many cases, reduce potentially significant impacts to less-than-significant levels. However, unless and until the mitigation is implemented, any impacts from changes in reservoir storage levels on cultural resources remain potentially significant.

Impact CUL-d: Disturb any human remains, including those interred outside of dedicated cemeteries

Changes in Hydrology

Regulatory Pathway

Changes in hydrology from implementation of the regulatory pathway would result in changes in water levels at some reservoirs, which could expose previously inundated land containing human burials and could result in disturbance of the burial and impacts from human activity. The regulatory pathway would have similar effects as evaluated in Section 7.7, *Cultural Resources*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in reservoir levels would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Section 7.7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reservoir levels under the starting point for the regulatory pathway for the revised proposed Plan amendments generally would remain at higher elevations more frequently than evaluated in Section 7.7 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.7.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway would also result at times in changes in water levels at some reservoirs on tributaries with HRL commitments and reservoirs, which could result in more exposed barren land at reservoir edges when the water level is lowered. Exposure of previously inundated land may yield human burials, which could result in the disturbance of the burial and impacts from human activity, such as looting, similar to the effects described in Section 9.7.7, *Cultural Resources*. Flows under the VA pathway for the revised proposed Plan amendments would generally be lower on the tributaries with HRL commitments than under the regulatory pathway, so the impact on reservoir levels, would be less than under the regulatory pathway for the term of the VA pathway. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, changes in water levels at some reservoirs could be reduced below baseline, possibly affecting human remains or burials. Surface water elevations for reservoirs normally fluctuate throughout the year and from year to year. Under the revised proposed Plan amendments, the primary potential effect on human remains or burials would be associated with potential reservoir drawdown that may expose previously inundated land, which could result in disturbance of the burial and impacts from human activity, such as looting. Most of the changes in reservoir elevations would be within the historical ranges; however, elevations could be lower more frequently than

under baseline for some reservoirs. As flow requirements increase, additional releases from reservoirs in the winter and spring are larger, potentially leading to greater changes in reservoir levels relative to baseline. Because flows under the VA pathway would generally be lower than the regulatory pathway, the magnitude of this impact would be less during the term of the VA pathway. Cold water habitat provisions in the Bay-Delta Plan would provide flexibility for reservoir operators to manage temperature flow, and carryover storage in a coordinated manner which would be expected to reduce the magnitude of the effects. These impacts could be potentially significant.

Implementation of Mitigation Measure MM-CUL-d: 1 will involve implementation of, or compliance with, practices to protect cultural resources found on lands surrounding reservoirs in the event of an unanticipated discovery (Mitigation Measures MM-CUL-a,b). These practices could reduce these impacts to less-than-significant levels. However, unless and until the mitigation measures are fully implemented, the identified impacts related to cultural resources remain potentially significant.

13.7.8 Energy

This section describes the potential impacts on energy that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9. The energy evaluation is generally similar to what was described in Chapters 7 and 9, although there is now some discussion of possible hydropower effects associated with power bypass that could be required for meeting the cold water habitat objective.

Appendix F of the State CEQA Guidelines (Cal. Code Regs., tit. 14, § 15000 et seq.) contains recommendations for assessing energy impacts and mitigation measures that may be considered in making a decision on a project. After the Notice of Preparation for the Plan amendments, these recommendations were integrated in a simplified form into the sample Environmental Checklist in Appendix G of the State CEQA Guidelines. CEQA requires a discussion of potential energy impacts to ensure that energy implications are considered, with emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy and adhering to state or local plans for renewable energy or energy efficiency. Appendix F was used as guidance for the following discussion of the energy implications of the revised proposed Plan amendments.

The impact thresholds for energy are broad and interrelated. The evaluation of Impact EN-a estimates the effect of changes in hydrology on Sacramento/Delta hydropower generation and energy savings associated with reduction in Delta exports. Impact EN-e estimates the energy effects associated with actions that could be taken in response to reduced Sacramento/Delta supply, including groundwater pumping, desalination, and other water management actions such as groundwater storage and recovery, water transfers, water recycling, and water conservation. Impacts EN-a and EN-e inform the analyses in Impact EN-b and Impact EN-d. Impact EN-c considers whether the changes in hydropower generation would have local or regional effects on energy supplies and includes a power flow analysis of electrical grid reliability and effects during rotating power outages.

Several types of quantitative analyses were performed for the energy analysis presented in Section 7.8, *Energy*, Section 9.7.8, *Energy*, and Appendix A5, *Hydropower, Energy Grid, and Export Energy Analyses.* Hydropower calculations were performed to assess the potential effect of changes in hydrology on hydropower generation. The potential effect of changes in hydropower generation on reliability of the California electrical grid was assessed with power flow modeling of the 75 scenario, the scenario most likely to cause reliability issues. In addition, calculations were performed to estimate energy savings associated with reduction in Delta exports. These quantitative assessments capture the range of effects that would be expected with the revised proposed Plan amendments and are not repeated for the 55 w/WSAs scenario for this chapter. Accordingly, these quantitative assessments presented in Chapters 7 and 9 are referenced in the discussion below where appropriate.

13.7.8.1 Impact Analysis

Impact EN-a: The effects of the project on energy resources

Changes in Hydrology

Regulatory Pathway

Changes in hydrology from implementation of the regulatory pathway would alter hydropower generation in the Sacramento/Delta. Similar to what is described in Section 7.8, *Energy*, the main effect of the regulatory pathway on hydropower would be an increase in generation during the spring and a reduction during the summer, resulting primarily from changes in flow. Percent change in hydropower generation would be relatively small at most facilities on an annual basis because the total annual unimpaired inflow to the upper watersheds where most hydropower facilities are located would not change and because storage would not be greatly reduced. Changes in summer generation are of more concern than changes during other times of the year because peak demand for electricity occurs in the summer.

Reduction in summer hydropower generation would be replaced by other sources of electricity. In the short term, replacement would likely be provided by increased generation at natural gas facilities. Changes in hydropower generation would vary by individual facility in a manner similar to what is described for Impact EN-c in Section 7.8, with effects associated with the 55 scenario being larger than effects associated with the 35 and 45 scenarios (Low Flow Alternative).

The primary cause of reductions in summer hydropower generation would be the effect of reductions in flow on flow through powerhouses. The regulatory pathway would have similar effects as evaluated in Section 7.8; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in flow would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, flows under the starting point for the regulatory pathway generally would be lower than evaluated in Section 7.8 due to these refinements.

The effect of the starting point for the regulatory pathway (55 w/WSAs scenario) on reductions in summer flow relative to the reductions described in Chapter 7 varies by river, month, and portion of

the distribution of results that is evaluated. Summer flow reductions in the largest hydropower generating tributaries (i.e., upper Sacramento River, Feather River, Yuba River, Bear River, American River, and Mokelumne River) under the 55 w/WSAs scenario (presented in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*) would generally be less than under the 55 scenario and often similar to the summer flow reductions under the Low Flow Alternative (35 and 45 scenarios) (presented in Appendix A1, *Sacramento Water Allocation Model Methods and Results*) due to water supply adjustments.

Additional changes in hydropower generation could occur in association with power bypass operations at particular hydropower facilities in order to meet cold water habitat requirements. For example, as described in Sections 7.12.1, *Surface Water*, and 7.6.2, *Aquatic Biological Resources*, increases in power bypass operations at Hyatt Power Plant at Lake Oroville might be one way to improve water temperatures for fish in the Feather River. Effects of power bypass on hydropower would likely be relatively small overall compared to other changes in hydropower evaluated in this section. The magnitude of increased power bypass is uncertain and will depend on long-term strategies that have yet to be developed.

Similar to what is described in Section 7.8, under the starting point for the regulatory pathway changes in hydrology could reduce energy requirements for exporting and conveying Delta water to end users. These energy savings would depend on the magnitude of the reduction in exported water supply from the Delta. As described in Section 13.4, reductions in Sacramento/Delta water supply would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.8.

Because changes in hydrology and effects on hydropower generation under the starting point for the regulatory pathway (55 w/WSAs scenario) would be expected to generally be less than the 55 scenario, this section references changes in hydropower generation described in Chapter 7 for the 45 scenario as a surrogate for possible changes under the 55 w/WSAs scenario. Similarly, because changes in water supply and energy savings associated with reductions in Delta exports would be smaller and similar to the Low Flow Alternative (35 and 45 scenarios), the results from the 45 scenario evaluated in Chapter 7 are used as an example of possible effects associated with reductions in water supply and Delta exports.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway also would result in small changes in hydropower generation compared to baseline, similar to the effects described in Section 9.7.8. As described in Section 9.7.8, the hydropower evaluation included expansion of effects to account for flow commitments that were not simulated by SacWAM.

The main effect of the VA pathway on hydropower would be a small increase in generation during the spring and a small reduction during the summer, resulting primarily from changes in flow. The annual effect on hydropower generation in the Sacramento/Delta would be minimal and other sources of energy could replace the relatively small reductions in hydropower generation that may occur in some months. Changes in hydrology and associated effects on hydropower generation with

implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*; therefore, effects would be similar to those described in Chapter 9.

Impact Discussion and Conclusion

Changes in hydrology under the revised proposed Plan amendments could cause small reductions in annual hydropower generation and larger reductions in summer hydropower generation. For example, for the 45 scenario, the estimated reduction in median annual hydropower generation is 270 gigawatt-hours (GWh) (Table 7.8-3), which represents a decrease of about 2.0 percent in hydropower generation in the 47 hydropower facilities evaluated for the Sacramento/Delta region. When compared with all the electricity generated in California for 2021 (194,127 GWh, Table 7.8-1), a critically dry year, this annual change (270 GWh) represents a 0.14 percent decrease.

Under the regulatory pathway, the largest monthly decrease in estimated hydropower generation would likely occur during July (Figure 7.8-10). Section 7.8 estimates that under the 45 scenario, median hydropower generation would decrease by 116 GWh, which would be approximately 7 percent of the July baseline median generation of 1,679 GWh calculated for the 47 hydropower facilities evaluated for the Sacramento/Delta region.

The main effect of the VA pathway on hydropower generation would be a small increase during the spring and a small reduction during the summer (Figure 9.7-2). For the analysis presented in Chapter 9, changes in hydropower generation were extrapolated to estimate the possible effect of unspecified water purchases. The extrapolated percent change in hydropower generation for July–September varied between an increase of 1.4 percent to a decrease of 6.7 percent depending on month and water year type (Table 9.7-9).

Overall, the effect of changes in hydropower generation would range from less than significant for the VA pathway to potentially significant for the regulatory pathway. While reduced hydropower is not significant statewide, hydropower production can be an important local resource, and reduced hydropower generation could be significant for an individual project or community. Potential localized impacts of reductions in hydropower generation are further evaluated under Impact EN-c.

The energy evaluations in Chapter 7 and Chapter 9 include calculations of energy savings associated with reductions in Delta exports. The annual average energy savings associated with simulated reductions in Delta exports is much larger than the estimated annual average reduction in hydropower generation in the Sacramento River watershed and Delta eastside tributaries regions (e.g., 839 GWh versus 257 GWh for the 45 scenario). However, the reduction in energy use would be offset to some degree by energy used to replace reductions in Sacramento/Delta water supply. The degree of offset would depend on how water users respond to decreased Sacramento/Delta water deliveries. An evaluation of the net energy effects of reductions in diversions, Delta exports, and water supply is discussed under Impact EN-e.

Impacts related to hydropower generation would be reduced through implementation of the cold water habitat objective, local cooperative solutions, and mitigation measures. Under the regulatory pathway, the revised proposed Plan amendments would require reservoir operators in the

Sacramento/Delta to develop and implement long-term strategies and annual operations plans for approval by the State Water Board to implement the cold water habitat objective in a way that considers a tributary's unique structural, operational, and hydrological characteristics. Upstream water users would be required to participate in development of the strategies to the extent that their operations affect achievement of requirements below the rim reservoirs. As determined by the Executive Director of the State Water Board, upstream reservoir operators may also be required to develop their own strategies if their reservoir operations would affect achievement of the narrative objective for stream segments above the rim reservoirs. The requirements may reduce significant reservoir drawdown, which could prevent water levels from dropping below hydropower intake facilities and prevent reductions in hydraulic head, thereby protecting hydropower production.

Additionally, the revised proposed Plan amendments promote local cooperative solutions that could amplify the ecological benefit of new and existing flows with physical habitat restoration or other complementary ecosystem measures that may reduce the volume of water that needs to be dedicated for instream purposes, resulting in smaller effects on hydropower generation. The program of implementation allows for and encourages water users on tributaries to work together to meet the proposed flow and cold water habitat requirements in a manner that minimizes impacts on hydropower production to the extent possible. Local cooperative solutions could be a method for tributaries with significant interbasin diversions to reduce impacts on hydropower by optimizing interbasin diversions for hydropower and other resource benefits while still contributing to Delta inflow.

In addition to the cold water habitat provisions and local cooperative solutions, implementation of Mitigation Measure MM-EN-a–e can further avoid or minimize impacts on hydropower generation. Mitigation Measure MM-EN-a-e: 1 incorporates Mitigation Measure MM-AQUA-a,d: 1i-ii, which require reservoir operators in the Sacramento/Delta to avoid or reduce effects on hydropower in their long-term strategies and annual operations plans for cold water habitat objective implementation and states that in exercising its regulatory authorities, the State Water Board will consider hydropower generation to ensure that any impacts on hydropower are avoided or minimized.

Other existing requirements, independent of the Bay-Delta Plan, may already limit hydropower production to some degree. Many reservoirs with hydropower operations are subject to regulation by FERC and have independent obligations to meet temperature and other instream flow requirements. Many reservoirs also are subject to Endangered Species Act (ESA) and California Endangered Species Act requirements, including biological opinion provisions. To the extent possible, Bay-Delta Plan requirements are proposed to be integrated with ongoing efforts in the FERC relicensing process and associated water quality certification by the State Water Board, as well as ESA and CEQA requirements.

It is not certain how parties may choose to cooperate to implement the regulatory pathway and whether localized impacts from reductions in hydropower generation could be fully mitigated by Mitigation Measures MM-EN-a-e. Therefore, potential impacts from changes in hydrology due to localized reductions in hydropower generation remain potentially significant.

Impact EN-b: The effect of the project on peak and base period demands for electricity and other forms of energy

Changes in Hydrology and Water Supply

Regulatory Pathway

Changes in hydrology and changes in water supply under the regulatory pathway may affect the peak and base period demands for electricity. As described for Impact EN-a, changes in hydrology would result in a reduction in hydropower generation during the summer, which likely would be replaced with natural gas generation in the near term. As described for Impact EN-e, reduction in water supply could result in a reduction in energy required for conveyance of water to export areas, but reduction in water supply could also result in energy expenditure to secure replacement water supply. The net effect of reduction in supply on energy use is uncertain, but there could be a net increase in energy expenditure that is described under Impact EN-e.

The regulatory pathway would have similar effects to those that were evaluated in Section 7.8; however, as described in Section 13.4, under the starting point for the regulatory pathway changes in hydrology and water supply would be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. Due to these refinements, the magnitude of hydropower effects and energy effects associated with the revised proposed Plan amendments would likely be less than those described in Section 7.8.

As described for Impact EN-a, reduction in summer hydropower generation under the starting point for the regulatory pathway (55 w/WSAs scenario) is expected to be generally less than the 55 scenario and often similar to reductions under the Low Flow Alternative (35 and 45 scenarios) due to water supply adjustments. Effects on energy to replace reductions in Sacramento/Delta water supply would be correlated with total reduction in water supply. Based on the SacWAM results presented in Section 13.4, changes in total Sacramento/Delta water supply under the 55 w/WSAs scenario are expected to be similar to those under the Low Flow Alternative (35 and 45 scenarios in Table 6.4-2). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.8.

Voluntary Agreement Pathway

Implementation of the VA pathway is likely to have small effects on peak and base periods of demand for electricity very similar to the effects described in Section 9.7.8. As described for Impact EN-a, changes in hydrology from implementation of the VA pathway would have only a small effect on hydropower generation. As described for Impact EN-e, implementation of the VA pathway could have small effects on water supply, which could have small, variable effects on energy use. Because of the relatively small volume of HRL flow commitments as a percentage of total water supply, the VA pathway is not expected to result in substantial increases in energy to replace reductions in water supply. The combined effects are unlikely to affect energy availability and demand during peak and base periods. Changes in hydrology and water supply, and associated changes in hydropower generation and energy use, with implementation of the VA pathway for HRL water rights and the

regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Overall, changes in hydrology and water supply under the revised proposed Plan amendments could have effects on hydropower generation as discussed for Impact EN-a and effects on use of energy as discussed for Impact EN-e that range from less than significant for the VA pathway, to potentially significant under the regulatory pathway. These impacts could affect the peak and base period demands for electricity. Discussion of mitigation measures is provided under Impact EN-c and Impact EN-e.

Impact EN-c: The effects of the project on local and regional energy supplies and requirements for additional capacity

Changes in Hydrology

Regulatory Pathway

Changes in hydrology from implementing the regulatory pathway could affect individual hydropower facilities in a manner similar to what is described in Section 7.8 for Impact EN-c. To show which facilities would be most affected, a summary of average changes at all the facilities evaluated is provided for the 55 scenario in Section 7.8 (Figure 7.8-14) and for the 35–75 scenarios in Appendix A5 (Figures A5-16 through A5-20).

To evaluate possible effects of reductions in summer hydropower generation on the electrical grid, Power Gem's Transmission Adequacy and Reliability Assessment (TARA) software was used for a power flow assessment to examine any reliability violations under normal system conditions as well as contingency (i.e., outage) conditions as described in Section 7.8 and Appendix A5. This analysis compared baseline conditions to the 75 scenario using the 2021 power flow case representing the electrical grid under heavy summer demand conditions for the entire Western Interconnection. While this evaluation covered a large area, the TARA software by necessity includes detailed evaluation of local electrical grid infrastructure. The power flow assessment only analyzed the 75 scenario because this scenario would result in the greatest reductions in reservoir storage (head) and the largest changes in flow for hydropower due to reduced interbasin diversions between watersheds and shifts in flow from summer to spring (see Appendix A5).

Based on the power flow analysis, changes in hydropower generation are not expected to cause the electrical grid to become unreliable because energy could be dispatched from other generating facilities to compensate for reductions in hydropower generation during the summer even under the 75 scenario. However, in the rare event of rotating power outages (rolling blackouts), reductions in hydropower generation could result in incremental increases in the area of outage as described in Section 7.8, with potential effects being larger for the 55 scenario than for the 35 and 45 scenarios (Low Flow Alternative).

The regulatory pathway would have similar hydropower and energy supply effects as those that were evaluated in Section 7.8; however, as described in Section 13.4, under the starting point for the

regulatory pathway changes in flow could be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As described for Impact EN-a, reduction in summer hydropower generation under the 55 w/WSAs scenario is expected to be generally less than the 55 scenario and often similar to reductions under the Low Flow Alternative (35 and 45 scenarios). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.8.

Voluntary Agreement Pathway

Changes in hydrology from implementing the VA pathway would have small effects on individual hydropower facilities very similar to what is described in Section 9.7.8. These changes in hydropower generation are not expected to cause issues with grid reliability and would have minimal effect during rare instances of rolling blackouts as described in Section 9.7.8. Changes in hydrology, and associated changes in local and regional energy supplies, with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2

Impact Discussion and Conclusion

Changes in hydrology could reduce generation at individual hydropower facilities, particularly in the summer. Changes in hydrology simulated by SacWAM would result in a range of hydropower effects at the hydropower facilities in the Sacramento River watershed and Delta eastside tributaries regions (e.g., see Figure 7.8-14). The largest changes in flow and hydropower would be expected to occur under the regulatory pathway at the rim reservoirs and downstream because modification of the rim reservoir operations is the primary way the flow objectives would be met. However, in some cases, implementation of the regulatory pathway could result in a reduction of water diversions between watersheds, particularly for the higher end of the flow range. A reduction in interbasin diversions could reduce generation at facilities that depend on the diversions. Conversely, a few facilities may benefit from the retention of flows within a watershed.

Changes in hydropower generation at individual hydropower facilities under the VA pathway are expected to be small (see Figure 9.7-4). For example, the largest reduction in average July generation, 10 GWh at Hyatt Powerplant, represents only 3.4 percent of the average July baseline generation of 295 GWh for this facility.

Estimated changes in hydropower generation do not by themselves indicate whether local and regional energy supplies would be affected. As long as the electrical grid can move sufficient energy to where it is needed, there is no need for additional capacity. Changes in hydropower generation would be within the baseline condition range of capacity for the Sacramento River watershed and Delta eastside tributaries regions. Reductions in hydropower generation are expected to be replaced by other sources of generation; the TARA power flow analysis indicated that even under the 75 scenario, changes in hydropower generation are not expected to cause the electrical grid to become

unreliable because energy could be dispatched from other generating facilities to compensate for reductions in hydropower.

Although the power flow modeling results show that the California electrical grid would generally be reliable under both baseline conditions and the 75 scenario, the rolling blackout events that occurred during August 14 and 15, 2020, indicate there are some extreme circumstances that can cause California's electrical grid to become unreliable due to inadequate electric supply, leading to the need for rotating power outages. During rare instances of rolling blackouts, reduction in hydropower generation could increase the affected area. Reductions in hydropower generation could result in incremental increases in the extent of outages as described in Section 7.8, with potential effects being larger for the 55 scenario than for the 35 and 45 scenarios (Low Flow Alternative). For example, as described in Section 7.8, the estimated 700 MW reduction in summer peak power generation associated with the 55 scenario represents approximately 1.5 percent of the CAISO peak energy demand during the August 14, 2020, rolling blackouts, whereas the estimated 400 MW reduction in power generation associated with the 45 scenario represents approximately 0.9 percent of the August 14, 2020, peak energy demand. Because the effects of the 55 w/WSAs scenario on changes in hydrology are more similar to the Low Flow Alternative than the 55 scenario (see Section 13.4), the effects of the 55 w/WSAs scenario on reductions in summer peak power generation that could affect the extent of power outages during rolling blackouts would be expected to be more similar to the effects of the 45 scenario.

Overall, the revised proposed Plan amendments could affect local hydropower generation. This effect is generally not expected to affect grid reliability, but in rare instances of rotating power outages, effects on hydropower generation could cause an incremental increase in the area of effect. The effects on local or regional energy supplies would range from less than significant for the VA pathway to potentially significant for the regulatory pathway.

Impacts related to hydropower effects on local and regional energy supplies would be reduced through implementation of the cold water habitat objective, local cooperative solutions, and mitigation measures as described for Impact EN-a.

Impact EN-d: The degree to which the project complies with existing energy standards

Changes in Hydrology and Water Supply

Regulatory Pathway

The regulatory pathway would have similar effects to those that were evaluated in Section 7.8; however, as described in Section 13.4, under the starting point for the regulatory pathway changes in hydrology and water supply would be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.8.

As described for Impact EN-a, changes in hydrology with the regulatory pathway would result in decreases in annual and summer hydropower generation similar to what is described in Section 7.8.

As described for Impact EN-e, there is some chance use of energy to replace reductions in water supply could cause a net increase in energy consumption. These changes are evaluated below for their effect on overall per capita consumption, reliance of natural gas or oil, and reliance on renewable energy resources.

In an effort to increase reliance on renewable energy sources, the California Renewables Portfolio Standard (RPS) was established in 2000. Facilities that can contribute to the RPS include geothermal, biomass, biogas, wind, solar, and small hydropower facilities (CPUC 2017). As discussed in Section 7.8.2.2, *Electricity in California*, Senate Bill (SB) 100 and SB 1020 identify increasingly stringent renewable energy goals for the RPS, with providers of electricity eventually obligated to supply 100 percent carbon-free electricity by 2045. To meet these goals, other carbon-free energy sources such as large hydropower and nuclear power, that are not part of the RPS, can be utilized. These goals could be more difficult to reach if overall per capita energy consumption or reliance on natural gas or oil were to increase.

Overall Per Capita Consumption. Changes in water supply from implementation of the regulatory pathway under the revised proposed Plan amendments could have a limited effect on per capita energy consumption. As described for Impact EN-e, there is some chance use of energy to replace reductions in water supply could cause a net increase in energy consumption that could have a small effect on per capita energy consumption.

Reliance on Natural Gas and Oil. As described for Impact EN-a, changes in hydrology with the regulatory pathway would result in net decreases in annual hydropower generation similar to what is described in Section 7.8. Initially, these decreases would likely be offset by natural gas–fired power plants. Natural gas is currently the largest electrical energy source in California and the most effective at meeting daily spikes in demand besides hydropower. Therefore, the regulatory pathway would likely cause some increased reliance on natural gas in the short term before full conversion to carbon-free electricity.

Reliance on Renewable Energy Resources. As described for Impact EN-a, changes in hydrology from implementing the regulatory pathway could reduce hydropower generation, including at small hydropower facilities that contribute to the California renewables portfolio, particularly in the summer. Possible effects are similar to those described in Section 7.8. However, because recent annual trends in in-state energy generation show that renewable energy generation is growing (Section 7.8, Impact EN-d), and SB 100 requires that providers of electricity supply 100 percent carbon-free electricity by 2045, reductions in hydropower generation will eventually be replaced with other sources of carbon-free energy.

Voluntary Agreement Pathway

Changes in water supply from implementation of the VA pathway under the revised proposed Plan amendments would have a minimal effect on per capita energy consumption. As described for Impact EN-e, energy use in the state is not likely to change substantially overall as a result of the VA pathway. As described for Impact EN-a, changes in hydrology associated with the VA pathway would result in small changes in hydropower generation, similar to what is described in Section 9.7.8 and, therefore, would result in small increased reliance on natural gas for near-term replacement of electrical energy. As described for Impact EN-a and Section 9.7.8, the VA pathway is expected to have minimal effect on hydropower generation at the small hydropower facilities in the Sacramento/Delta

that contribute to the California RPS. Changes in hydrology and water supply, and associated effects on compliance with existing energy standards, with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

The estimated change in hydropower generation for the revised proposed Plan amendments is not substantial when compared with the recent increases in renewable generation and the expected future increases in zero-carbon generation. Therefore, the revised proposed Plan amendments are unlikely to prevent the eventual attainment of the goals of SB 100 and SB 1020.

Overall, however, changes in hydrology and changes in water supply under the revised proposed Plan amendments could increase the effort needed to meet the objectives of SB 100 and SB 1020, ranging from less-than-significant impacts for the VA pathway to potentially significant impacts under the regulatory pathway. This increased effort would result from decreases in hydropower generation that could necessitate increased reliance on natural gas in the near term and possible net increases in energy use to replace Sacramento/Delta supplies.

Local cooperative solutions and implementation of the cold water habitat objective and Mitigation Measure MM-EN-a–e can avoid or minimize impacts on hydropower generation and impacts from increased energy consumption and can help increase the degree to which the revised proposed Plan amendments comport with statewide energy standards. The existing water supply sector is already very energy intensive. As the state moves forward with reducing reliance on the Delta for water supplies, opportunities exist to implement alternative solutions that consider energy production and use. Changes in water supply would likely reduce the availability of surface water for diversion by some users, which provides an incentive to use water more efficiently, extending supplies and reducing energy demands.

While the State Water Board has some authority to ensure mitigation is implemented for some actions, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the revised proposed Plan amendments. Accordingly, the State Water Board cannot guarantee that measures will always be adopted or applied to fully mitigate potential energy impacts. Therefore, unless and until the mitigation is fully implemented, the impacts remain potentially significant.

Impact EN-e: Energy requirements and energy use efficiencies by amount and fuel type for each stage of the project

Changes in Hydrology and Water Supply

Regulatory Pathway

The primary ways changes in hydrology and changes in water supply associated with the regulatory pathway would affect energy requirements are by reducing the energy needed to transport Sacramento/Delta water supply and by increasing energy consumption to replace reductions in

Sacramento/Delta water supply. As described in Section 7.8 for Impacts EN-a and EN-e, reduction in Sacramento/Delta water supply would reduce the energy needed to convey water supply. However, energy is likely to be required to replace reductions in Sacramento/Delta water supply, with the amount depending on how water users respond to decreased water deliveries. Depending on the location, water users may utilize options such as switching to or increasing use of groundwater supplies, and other water management actions, such as groundwater storage and recovery, water transfers, water recycling, and water conservation measures. Another response action is desalination. The energy to replace Sacramento/Delta water supply could be more energy intensive than the energy savings associated with reduction in energy for transporting water supplies.

The regulatory pathway under the revised proposed Plan amendments would have similar effects to those that were evaluated in Section 7.8; however, as described in Section 13.4, under the starting point for the regulatory pathway changes in water supply would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As described for Impact EN-a, reduction in Sacramento/Delta water supply under the starting point for the regulatory pathway (55 w/WSAs scenario) is expected to be similar to reductions under the Low Flow Alternative (35 and 45 scenarios). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.8.

Voluntary Agreement Pathway

Changes in water supply from implementation of the VA pathway would result in reductions in Sacramento/Delta surface water supplies within the Sacramento/Delta watershed. These reductions in water supply would be from voluntary reductions in water supplies that would be largely or entirely from agricultural land fallowing, reservoir reoperations, or groundwater substitution. Groundwater substitution would cause an increase in net energy consumption because conveyance of surface water within the Sacramento/Delta region generally requires less energy than the energy needed for groundwater pumping. However, most of the HRL flow commitments are not expected to be provided through groundwater substitution, but instead through agricultural land fallowing, which would not affect energy use. Because the magnitude of effect on water supply associated with VA pathway is relatively small as described in Section 13.4.4, *Changes in Surface Water Supply*, the VA pathway would not be expected to cause substantial changes in energy required for providing water supply. Changes in hydrology and water supply and associated changes in energy consumption with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

As summarized in Section 13.4, the SacWAM results for the VA pathway indicate that there could be some increases in exports during April and May compared to baseline because the VA scenario does not retain the more stringent I:E requirements applied to the SWP and CVP under the SacWAM baseline (see Section 13.4.2.4). Although these increases in exports could increase energy needed for conveyance, the increases would be relatively small compared to total Delta exports and could replace other water sources that have their own energy requirements. In addition, if much of the

unspecified water purchases under the VA pathway were to come from reductions in Delta exports, as was evaluated in the High Export Cuts scenario in Chapter 9, increases in exports would largely be offset by these reductions.

Impact Discussion and Conclusion

The energy cost for conveying export water depends on how high water must be pumped before it can reach its ultimate destination, as well as how much of the energy expended in pumping can be recaptured as water drops in elevation. Energy needed to convey water to the Central Coast and Southern California regions is high because of the need to traverse mountain ranges (see Table 7.8-5). Within each region, the energy cost of conveyance varies depending on the ultimate destination of the water within the region.

The net change in energy use associated with reduction in Sacramento/Delta water supply under the regulatory pathway would depend on the response actions that are chosen. There is much uncertainty in the degree to which each approach would be used. Desalination of ocean water would be the most energy-intensive replacement mechanism, at a cost of approximately 4,500 kilowatt-hour per acre-foot (kWh/AF). Conservation would be the least energy-intensive way to replace reduction in water supply. Municipal water conservation can lead to large energy savings (up to 8,850 kWh/AF of electricity for indoor residential water use, not including energy savings associated with reduced use of natural gas).

In reality, the full suite of replacement options would be used, and energy effects would be somewhere between those associated with seawater desalination and indoor water conservation. To the extent that they occur, water transfers would likely counteract the energy savings associated with conveyance of water supply, producing a net energy effect that is close to zero. Based on cost and need for proximity to the ocean, desalination of ocean water would likely be limited; and other less energy-intensive methods, such as conservation, water recycling, and groundwater pumping, would be more common replacement methods. Desalination of brackish water could also occur as a less energy-intensive method; energy for desalination of brackish water depends on the level of salinity in the water. Groundwater pumping is more likely to occur in areas where groundwater levels are closer to the surface because in those areas pumping would be less expensive, less likely to be influenced by Sustainable Groundwater Management Act (SGMA), and less energy intensive.

Due to uncertainty in the actions that would be taken to replace reduced Sacramento/Delta water supply in each region, it is difficult to know whether the total energy required for these actions would be greater than the total energy savings associated with reduced conveyance and indoor water conservation. There could be a net increase in energy consumption under the regulatory pathway. As described above, due to the relatively small water supply effects, the VA pathway would not be expected to cause substantial changes in energy required for providing water supply.

Overall, changes in hydrology and changes in water supply under the revised proposed Plan amendments could result in net increases in energy consumption ranging from less than significant for the VA pathway, to potentially significant under the regulatory pathway.

The program of implementation promotes local cooperative solutions that could amplify the ecological benefit of new and existing flows with physical habitat restoration or other complementary ecosystem measures that may reduce the volume of water that needs to be

dedicated for instream purposes, resulting in smaller effects on water supply. Water users would be encouraged to work together to tailor approaches to meet the proposed flow and cold water habitat requirements in a manner that minimizes effects on energy consumption.

Implementation of Mitigation Measure MM-EN-a–e: 1 through 6 can reduce the increased energy use associated with replacing Sacramento/Delta supplies. Water users can and should diversify their water supply portfolios to the extent possible, in an environmentally responsible manner and in accordance with the law. Water users and providers should consider the energy efficiency of other water supplies and pursue options that require less energy to the extent possible, including using energy from renewable sources. The State Water Board, California Department of Water Resources, California Public Utilities Commission, California Department of Food and Agriculture, and California Energy Commission will continue to implement the response plan to the Governor's Executive Order B-37-16 (May 9, 2016). The plan includes recommendations and an implementation timeline to (1) use water more wisely; (2) eliminate water waste; (3) strengthen local drought resistance; and (4) improve agricultural water use efficiency and drought planning. The State Water Board will continue to pursue the development of programs that continue to increase water use efficiency and conservation in order to maximize the beneficial use of Sacramento/Delta supplies, including through conditions on discretionary approvals for funding and other approvals, as appropriate.

In addition, implementation of greenhouse gas emission mitigation (Mitigation Measures MM-GHG-a and MM-GHG-b), as incorporated into Mitigation Measures MM-EN-a–e, will reduce energy impacts associated with responses to reduction in water supply, including other water management actions.

While the State Water Board has some authority to ensure that mitigation is implemented for some actions, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the revised proposed Plan amendments. Accordingly, the State Water Board cannot guarantee that measures will always be adopted or applied to fully mitigate potential energy impacts. Unless and until the mitigation is fully implemented, the impacts remain potentially significant.

13.7.9 Geology and Soils

This section describes the potential impacts on geology and soils that may result from changes in hydrology and changes in water supply under the revised proposed Plan amendments. This section summarizes impact conclusions from previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

13.7.9.1 Impact Analysis

Impact GEO-c: Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse

Changes in Water Supply

Regulatory Pathway

Implementation of the regulatory pathway could result in changes in Sacramento/Delta surface water supplies that could lead to increased groundwater pumping in response to the reduced supply and a reduction in incidental groundwater recharge from applied irrigation water and agricultural conservation measures that could lower groundwater levels in some locations in the Sacramento/Delta watershed and other regions. Increased groundwater pumping could lead to lower groundwater levels and could contribute to subsidence. The regulatory pathway would have similar effects as evaluated in Section 7.9, *Geology and Soils*; however, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in water supply would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reductions in water supply under the starting point for the regulatory pathway generally would be lower than evaluated in Section 7.9 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.9.

Voluntary Agreement Pathway

Changes in water supply from implementation of the VA pathway could also result in reductions in Sacramento/Delta surface water supply that would primarily affect agricultural uses. A reduction in irrigation water available for existing agricultural lands could lead to increased groundwater pumping. Increased groundwater pumping and reduced groundwater recharge from applied irrigation could lower groundwater levels which, in addition to reduced incidental recharge from irrigation, could contribute to subsidence, similar to the effects described in Section 9.7.9, *Geology and Soils*. Flows under the VA pathway would generally be lower than under the regulatory pathway on the tributaries with HRL commitments, so reductions in Sacramento/Delta water supplies for agricultural uses would be less; therefore, groundwater pumping, and potential subsidence that would result from groundwater pumping, would be less under the VA pathway than under the regulatory pathway for the term of the VA pathway. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, implementation of the revised proposed Plan amendments would result in reductions in Sacramento/Delta supply, which could lead to increased groundwater pumping to replace supply, and reduced groundwater recharge from applied irrigation. These conditions could lower groundwater levels, which may contribute to and exacerbate existing problems with subsidence.

As discussed in Section 7.9, if groundwater withdrawal continued at the rates of the 2012–2016 and 2020–2022 droughts, similar subsidence rates could be expected in the same areas of the study area that experience subsidence including the Sacramento Valley (excluding the Delta), and San Joaquin Valley region.

It is state policy to reduce reliance on the Delta, improve regional self-reliance, and address numerous groundwater management issues, including subsidence, and the Sustainable Groundwater Management Act (SGMA) addresses numerous groundwater management issues, including subsidence. However, these policies and other actions to increase groundwater levels could take many years to implement. Impacts would be potentially significant.

Mitigation Measure MM-GEO-c (which incorporates Mitigation Measure MM-GW-b) could reduce impacts. Implementing SGMA and other actions to increase groundwater levels or reduce groundwater extraction could reduce or halt subsidence. While the State Water Board has some authority to ensure that mitigation is implemented for some actions, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the revised proposed Plan amendments. The State Water Board cannot guarantee that measures will always be adopted or applied in a manner that fully mitigates the impact. Therefore, unless and until the mitigation is fully implemented, the impacts remain potentially significant.

13.7.10 Greenhouse Gas Emissions

This section describes the potential impacts on greenhouse gas (GHG) emissions that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes impact conclusions from previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

13.7.10.1 Impact Analysis

Impact GHG-a: Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment

Changes in Water Supply

Regulatory Pathway

Changes in water supply from implementation of the regulatory pathway would result in reductions in Sacramento/Delta surface water supply for agricultural and municipal uses that could lead to

increased groundwater pumping in response to reduced supply resulting in effects on GHG emissions from the use of diesel pumps and generators. As discussed under *Impact Discussion and Conclusions*, the evaluation of GHG emissions conservatively assumes that diesel pumps would be used for groundwater pumping although it is anticipated that most deep wells are and would be powered by electric pumps, which generate less emissions. The regulatory pathway would have similar effects as those that were evaluated in Section 7.10, *Greenhouse Gas Emissions*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in hydrology and water supply would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reductions in supply under the starting point for the regulatory pathway generally would be lower than evaluated in Section 7.10 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.10.

Voluntary Agreement Pathway

Changes in water supply under the VA pathway also would result in reductions in Sacramento/Delta surface water supply at times, and these reductions would primarily affect agricultural uses. A reduction in irrigation water available for existing agricultural lands could lead to increased groundwater pumping. Additionally, under the VA pathway, some flow could be provided through groundwater substitution. Increased groundwater pumping for agricultural water supply and for provision of flows through groundwater substitution could result in effects on GHG emissions from the use of diesel pumps and generators very similar to the effects described in Section 9.7.10, *Greenhouse Gas Emissions*. Flows under the VA pathway would generally be lower than the regulatory pathway on the tributaries with HRL commitments, so the reductions in Sacramento/Delta water supplies would be less. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*. Because groundwater pumping would be less, then potential resulting emissions from groundwater pumping would be lower than under the regulatory pathway for the term of the VA pathway.

Impact Discussion and Conclusion

Overall, implementation of the revised proposed Plan amendments would result in reductions in Sacramento/Delta supply, which could lead to increased groundwater pumping to replace supply. Groundwater pumping would result in increased GHG emissions associated with the use of diesel pumps and generators. As discussed in Section 7.10 and Section 9.7.10, several local air pollution control districts (e.g., Sacramento Metropolitan Air Quality Management District) have established a threshold of 10,000 metric tons of carbon dioxide equivalent ($MTCO_2e$) per year to evaluate emissions from individual industrial and stationary source projects, such as diesel-powered pumps.

The total extent of electric and nonelectric groundwater pumping that may result from changes in supply is unknown. Further, it is currently unknown what types of pumps (electric, diesel, gas, other

fuel) would be used to pump groundwater because it is not known at this time which wells (existing and/or new) would increase pumping. The extent of groundwater pumping in response to reduced Sacramento/Delta supply is also unknown. As discussed in Section 7.10 and Section 9.7.10, it is anticipated that most deep wells are and would be powered by electric pumps, while a smaller portion would be powered by diesel, gasoline, and other fuels. Electric pumps generate about 30 percent less GHG emissions per horsepower-hour than an equivalently sized diesel pump (based on emission factors from U.S. Environmental Protection Agency [USEPA] and Trinity Consultants), and more than 85 percent of irrigation wells in California are powered by electric pumps.

Depending on the type of fuel used, emissions could vary, though diesel pumps are typically more polluting than pumps powered by other fuels. Therefore, this analysis conservatively assumes that diesel pumps would be used for groundwater pumping and uses the threshold of 10,000 $MTCO_2e$ per year for the combined emissions of diesel, gasoline, or other nonelectric groundwater pumping. Based on emission factors from the California Emissions Estimator Model, using a diesel pump to pump 1 acre-foot (AF) of water, which requires 400 to 1,200 kilowatt hours of energy, would generate carbon dioxide equivalent (CO_2e) emissions of 227 to 682 pounds.

Emissions from diesel-powered pumps would occur locally at the pump source. Depending on the extent of groundwater pumping, the combined emissions level of all other groundwater pumping in the study area could exceed the 10,000 $MTCO_2e$ threshold. This would be a potentially significant impact.

Implementation of Mitigation Measure MM-GHG-a will reduce potential GHG emissions through implementation of water use efficiency, water conservation, energy efficiency, and irrigation system management strategies. Implementation of Mitigation Measure MM-GHG-b requires compliance with applicable air quality plans, programs, rules, and regulations and promotes use of renewable energy sources to minimize GHG emissions. These measures were adapted from agency best practices and mitigation designed to avoid or minimize GHG emissions effects, including: California Air Pollution Control Officers Association's *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity: Designed for Local Governments, Communities, and Project Developers*; California Department of Water Resources' (DWR's) *Climate Action Plan* (CAP); State Water Board's *Resolution No. 2017-0012: Comprehensive Response to Climate Change*; and USEPA's *Water Conservation Plan Guidelines* and *Energy Efficiency in Water and Wastewater Facilities*. Many of these measures are project-level measures appropriate for project-specific development. Individual projects by other public agencies would be subject to the appropriate level of environmental review at the time they are proposed, and site-specific, project-specific mitigation would be identified to avoid or reduce significant effects prior to any project-level action. However, some actions may not require approvals and may not be subject to project-level CEQA review. Unless and until the mitigation is fully implemented, this impact remains potentially significant.

Impact GHG-b: Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases

Changes in Water Supply

Regulatory Pathway

Changes in water supply from implementation of the regulatory pathway under the revised proposed Plan amendments would result in reductions in Sacramento/Delta surface water supply that could lead to increased groundwater pumping in response to reduced supply for agricultural and municipal uses. The increased groundwater pumping from wells with diesel-powered pumps could result in emissions in excess of existing thresholds and could conflict with the state's long-term emission reduction trajectory. The regulatory pathway would have similar effects as evaluated in Section 7.10; however, as discussed in Section 13.4, under the starting point for the regulatory pathway changes in hydrology and supply would be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Section 7.10 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reductions in supply under the starting point for the regulatory pathway generally would be lower than evaluated in Section 7.10 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.10.

Voluntary Agreement Pathway

Changes in water supply under the VA pathway would result in reductions in Sacramento/Delta surface water supply at times, and these reductions would primarily affect agricultural uses. Increased groundwater pumping for agricultural water supply and for provision of flows through groundwater substitution could result in emissions in excess of existing thresholds and could conflict with the state's long-term emission reduction trajectory, similar to the effects described in Section 9.7.10. Flows under the VA pathway would generally be lower than the regulatory pathway on the tributaries with HRL commitments, so the reductions in Sacramento/Delta water supplies would be less. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*. Overall, groundwater pumping would be less, and resulting emissions from groundwater pumping and potential for conflict with state regulations would be lower than under the regulatory pathway for the term of the VA pathway, even though some flows would be provided through groundwater substitution.

Impact Discussion and Conclusion

Overall, the revised proposed Plan amendments would not conflict with larger state efforts related to GHG emissions and climate change. The State Water Board intends to follow the direction provided in its Resolution 2017-0012 to ensure that criteria (e.g., whether a project is consistent with plans or state goals to reduce or mitigate GHGs, including consistency with California Air

Resources Board's [CARB's] *California's 2017 Climate Change Scoping Plan*, regulations, or requirements adopted by CARB; or whether a proposed project is part of a plan that includes overall reductions in GHG emissions) are met.

Executive Order (EO) S-3-05 establishes GHG emissions reduction targets for the state of California, including reducing GHG emissions to 80 percent below 1990 levels by 2050. EO B-55-18 strengthens the state's reduction commitment to achieve carbon neutrality by 2045. This target was codified by Assembly Bill (AB) 1279, which also mandates an 85-percent reduction in statewide anthropogenic GHG emissions (from 1990 levels) by 2045. EO B-30-15 requires all state agencies to implement measures pursuant to statutory authority to reduce GHG emissions in order to meet the state's reduction targets. The state's Renewables Portfolio Standard (RPS) also requires electric utilities to achieve sales of renewably generated electricity of 44 percent by 2024, 52 percent by 2027, 60 percent by 2030, 90 percent by 2035, 95 percent by 2040, and 100 percent by 2045. GHG emissions from electricity generation are, therefore, expected to decrease over time, eventually achieving carbon neutrality in 2045. The revised proposed Plan amendments are unlikely to hinder attainment of the state's RPS.

Overall, changes in water supply would not conflict with the Clean Air Act; however, as discussed under Impact GHG-a, the revised proposed Plan amendments could result in increased groundwater pumping for replacement supplies. Additionally, under the VA pathway, some tributary flows could be provided through groundwater substitution. Increased groundwater pumping in the study area could potentially result in emissions in excess of the 10,000 $MTCO_2e$ per year threshold that could affect the state's ability to meet the Senate Bill (SB) 32 (2030) and AB 1279 (2045) GHG reduction goals. This impact would be potentially significant. Implementation of Mitigation Measures MM-GHG-a and MM-GHG-b can reduce potential GHG emissions and conflicts with the state's GHG reduction plans from increased groundwater pumping if adopted by local water districts and suppliers, regional groundwater agencies, irrigation districts, local utilities, and local agencies and governments. Unless and until the mitigation is fully implemented, this impact remains potentially significant.

13.7.11 Hazards and Hazardous Materials

Potential impacts on hazards and hazardous materials evaluated in Chapter 7 and Chapter 9 would all be less than significant or have no impact. The no impact and less-than-significant impact conclusions are reflected in Table 13.7.22-1. Because the impact mechanisms and reasons for the significance determinations would not be changed under the revised proposed Plan amendments but would remain as explained in Chapter 7 and Chapter 9, the analysis of these impact topics is not repeated in this chapter.

13.7.12 Hydrology and Water Quality

13.7.12.1 Surface Water

This section describes the potential impacts on surface water quality that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments, which includes the ranges of flow previously analyzed, but also new water supply adjustments at the outset of Plan implementation that lower flow requirements under certain conditions. This section

summarizes previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

The revised proposed Plan amendments could result in substantial improvements in water quality, including dilution and flushing of some contaminants and reduction in electrical conductivity (EC), bromide, and chloride in the Delta associated with reduced seawater intrusion. In addition, water quality for fish would be enhanced by increases in flow (e.g., increased low-salinity habitat in the Delta) and other beneficial effects associated with higher flows (e.g., reduced water temperature). Most potential adverse impacts would likely be less than significant, except for potential water quality effects associated with decreases in reservoir storage and streamflow, and reduced water supply for municipalities and managed wetlands.

Some water quality impacts would be considered negative for some resources and beneficial for others. For example, increases in nutrients could lead to harmful algal blooms (HABs) but also could increase primary production to support the ecosystem. Similarly, increases in turbidity may affect drinking water treatment plants but also could help Delta smelt.

Recent changes to requirements for operations of the CVP and SWP that are described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, could interact with changes in Sacramento/Delta tributary flows, Delta inflows, and Delta outflows under the regulatory and VA pathways, which may affect surface water resources as described below for contaminants, water temperature, HABs, salinity, water quality compliance by utilities, and flooding. The effects of the 2025 LTO ROD and 2025 CDFW ITP (collectively, 2025 ROD/ITP) are evaluated by comparing SacWAM results for changes in hydrology under the starting point for the regulatory pathway and under the VA pathway in combination with the 2025 ROD/ITP (55 w/WSAs + 2025 ROD/ITP and VA + 2025 ROD/ITP scenarios) with results for the 55 w/WSAs scenario and VA scenario and baseline. For the water temperature analysis, the effects of the 2025 ROD/ITP are evaluated by comparing temperature modeling using the SacWAM results for the 55 w/WSAs + 2025 ROD/ITP and VA + 2025 ROD/ITP scenarios with the results for the 55 w/WSAs scenario and VA scenario. As discussed in Section 13.4, *Changes in Hydrology and Water Supply*, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results.

Impact Analysis

Impact SW-a: Violate any water quality standards or waste discharge requirements

Impact SW-f: Otherwise substantially degrade water quality

The analyses of water quality standards and water quality degradation are closely related and are therefore combined and addressed together under Impact SW-a and Impact SW-f.

Changes in Hydrology

Contaminants

Regulatory Pathway

Changes in hydrology under the regulatory pathway could affect the concentration of contaminants, such as pathogens, trace metals and metalloids, current-use pesticides, legacy contaminants, and contaminants of emerging concern. This could result in localized degradation of water quality in some areas.

The regulatory pathway would have similar effects as those that were evaluated in Section 7.12.1, *Surface Water*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply, under* the starting point for the regulatory pathway changes in hydrology would be expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These adjustments include both watershed-wide adjustments and tributary-specific adjustments. As such, the likelihood of degradation of localized water quality under the starting point for the regulatory pathway would be less than evaluated in Section 7.12.1 due to these refinements. SacWAM results for changes in hydrology show that the reductions in flow during the summer and early fall under the starting point for the regulatory pathway (55 w/WSAs scenario) relative to the reductions described in Chapter 7 varies by river, month, and portion of the distribution of results evaluated. Summer and early fall flow reductions relative to baseline under the 55 w/WSAs scenario (presented in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*) would generally be less than under the 55 scenario and often similar to the summer flow reductions under the Low Flow Alternative (35 and 45 scenarios) evaluated in Chapter 7 (modeling results presented in Appendix A1, *Sacramento Water Allocation Model Methods and Results*) due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.1.

Voluntary Agreement Pathway

Changes in hydrology under the VA pathway could result in small changes in streamflow in the Sacramento/Delta relative to baseline, similar to the effects described in Section 9.7.12.1, *Surface Water*, which could affect the concentration of contaminants. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Under the regulatory pathway, changes in streamflow may result in more dilution of contaminants compared to baseline due to increases in flow during winter and spring; however, flows may be reduced in the summer and early fall in some streams in the Sacramento/Delta and in some streams below export reservoirs. Reductions in summer and fall flows in some Sacramento/Delta tributaries

relative to baseline conditions could occur because the existing flow regime on regulated tributaries can include substantially elevated flows above required flow levels and above unimpaired conditions (i.e., greater than 100 percent unimpaired flow) in summer and fall to supply downstream water diversions. This flow reduction could reduce dilution of local contaminants, either from wastewater plant treatment plant (WWTP) discharges, other types of contaminated discharges, or uncontrolled and natural sources of contaminants. The VA pathway could have similar effects, although reductions in flow are expected to be relatively small. These flow reductions could occasionally increase the concentration of contaminants and result in localized degradation of water quality in some areas.

Overall, changes in hydrology could result in occasional reductions in flow and this could reduce dilution of local contaminants, either from WWTP discharges, other types of contaminated discharges, or uncontrolled and natural sources of contaminants. Flow reductions are expected to be relatively small for the VA pathway relative to the regulatory pathway. However, the reductions in flow under the revised proposed Plan amendments could occasionally increase the concentration of contaminants and result in localized degradation of water quality in some areas under both the regulatory and VA pathways. These impacts could be potentially significant.

Implementation of Mitigation Measure MM-SW-a,f: 1 will reduce or avoid water quality impacts from increased concentration of contaminants that may occur if streamflow is reduced in the summer and early fall. Contaminants in waterbodies are a statewide water quality issue that exists independently of potential incremental effects from the revised proposed Plan amendments; various ongoing state efforts are addressing this problem. The regulation of water quality pollution is accomplished primarily through waste discharge permits, including National Pollutant Discharge Elimination System (NPDES) permits for point-source discharges, and waste discharge requirements (WDRs) for nonpoint-source discharges. As explained in Section 7.12.1.2, *Environmental Setting,* the State and regional water boards administer a variety of permit programs that regulate discharges of waste. Total maximum daily loads (TMDLs) are adopted and implemented to bring waterbodies into compliance over time when water quality impairments persist. The State and regional water boards, pursuant to their pre-existing duties will continue to regulate waste discharges and support TMDL development and implementation. Efforts to control some contaminants may take time. The State Water Board cannot be certain that these efforts will mitigate every incremental water quality impact associated with reduced flows to a less-than-significant level. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

YCFCWCD HRL Flow Commitments

As described in Section 13.2, *Planning Process*, after release of the 2023 draft Staff Report, a proposal for HRL commitments by the Yolo County Flood Control and Water Conservation District (YCFCWCD) was submitted to the State Water Board. The HRL commitment involves YCFCWCD providing flows from either Putah Creek sources or routing surface water flows from Cache Creek to lower Putah Creek, either directly or via groundwater recharge and banking. (see Section 13.3.4.3, *HRL Flow Commitments*). Providing these flow commitments from Cache Creek is dependent on YCFCWCD HRL participants obtaining a new water right permit to divert water from Cache Creek. The State Water Board has not made any decision on approving a water right application that would provide for the diversion of water from Cache Creek for use in Putah Creek which would be considered as part of a separate State Water Board decision-making process from the Sacramento/Delta update to the Bay-Delta Plan and would include a separate environmental review process Depending on the source of

water to implement the HRL flow commitment, it is possible that water quality could be degraded in Putah Creek because Cache Creek surface water and banked groundwater can have worse water quality conditions than Putah Creek at times for certain constituents. For example, high levels of boron are known to occur naturally in the Cache Creek watershed (YCFCWCD 2006). Under the VA pathway, the transfer of water from the Cache Creek watershed into lower Putah Creek has the potential to exacerbate existing water quality concerns in Putah Creek that could cause potentially significant impacts.

Implementation of Mitigation Measure MM-SW-a,f: 12, Water Quality Monitoring and Management in Putah Creek, which is consistent with commitments in the YCFCWCD term sheet, will reduce potential impacts from implementation of the YCFCWCD HRL flow commitments on degrading water quality conditions in Putah Creek to less-than-significant levels. Prior to releasing any Cache Creek surface water or banked groundwater into Putah Creek, YCFCWCD will develop, in consultation with State Water Board and Central Valley Regional Water Quality Control Board (Central Valley Water Board) staff, a monitoring plan to inform whether releases would result in adverse water quality effects in Putah Creek. The monitoring plan is subject to approval by the Executive Director of the State Water Board, including any conditions of approval. Once approved, YCFCWCD will conduct monitoring in accordance with that approved plan. The monitoring must include provisions to evaluate effects related to boron, nitrates, HABs, and mercury and include monitoring of Cache Creek water quality and banked groundwater quality prior to diversion into Putah Creek, and Putah Creek water quality before releases of Cache Creek water or banked groundwater into Putah Creek. If the monitoring shows no expected significant adverse effects to Putah Creek water quality, YCFCWCD will continue to monitor Putah Creek during and after releasing Cache Creek water or banked groundwater into Putah Creek. If monitoring information indicates possible significant adverse effects to Putah Creek water quality, YCFCWCD will notify the State Water Board and Central Valley Water Board immediately and cease releasing water into Putah Creek until the State Water Board Executive Director, in coordination with Central Valley Water Board staff, determine that significant adverse effects to water quality in Putah Creek are no longer expected.

2025 ROD and 2025 ITP

With the 2025 ROD/ITP, removal of the fall X2 requirements could reduce flows in the American and Feather Rivers during September in wet and above normal years, which would also reduce flow in the Sacramento River downstream of the Feather River for the starting point for the regulatory pathway (55 w/WSAs + 2025 ROD/ITP scenario compared to the 55 w/WSAs scenario and baseline) and VA pathway (VA + 2025 ROD/ITP scenario compared to the VA scenario and baseline) (see Appendix H1a6, *Sensitivity Analysis for the 2025 Record of Decision and Incidental Take Permit Amendments* and Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*). Modeling indicates these reductions in flow could be larger on the Feather River and, for the Feather River, would be larger under the VA pathway than under the regulatory pathway. However, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, there is uncertainty in the SacWAM results, and as a result, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results. Although reductions in streamflow would primarily occur in only one month and only occur on the Project tributaries, they could have the same type of effect on contaminant concentrations as is described above (see *Impact Discussion and Conclusion*), including incrementally reducing dilution of local contaminants. However, these

reductions would generally occur during wetter years with higher flow, when dilution of contaminants would be higher.

As described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, the new LTO baseflow balancing provision that would apply under the VA pathway of the revised proposed Plan amendments requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The analyses presented here evaluate the effects of not having the LTO baseflow balancing provision. However, the LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway, which could also reduce changes in streamflows on Project tributaries that could affect contaminant concentrations. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the narrative interior Delta flow objective. During annual and periodic reviews, the State Water Board will assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

Mercury

Regulatory Pathway

Changes in hydrology could incrementally increase the contributions of mercury from upstream watersheds with naturally occurring and legacy mining sources to downstream waterways and the Delta. The regulatory pathway would have similar effects on changes in hydrology as those evaluated in Section 7.12.1; however, as described in Section 13.4, under the starting point for the regulatory pathway changes in hydrology are expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation.

Increases in water level fluctuation in reservoirs also have the potential to increase production and bioaccumulation of methylmercury in fish, as explained in Section 7.12.1. SacWAM results show that average annual changes in water surface elevations in reservoirs would generally decrease relative to baseline but could increase in a few reservoirs (see Section 13.4 and Table H1a2-136 in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*). Increases in fluctuation would be smaller under the 55 w/WSAs scenario than under the 55 scenario and more similar to the changes under the Low Flow Alternative (35 and 45 scenarios) presented in Appendix A1 (see Table A1-145 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*).

Voluntary Agreement Pathway

Changes in hydrology under the VA pathway would result in small changes in streamflow in the Sacramento/Delta relative to baseline, similar to the effects described in Section 9.7.12.1.

Increases in water level fluctuation in some reservoirs relative to baseline under the VA pathway could incrementally increase ongoing production and bioaccumulation of methylmercury in those reservoirs. Based on SacWAM results, the average annual change in water surface elevation under the VA pathway would be the same as or similar to baseline (see Section 13.4 and Appendix H1a2,

Table H1a2-136). However, actual operation could vary to some degree from modeled outcomes and there could be additional changes in reservoir levels beyond the modeled changes.

Changes in hydrology and reservoir level fluctuation with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Mercury is a statewide problem, and the amount of mercury moved from one area to another is of concern under existing conditions. Due to high levels of methylmercury found in fish tissue, consumption of contaminated fish is a greater concern for human health than is mercury in drinking water. High levels of methylmercury in the environment also pose a threat to fish and wildlife because of methylmercury's toxicity and ability to accumulate in the aquatic food web.

The Yolo Bypass exemplifies a location where the combination of increased mercury input and transformation to methylmercury could occur due to the existing concentrations of mercury in the tributaries and large wetland acreage. The main tributaries to the Yolo Bypass (the Sacramento River, Cache Creek, and Putah Creek) intermittently deliver mercury to the Yolo Bypass under existing conditions. The Sacramento River often contributes the most flow to the bypass during high-flow conditions, but Putah Creek and, particularly, Cache Creek have higher concentrations of mercury.

The SacWAM results for changes in flow in the Yolo Bypass downstream of Putah Creek under the starting point for the regulatory pathway (55 w/WSAs scenario) indicates that there could be increased flow contributions from Cache Creek and Putah Creek. Because sediment (and mercury attached to sediment) moves more under high-flow conditions, average increases in flow during the high-flow months of January through March are illustrative of potential increases in mercury transport. Based on SacWAM results, changes in flow at these locations and during these same months under the 55 w/WSAs scenario (Table 13.7.12.1-1) are expected to be more similar to changes under the Low Flow Alternative (35 and 45 scenarios) than to the 55 scenario (see Chapter 6, *Changes in Hydrology and Water Supply* and Appendix A1 of the 2023 draft Staff Report) due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.1.

Changes in hydrology under the regulatory pathway could cause an incremental increase in the movement of mercury from the upper watersheds to downstream waterways and the Delta due to increases in instream flow and an incremental increase in formation of methylmercury due to floodplain inundation, with the largest effects likely to occur in the Yolo Bypass. Increased flow combined with increased floodplain inundation, could lead to increased deposition of mercury and transformation of mercury to methylmercury, particularly in the Yolo Bypass. The effect of increases in mercury and methylmercury may carry downstream to the Delta, San Francisco Bay, exports, export reservoirs, and streams downstream of export reservoirs. The effect would be dissipated by mixing with other water sources, settling of mercury attached to sediment, dredging, and photodegradation of methylmercury back to mercury.

During high-flow months, increases in flow relative to baseline, and thus the potential movement of mercury to the Yolo Bypass under the starting point for the regulatory pathway (55 w/WSAs scenario) would generally be higher than during the term of the VA pathway, particularly for Putah Creek (Table 13.7.12.1-1).

Table 13.7.12.1-1. Average Monthly Flow at Downstream Ends of Cache Creek and Putah Creek, and Yolo Bypass below Putah Creek Inflow during High-Flow Months—Percent Change from Baseline

			Percent Change from Baseline	
Location	Month	Baseline (cfs)	55 w/WSAs Scenario	VA Scenario
Cache Creek	January	947	7	0
	February	1,389	-2	0
	March	946	1	0
Putah Creek	January	198	52	-2
	February	333	22	-2
	March	351	-3	-4
Yolo Bypass	January	8,831	3	-1
	February	13,382	-3	-1
	March	7,381	-2	0

cfs=cubic feet per second

The VA pathway would cause minimal changes in the flows into the Yolo Bypass; however, modifications to Tisdale Weir would increase the frequency and magnitude of flows into the Sutter Bypass. Increased flow into Sutter Bypass could increase the transformation of mercury into methylmercury due to floodplain inundation (see Table 9.5-8 from Chapter 9). As such, the effect of changes in hydrology on mercury deposition and methylmercury production in some floodplain locations under the revised proposed Plan amendments would be potentially significant for both pathways.

The State Water Board recognizes that wetlands and floodplain inundation provide valuable water quality, wildlife habitat, and flood control functions and should not be disincentivized due to mercury concerns. Floodplain benefits are described in Section 3.14.2, *Salmonid Tributary Habitat Analyses*, and Appendix A8, *Salmonid Tributary Habitat Analysis*. Methylmercury production from physical habitat restoration projects, such as notching the Fremont Weir, is evaluated in Section 7.21, *Habitat Restoration and Other Ecosystem Projects*.

In addition, increases in water level fluctuation could incrementally increase ongoing bioaccumulation of methylmercury in reservoirs. Although increased fluctuation is generally not expected as indicated in Table H1a2-136, increased fluctuation could occur at some reservoirs. The effect of changes in water level fluctuation on bioaccumulation of methylmercury in some reservoirs would be potentially significant for both the regulatory pathway and the VA pathway. Although large water level fluctuations in reservoirs have been associated with increased levels of methylmercury in fish, water level fluctuation is necessary for reservoirs to function as designed.

Mercury impacts from the revised proposed Plan amendments can be reduced through implementation of Mitigation Measure MM-SW-a,f: 2; however, the aspect of measure 2i, *Mercury*

Control Program for Reservoirs, related to long-term strategy and annual operations plans and all of measure 2iii, related to high flows on Cache Creek, would not apply to the VA pathway. Mercury is a statewide water quality issue that exists independently of the potential incremental effects from the revised proposed Plan amendments and is being addressed through various State and federal water quality efforts. Reservoir owners and operators in the study area will describe participation in any adopted mercury control program for reservoirs. Under the regulatory pathway, owners and operators of reservoirs in the plan area will incorporate mercury measures into long-term strategy and annual operations plans. In addition, the State Water Board will work with the appropriate regional water boards to implement the San Francisco Bay Mercury and the Sacramento-San Joaquin Delta Methylmercury TMDLs. In addition, the State Water Board will coordinate with U.S. Army Corps of Engineers (USACE), California Department of Water Resources (DWR), and other appropriate agencies to ensure that implementation of flow requirements does not interfere with the functioning of the Cache Creek settling basin in reducing mercury inputs to the Sacramento/Delta. Health-related effects associated with mercury will be limited by issuance of fish consumption advisories from Office of Environmental Health Hazard Assessment (OEHHA). Resolving mercury issues is expected to take time and will occur on multiple fronts; however, the State Water Board cannot be certain that these efforts will mitigate all potential mercury impacts associated with the revised proposed Plan amendments to a less-than-significant level. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

YCFCWCD HRL Flow Commitments

As described above, under the VA pathway, implementation of the YCFCWCD HRL commitments could result in the transfer of surface water or banked groundwater with elevated levels of mercury from Cache Creek to Putah Creek, which could exacerbate existing water quality impairments in Putah Creek (^Central Valley Water Board 2010). These impacts could be potentially significant. Implementation of Mitigation Measure MM-SW-a,f: 12 will reduce these impacts to less-than-significant levels. As described above under *Contaminants*, YCFCWCD would be required to demonstrate no significant adverse water quality effects to Putah Creek, including from mercury, prior to routing surface water or banked groundwater from its recharge efforts to Putah Creek.

Water Temperature

Regulatory Pathway

As described in Section 7.12.1, changes in flow and reservoir storage could cause increases in water temperature in the Sacramento/Delta watershed and in streams below export reservoirs during some parts of the year prior to full implementation of the cold water habitat objective.

The regulatory pathway under the revised proposed Plan amendments would have similar effects as those evaluated in Section 7.12.1; however, as described in Section 13.7.6.2, and shown in Appendix H1b, *Water Temperature Modeling for the Sacramento, Feather, Yuba, and American Rivers*, under the starting point for the regulatory pathway changes in water temperature under the regulatory pathway would generally be expected to be smaller than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. The effect of these changes in

temperatures on fish would be variable, with some effects becoming more similar to the Low Flow Alternative (35 and 45 scenarios) than the 55 scenario, as described in Section 13.7.6.2, *Aquatic Biological Resources*. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Sections 7.12.1 and 7.6.2.

Voluntary Agreement Pathway

Water temperature effects on fish associated with the VA pathway would be similar to those discussed in Section 9.7.6.2. Changes in water temperature with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Elevated water temperatures are an existing concern in California, particularly in rivers where rim reservoirs prevent access to upper watershed cooler habitats for native cold water anadromous fish. In general, consistent with the narrative cold water habitat objective and the flexibility provided in the flow objectives, the regulatory pathway is expected to improve water temperature conditions for native cold water fish. Streamflows are expected to resemble a more natural pattern, with higher peak flows in winter and spring on most tributaries in response to precipitation and runoff events. However, changes in reservoir storage and flow could cause increases in water temperature during some parts of the year prior to full implementation of the cold water habitat objective.

On regulated tributaries, the inflow requirements under the regulatory pathway would generally result in higher spring flows compared to baseline conditions. While higher spring flows that more closely resemble the natural hydrologic regime would benefit native anadromous salmonids and other native species, higher spring flows also could result in a reduction in reservoir storage at the end of spring and a smaller cold water volume in summer and fall months. Modeled end-of-April reservoir levels under the 55 w/WSAs scenario generally indicate decreases from baseline in all but the driest years and across all years, with some reservoirs showing increases from baseline and others showing decreases from baseline in the driest years (see Section 13.4.3.2, *Reservoir Storage and Elevation*). Generally, end-of April storage levels under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario under the starting point for the regulatory pathway due to water supply adjustments. Modeled end-of-September storage levels under the 55 w/WSAs scenario generally show increases from baseline in the driest years (with a few exceptions) and decreases from baseline in wetter years and across all water year types. Across all years, end-of-September storage levels under the 55 w/WSAs scenario show a smaller difference from baseline than under the 55 scenario, excepting some reservoirs (see Section 13.4.3.2). Generally, end-of-September storage levels under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario under the starting point for the regulatory pathway due to water supply adjustments, with some exceptions.

Regulated tributaries may experience some reductions in summer and fall flows relative to baseline conditions because the existing flow regime on regulated tributaries can include substantially elevated flows above required flow levels and above unimpaired conditions (i.e., greater than 100

percent unimpaired flow) in summer and fall to supply downstream water diversions. In order to meet the instream flow and cold water habitat objective and to retain more water in storage for cold water habitat protection, water suppliers may reduce summer water deliveries that are conveyed instream, which could reduce flows on some tributaries at times. Reductions of instream flow can increase the travel time of water, which means that cold reservoir releases can reach equilibrium with air temperature (and other meteorological conditions) faster, and thus create less instream cold water habitat.

In the upper watersheds, substantial effects on storage are not expected in most reservoirs. However, some upper watershed reservoirs might experience substantial temperature effects, especially those involved with inter-basin diversions and those that need to release additional water to meet inflow requirements for the rim reservoirs downstream (see Chapter 6, *Changes in Hydrology and Water Supply*). Cold water habitat measures could be required for these upper watershed reaches if water temperature concerns exist or become problematic as a result of implementation.

Sacramento/Delta supplies to the Southern California, San Francisco Bay Area, and Central Coast regions would be reduced, which could result in lower reservoir storage in export reservoirs. While Millerton Reservoir on the San Joaquin River does not directly receive Sacramento/Delta supply, similar temperature effects could be experienced by the Friant Division if calls on Friant are made by the San Joaquin River exchange contractors in response to reduced Sacramento/Delta supply under the regulatory pathway. There is uncertainty in how reservoir operators may respond to changes in Sacramento/Delta supplies, and it is possible that streamflows below export reservoirs receiving Sacramento/Delta supplies could be reduced, and water temperatures could increase. Water temperature effects on fish are discussed in Section 13.7.6.2.

Under the VA pathway, changes in streamflows and reservoir levels would be less compared to the regulatory pathway. Although during implementation under the VA pathway, HRL water rights would not be required to contribute to the regulatory pathway cold water habitat implementation requirements, the HRL commitments are in part intended to avoid temperature impacts. Simulated changes in water temperature associated with the VA pathway on the Sacramento, Feather, Yuba, and American Rivers are small as shown in Appendix H1b. However, actual operation could vary to some degree from modeled outcomes. The simulated temperatures represent temperature effects based on SacWAM model results for HRL tributary flows, which do not assume additional inflows from unspecified water purchases given the unknown origin of these water purchases. If unspecified water purchases are provided from sources in the Sacramento, Feather, Yuba, and American River watersheds, water temperatures on these rivers could be further affected beyond the model results presented in Appendix H1b. In addition, the VA pathway includes flexibility in the timing of flow commitments, so streamflows, reservoir levels, and water temperatures could deviate to some degree from modeled results. Changes in water temperature could also occur in other Sacramento/Delta tributaries that were not included in the water temperature modeling, and it is possible that there could be instances where an increase in water temperature could occur due to reduced reservoir storage levels and reduced streamflows.

Simulated changes in water temperature associated with the regulatory and VA pathways on the Sacramento, Feather, American, and Yuba Rivers for the 10th, 50th, and 90th percentile temperature

values are shown in Appendix H1b. Water temperature effects on fish under the revised proposed Plan amendments are discussed in Section 13.7.6.2.

Overall, potential changes in reservoir levels and lowered streamflows below reservoirs under either pathway could increase water temperatures in some locations and times of year. Because flow requirements under the VA pathway would generally be lower than under the regulatory pathway, this impact would be smaller during the term of the VA pathway. These impacts could be potentially significant.

While implementation of the cold water habitat requirement under the regulatory pathway is intended to avoid potential impacts, it may take time to implement protective measures, and water temperature increases associated with changes in hydrology could occur in some streams under some circumstances. Increases in temperature would primarily be a concern for native cold water fish. For this reason, the cold water habitat objective and the water temperature mitigation measures are tailored to fish. Implementation of the proposed cold water habitat objective under the regulatory pathway is expected to reduce or avoid any temperature impacts. In addition, temperature effects can be minimized due to the flexibility provided in the flow objectives (range of flow levels, shaping and shifting of flows, groups of tributaries developing local cooperative solutions) and other provisions of the program of implementation. However, because some uncertainty exists regarding the precise implementation measures for the cold water habitat objective under the regulatory pathway and application of the flexibilities provided for implementation of the inflow objective (including decisions regarding tradeoffs between instream flows and cold water supplies), it is possible that limited instances of temperature impacts would occur.

In addition to implementation of the cold water habitat objective under the regulatory pathway, implementation of Mitigation Measure MM-SW-a,f: 3 (*Reservoir Management*) will avoid or reduce temperature impacts for both pathways. Mitigation Measure MM-SW-a,f: 3 incorporates Mitigation Measure MM-AQUA-a,d: 1.i-ii. All reservoir owners and operators are subject to existing regulatory requirements that protect water quality in reservoirs and streams below reservoirs. In exercising its regulatory authorities, the State Water Board will consider surface water and ensure that any surface water impacts are avoided or reduced. However, because the effectiveness of temperature protection with existing regulations is uncertain, impacts from changes in reservoir storage levels and reduced streamflow below reservoirs and related impacts on water temperature remain potentially significant.

2025 ROD and 2025 ITP

Effects of the 2025 ROD/ITP on water temperatures were simulated using the SacWAM results for the starting point for the regulatory pathway with the 2025 ROD/ITP (55 w/WSAs + 2025 ROD/ITP scenario) and VA pathway (VA + 2025 ROD/ITP scenario) for the Sacramento, Feather, Yuba, and American Rivers (see Section H1a6.6, *Changes in Water Temperature,* in Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*). Changes in temperature associated with the 2025 ROD/ITP (evaluated by comparing the 55 w/WSAs + 2025 ROD/ITP scenario to the 55 w/WSAs scenario and comparing the VA + 2025 ROD/ITP scenario to the VA scenario) could occur due to changes in storage, streamflow, reservoir release target

temperatures associated with changes in storage, and changes in the triggering of the power bypass in Oroville Reservoir, primarily associated with removal of fall X2 requirements.

Most of the effects of the 2025 ROD/ITP on the temperature distributions presented in Appendix H1a6.6 are less than or equal to 0.5 °F, and for the Yuba River that is not affected by fall X2 requirements there are no expected changes in water temperature associated with the 2025 ROD/ITP, although water temperature modeling results are presented in Section H1a6, *Changes in Water Temperature*, for the Yuba River for completeness. The 2025 ROD/ITP could result in limited instances of temperature increases greater than 0.5 °F, with the largest effects occurring in the Feather River. However, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, there is uncertainty in the SacWAM results, and as a result, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results. The 2025 ROD/ITP is not expected to affect non-Project tributaries beyond what is described above (see *Impact Discussion and Conclusion*).

Water temperature effects associated with the 2025 ROD/ITP are further discussed in Section 13.7.6.2, *Aquatic Biological Resources*.

Harmful Algal Blooms (HABs) and Invasive Aquatic Plants

Regulatory Pathway

Changes in hydrology under the regulatory pathway may result in reduced reservoir storage levels in some reservoirs at some times, which could result in shallower, warmer, more stable water column conditions. As described in Section 7.12.1, these conditions could lead to increased reservoir HABs. In addition, changes in hydrology under the regulatory pathway could result in changes in net flow in some Delta channels, which could affect HABs and invasive aquatic plants.

The regulatory pathway would have similar effects as evaluated in Section 7.12.1; however, as described in Section 13.4.3.2, under the starting point for the regulatory pathway changes in reservoir levels would be expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation.

As described in Section 13.4.3.1, annual average south of Delta exports under the 55 w/WSAs scenario could decrease in summer and fall. Average total July through December south of Delta exports under the 55 w/WSAs scenario would be more similar to reductions under the Low Flow Alternative than the 55 scenario in all water year types due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.1.

Voluntary Agreement Pathway

As described in Section 13.4.3.2, effects of the VA pathway on Sacramento/Delta reservoir storage would be less than the effects of the regulatory pathway. Nonetheless, changes in hydrology under the VA pathway may result in reduced reservoir storage levels in some Sacramento/Delta reservoirs at some times and in associated shallower, warmer, more stable water column conditions in those reservoirs. Changes in hydrology under the VA pathway also have the potential to result in changes

in net flow in Delta channels, which might affect HABs and invasive aquatic plants in the Delta. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Reservoirs

Overall, changes in hydrology could result in reductions in reservoir storage levels at some reservoirs at some times and thereby create conditions that could lead to increased production of HABs in those reservoirs. With lower reservoir storage levels, cyanobacteria and cyanotoxins could be more likely to pass through reservoir outlets, potentially affecting downstream waterbodies and water supply. The presence of HABs in water supplies could necessitate additional drinking water treatment protocols to remove cyanobacteria, cyanotoxins, and associated taste and odor compounds.

Modeled end-of-April reservoir levels under the 55 w/WSAs scenario generally indicate decreases from baseline in all but the driest years and across all years, with some reservoirs showing increases from baseline and others showing decreases from baseline in the driest years (Section 13.4.3.2). Generally, end-of April storage levels under the 55 w/WSAs scenario are more similar to the Low Flow Alternative (35 and 45 scenarios) than the 55 scenario under the starting point for the regulatory pathway due to water supply adjustments. Modeled end-of-September storage levels under the 55 w/WSAs scenario generally show increases from baseline in the driest years (with a few exceptions) and decreases from baseline in wetter years and across all water year types. Across all years, end-of-September storage levels under the 55 w/WSAs scenario show a smaller difference from baseline than under the 55 scenario, excepting some reservoirs (Section 13.4.3.2). Generally, end-of-September storage levels under the 55 w/WSAs scenario are more similar to the Low Flow Alternative than the 55 scenario under the starting point for the regulatory pathway due to water supply adjustments, with some exceptions.

As described in Section 13.4.3.2, effects of the VA pathway on Sacramento/Delta reservoir storage would be less than the effects of the regulatory pathway. Nonetheless, changes in hydrology under the VA pathway may result in reduced reservoir storage levels in some Sacramento/Delta reservoirs at some times and in associated shallower, warmer, more stable water column conditions in those reservoirs. These conditions could lead to increased production of HABs in Sacramento/Delta reservoirs and increased likelihood that cyanobacteria and cyanotoxins could pass through reservoir outlets, similar to the effects described in Section 9.7.12.1. The effects of the VA pathway on export reservoirs would likely be small because the effect of the VA pathway on water supply would likely be small, as described in Section 13.4.3.2.

Increased HABs in reservoirs and lower water levels in reservoirs could potentially increase cyanobacteria and cyanotoxins in downstream waterways and in water supplies. HAB impacts associated with reductions in reservoir storage would be potentially significant under both pathways. Because flow requirements under the VA pathway would generally be lower than under the regulatory pathway, this impact would be less during the term of the VA pathway.

For reservoirs under the regulatory pathway, cold water habitat provisions in the Bay-Delta Plan would provide flexibility for reservoir operators to manage temperature, flow, and carryover storage in a coordinated manner which would be expected to reduce reservoir effects that can lead to HAB formation. And, for most reservoirs, the effect of the regulatory pathway on the lowest reservoir levels, which tend to occur in the early fall under drought conditions, would likely be small. Modeled end-of-September storage levels under the 55 w/WSAs scenario generally show increases from baseline in the driest years, with a few exceptions (see Table 13.4-101 in Section 13.4.3.2).

Delta Channels

Lower net flows in some Delta channels during the summer and fall could result in increases in water travel time, which could increase HAB formation or increase the presence of invasive aquatic plants, particularly in channels that may typically experience low net flow. Delta HABs and invasive aquatic plants are affected by both tidal and net flows. HABs and invasive aquatic plants typically occur in backwater, dead-end sloughs, and other waterways with poor water circulation in the central and southern Delta. Changes in Delta hydrology are unlikely to affect HABs in dead-end sloughs but could affect HABs if there are changes in net flow through channels that are typically stagnant. As described in Section 13.4, Delta outflow under the revised proposed Plan amendments would be expected to increase during January-June period on average across all water year types, which could lead to reduced HAB formation. However, due to reduced Delta inflows and Delta exports in summer and fall and potential increased water travel times through some Delta channels that convey Sacramento River water to Delta export pumps (as described in Section 7.12.1), the frequency of HAB formation and bloom size could incrementally increase at some times. Because the VA pathway would have only small effects on Delta inflow and exports during the warmer time of year when HABs and invasive aquatic plants are growing (see Section 13.4.3, *Changes in Hydrology*), incremental effects on HABs and invasive aquatic plants are likely to be small.

Changes in Delta flows under the revised proposed Plan amendments would be larger under the regulatory pathway and would be most likely to affect channels that convey water to the Delta export pumps. The revised proposed Plan amendments include new monitoring and special studies requirements, and coordination with the regional water boards, State and federal agencies, and others on improving research and identifying possible management and mitigation measures to control HABs in the Delta (see Section 13.3.9.2, *Harmful Algal Blooms*). Nevertheless, the effect of changes in Delta hydrology on HABs and invasive aquatic plants in some Delta channels would range from less than significant for the VA pathway to potentially significant for the regulatory pathway.

Potential HAB impacts in reservoirs and Delta channels can be reduced through implementation of Mitigation Measures MM-SW-a,f: 1, 3, 4, 5, and 7. HABs are a statewide water quality issue that exists independently of potential incremental effects from changes in hydrology. Several ongoing activities to address HABs, such as those coordinated by the Freshwater and Estuarine Harmful Algal Bloom (FHAB) Program, also could be employed to mitigate impacts. The State and regional water boards regulate discharges of nitrogen and phosphorus, which contribute to HAB formation. The most immediate HAB response efforts include public education and notification efforts to minimize exposure of pets and people to waterbodies containing HABs. The California Water Quality Monitoring Council maintains a website for the California Cyanobacteria and Harmful Algal Bloom (CCHAB) Network that tracks HABs and provides information about how to respond to HABs, including information from the U.S. Environmental Protection Agency on measures that should be

implemented to prevent and respond to HABs in surface waters and drinking water supplies. In addition, for the regulatory pathway in the Sacramento/Delta, the cold water habitat objective is intended to be implemented in a manner that protects cold water habitat for fish, which may also serve to mitigate HAB impacts. While the State Water Board and others are engaged in efforts to address HABs, those efforts will take time and may not fully resolve HAB issues, including the incremental impacts associated with changes in hydrology under the revised proposed Plan amendments. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

YCFCWCD HRL Flow Commitments

Under the VA pathway, potential implementation of a YCFCWCD HRL commitments could result in the transfer of cyanobacteria and cyanotoxins from Cache Creek to Putah Creek. Due to the potential transfer of cyanobacteria seedstock and nitrates, this could increase the occurrence of HABs in Putah Creek. However, it should be noted that the concentrations of cyanobacteria and cyanotoxins in lower Cache Creek are uncertain and would likely be less than observed in Clear Lake and Cache Creek closer to Clear Lake (Yolo County 2024; Central Valley Water Board 2025). Nevertheless, these impacts could be potentially significant. Implementation of Mitigation Measure MM-SW-a,f: 12 will reduce these impacts to less-than-significant levels. As described above under *Contaminants*, YCFCWCD would be required to demonstrate no significant adverse water quality effects to Putah Creek, including from cyanobacteria and cyanotoxins, prior to routing surface water or banked groundwater from its recharge efforts to Putah Creek. 2025 ROD and 2025 ITP with the 2025 ROD/ITP, carryover storage for Folsom Lake and Oroville Reservoir would be expected to increase in wetter conditions for the VA pathway (VA + 2025 ROD/ITP scenario compared to the VA scenario and baseline). For the regulatory pathway, there would also be some expected increases in carryover storage under wetter conditions with the 55 w/WSAs + 2025 ROD/ITP compared the 55 w/WSAs scenario, which results in smaller reductions in storage relative to baseline. ~~smaller reductions in end-of-September carryover storage (55 w/WSAs + 2025 ROD/ITP scenario compared to the 55 w/WSAs scenario)~~ (Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*). On Shasta Lake smaller reductions in carryover storage under the VA pathway, and small increases in storage under the regulatory pathway in wetter conditions would be expected compared with baseline. Overall, these changes would be expected to be small and would not be expected to affect HABs in reservoirs beyond the effects evaluated above (see *Impact Discussion and Conclusion*).

Removal of the fall X2 requirements under the 2025 ROD/ITP could reduce Delta inflows during September in wet and above normal years for the starting point for the regulatory pathway (55 w/WSAs + 2025 ROD/ITP scenario compared to the 55 w/WSAs scenario and baseline) and VA pathway (VA + 2025 ROD/ITP scenario compared to the VA scenario and baseline) (Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*). However, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, there is uncertainty in the SacWAM results, and as a result, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results. Although reductions in Delta inflows would primarily occur in only one month, they could cause incremental increases in HABs and invasive aquatic plants in Delta channels. However, these reductions in September inflows would generally occur during wetter years with higher flow, when HABs and invasive aquatic plants are less of a concern. In

addition, as described in Section 13.4, exports could increase during September of wet and above normal years, which would be expected to increase net negative flows in south Delta channels leading to the Project pumping facilities and could reduce HABs in those channels. However, with the 2025 ROD/ITP, Delta outflow would be expected to increase during the January-June period on average across all water year types compared to baseline (Section 13.4.6, *Sensitivity Analysis for 2025 Record of Decision and 2025 Incidental Take Permit*), which could lead to reduced HAB formation.

As described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, the new LTO baseflow balancing provision that would apply under the VA pathway of the revised proposed Plan amendments requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The analyses presented here evaluate the effects of not having the LTO baseflow balancing provision. However, the LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway that could affect HABs and invasive aquatic plants in Delta channels. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the narrative interior Delta flow objective. During annual and periodic reviews, the State Water Board will assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

Electrical Conductivity, Chloride, and Bromide

Regulatory Pathway

Changes in hydrology under the regulatory pathway could result in changes in EC, chloride, and bromide in some locations in the Delta at some times. EC is an indicator of salinity, and because concentrations of chloride and bromide are correlated with salinity, the effects of the flow scenarios on chloride and bromide would be similar to the effects on salinity. As described in Section 7.12.1, changes in hydrology would generally be expected to result in either little change or decreases in salinity, although there could be small increases in salinity at some locations at some times. In general, as described in Section 13.4, under the starting point for the regulatory pathway changes in hydrology would be expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.1.

DSM2 modeling was not performed for this evaluation because the less-than-significant findings from Chapter 7 are still valid. To confirm the continued applicability of the DSM2 analysis performed for Chapter 7, hydrologic effects of the regulatory pathway on hydrologic drivers of Delta water quality are considered in the impact discussion below.

Voluntary Agreement Pathway

Changes in Delta salinity under the VA pathway would be similar to what is described in Chapter 9. Changes in Delta salinity with implementation of the VA pathway for HRL water rights and the

regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Seawater intrusion is controlled by Delta outflow, and reductions in Delta outflow can lead to a greater inland extent of seawater effect on western Delta water quality. This possibility is more likely when Delta outflow is low, and seawater intrusion is high under baseline conditions.

DSM2 modeling was performed for the Delta EC analysis of the baseline and 35–65 scenarios presented in Section 7.12.1 and Appendix A2, *Delta Simulation Model II (DSM2) Methods and Results*. The DSM2 modeling relies on input from SacWAM for Delta hydrological boundary conditions. SacWAM modeling includes Delta EC objectives from the State Water Board's Water Right Decision 1641 (D-1641) in all scenarios. D-1641 includes EC objectives for agriculture, drinking water, and aquatic species in the Delta and Suisun Bay and Marsh. The DSM2 model results were used to evaluate changes in flows and salinity in the Delta in a more refined way than what is available in output from SacWAM, and the DSM2 modeling verifies whether the SacWAM model accurately estimated Delta inflows and exports that would meet the D-1641 objectives.

The DSM2 modeling for Chapter 7 showed that impacts to Delta water quality would be less than significant. While EC may occasionally increase, these increases would not result in exceedances of water quality objectives because reservoir releases and exports can be managed to ensure that EC objectives are attained in the Delta; DSM2 modeling indicated that changes in hydrology under the 35-65 scenarios would not affect the ability to meet Delta water salinity objectives.

Water diversions at the SWP and CVP export facilities (in combination with other conditions) can cause changes in interior Delta flows, including Old and Middle River (OMR) flows and net flows in the San Joaquin River at Jersey Point (QWEST). OMR reverse flows indicate the southern movement of Sacramento River water to the southern Delta, which can affect EC in the Delta to a limited degree. As described in Section 13.4, under the starting point for the regulatory pathway (55 w/WSAs scenario), the frequency of OMR reverse (net negative) flows could increase during April and May compared with baseline because of increasing exports. These increases in spring exports and OMR reverse flows result from differences in how the San Joaquin River flows inflow to export ratio (I:E) requirements for the CVP from the LTO ROD and CDFW ITP are reflected in the SacWAM baseline and the 55 w/WSAs scenario. The regulatory pathway for the revised proposed Plan amendments does not include the more stringent I:E requirements for the CVP but retains the more stringent I:E requirements for the SWP, though not as a Bay-Delta Plan requirement but an assumed CDFW ITP requirement (see Section 13.4 for further description of the I:E assumptions for baseline and the 55 w/WSAs scenario).

In general, the 55 w/WSAs scenario would result in OMR flows that are not substantially different from baseline, particularly at the higher levels of reverse flows (Section 13.4.3.1). While OMR reverse flows may be problematic for fish, they are generally not problematic for Delta salinity because Sacramento River water is generally of higher quality than San Joaquin River water and because changes in Delta outflow are a more important determinant of Delta salinity. The changes in OMR flows associated with the revised proposed Plan amendments relative to the flow scenarios evaluated in Chapter 7 are unlikely to change the conclusions of the DSM2 analysis.

Due to its importance in preventing seawater intrusion, the most important hydrologic driver for Delta water quality is Delta outflow. Impacts could occur if there were substantial reductions in Delta outflow. As described in Section 13.4, SacWAM results show that total Delta outflow under the 55 w/WSAs scenario would increase on average in January through June and July through December, when averaged across all water year types. Average total annual Delta outflow under the 55 w/WSAs scenario would be more similar to the Low Flow Alternative (see the 35 and 45 scenarios in Table 6.3-2 in Chapter 6) than the 55 scenario in all water year types under the starting point for the regulatory pathway due to water supply adjustments. However, changes in Delta outflow could differ from these average seasonal patterns during certain water year types and months. The largest concern would be reductions in Delta outflow that occur during months with low Delta outflow under baseline conditions. Monthly effects of the revised proposed Plan amendments on Delta outflow are evaluated below.

SacWAM results for the VA pathway show that Delta outflow would be expected to increase relative to baseline in January through June and decrease during July through December (see Section 13.4), which is largely consistent with results from Chapter 9. However, the changes in Delta outflow would represent a small percentage of total Delta outflow and would have minimal effect on salinity within the Delta. The evaluation of Delta salinity performed for Chapter 9 relied on DSM2 modeling as described in Appendix G3b, *Delta Simulation Model II (DSM2) Methods and Results for the Proposed Voluntary Agreements*. The modeling did not include unspecified water purchases. Inclusion of unspecified water purchases could increase Delta outflow, particularly in the spring, and would be unlikely to cause substantial increases in Delta salinity and would not cause water quality violations. Because concentrations of chloride and bromide are correlated with salinity, the effects of the VA pathway on chloride and bromide would be similar to the effects on salinity. The VA pathway is expected to produce little to no change in chloride and bromide concentrations at municipal intakes and would not result in exceedances of water quality objectives.

To verify the continued applicability of the DSM2 results from Chapters 7 and 9, changes in Delta outflow are considered here. Table 13.7.12.1-2 shows SacWAM model results for changes in Delta outflows for the 55 w/WSAs scenario and the VA scenario including the effect of unspecified water purchases. These values are derived from those presented in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*. Both scenarios produce increases in Delta outflow relative to baseline, particularly in the spring under low-flow conditions (i.e., lower percentiles), and small reductions in outflow, particularly in August and September for the 55 w/WSAs scenario. These reductions in outflow that occur in the 55 w/WSAs scenario are less than those simulated for the Low Flow Alternative (35 and 45 scenarios) for Chapter 7 (results presented in Table A1-102), with variation by month (July, August, and September) and comparable to those simulated for the 35, 45, and 55 scenarios as presented in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios*.

These comparisons indicate that reductions in outflow during July through September are generally similar to or less than what was evaluated in Sections 7.12.1 and 9.7.12.1. Accordingly, effects on Delta salinity associated with the revised proposed Plan amendments would be no worse than the less-than-significant impacts discussed in Chapter 7 that relied on DSM2 results.

The general discussion of salinity effects throughout the Delta is applicable to chloride and bromide at drinking water intakes. The flow scenarios generally would increase Delta outflow and reduce

exports, which would reduce seawater intrusion events and decrease concentrations of chloride and bromide in the Delta. The flow scenarios are expected to produce either little change or reductions in chloride and bromide at municipal intakes and would not result in exceedances of water quality objectives.

Overall, changes in hydrology under the revised proposed Plan amendments would result in a less-than-significant impact on EC, bromide, and chloride in the Delta and Suisun Marsh for the VA pathway and the regulatory pathway because changes would not result in substantial increases in salinity and exceedances of associated water quality objectives.

Table 13.7.12.1-2. Cumulative Distribution of Monthly Average Delta Outflow Simulated by SacWAM – Baseline and Changes from Baseline for WY 1923–2021

Percentile	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Baseline												
0%	3,094	3,508	4,507	4,518	7,406	7,518	7,208	4,163	4,160	4,186	3,164	3,068
10%	4,021	3,558	4,567	7,647	9,527	10,094	8,388	7,275	7,255	4,215	3,678	3,096
25%	4,267	4,517	6,568	11,283	16,852	16,163	10,117	8,282	7,294	5,191	4,181	3,123
50%	5,295	4,559	10,774	24,464	34,686	26,334	18,759	15,145	7,686	7,130	4,740	4,697
75%	7,398	5,838	34,578	48,138	66,161	51,786	37,709	25,102	13,595	8,232	6,132	11,880
90%	9,042	14,873	67,829	96,697	126,929	90,430	61,203	45,246	28,685	10,951	10,992	12,917
100%	33,783	68,575	149,425	252,997	259,252	239,630	146,210	71,971	67,870	29,042	23,016	21,506
Average	6,523	8,214	25,355	40,501	52,240	41,497	29,001	20,433	13,372	7,727	6,004	7,292
Percent Change for 55 w/WSAs Scenario												
0%	17.9	-0.2	-0.2	23.7	-2.4	-0.2	-0.1	-0.1	-0.3	-0.3	5.6	-0.4
10%	9.7	5.8	11.8	1.4	15.9	8.8	8.2	2.9	-0.1	-0.4	-0.7	-0.2
25%	14.8	-0.2	-4.8	5.0	2.1	17.2	31.2	27.0	0.2	-0.1	-2.6	-0.7
50%	30.7	19.9	8.8	1.8	-0.8	9.9	28.2	28.8	49.1	-5.8	-3.2	-11.2
75%	15.9	21.3	-1.0	5.6	3.6	0.7	-2.4	22.9	49.8	3.1	9.3	-8.7
90%	6.5	-4.9	-3.3	1.0	-5.7	-7.2	2.7	2.6	2.1	-2.7	-11.0	-10.5
100%	-7.8	0.9	-1.1	-2.3	-2.5	-0.8	-1.5	0.0	-1.9	0.5	1.0	1.5
Average	12.0	4.4	-0.5	1.6	-0.1	2.7	7.8	14.1	15.0	-0.4	-1.4	-6.6
Percent Change for VA Scenario including unspecified water purchases												
0%	10.1	0.0	0.0	10.8	0.0	2.7	11.1	12.7	0.0	0.0	0.0	0.0
10%	0.1	0.0	0.0	-6.0	1.7	6.0	14.6	7.3	0.0	0.0	9.6	0.4
25%	3.9	0.0	-6.6	-1.3	-0.1	11.8	27.6	19.5	0.3	6.9	0.2	5.5
50%	-3.3	-0.3	-3.6	0.4	-2.3	8.6	9.0	-8.5	5.7	2.7	1.6	-12.2
75%	1.9	7.8	-0.9	0.6	-0.7	0.3	-0.5	-10.1	-3.9	0.1	5.7	-1.1
90%	0.7	-1.7	-0.3	0.6	-0.8	-0.3	1.9	2.2	0.1	-4.3	-0.9	2.3
100%	4.1	0.1	0.0	0.0	0.0	0.0	1.0	1.5	0.0	-0.1	0.8	0.0
Average	0.9	-0.4	-1.2	0.0	-0.1	2.7	3.8	-0.6	0.8	1.1	1.6	-0.6

2025 ROD and 2025 ITP

With the 2025 ROD/ITP, removal of the fall X2 requirements could reduce Delta outflows during September of wet and above normal years for the starting point for the regulatory pathway (55 w/WSAs + 2025 ROD/ITP scenario compared to the 55 w/WSAs scenario and baseline) and VA pathway (VA + 2025 ROD/ITP scenario compared to the VA scenario and baseline) (Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*), allowing X2 and seawater intrusion to move inland, which could also have small effects on chloride and bromide. These reductions in Delta outflow would occur during wetter years when outflow is higher and Delta water quality is of less concern. However, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, there is uncertainty in the SacWAM results, and as a result, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results. However, it is not expected that there would be substantial reductions in Delta outflow compared to what was modeled in SacWAM and evaluated with postprocessing (see Section 13.4.6, *Sensitivity Analysis for 2025 Record of Decision and 2025 Incidental Take Permit*).

Planning models such as SacWAM prioritize meeting Delta salinity objectives, as do actual CVP and SWP operations. The 55 w/WSAs + 2025 ROD/ITP and VA + 2025 ROD/ITP scenarios include operational adjustments for meeting Delta water quality objectives, including Delta salinity objectives. Operational adjustments are expected to be made by the CVP and SWP such that Delta water quality objectives continue to be met with the 2025 ROD/ITP.

As described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, the new LTO baseflow balancing provision that would apply under the VA pathway of the revised proposed Plan amendments requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The analyses presented here evaluate the effects of not having the LTO baseflow balancing provision. However, the LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway, which would be expected to prevent increases in Delta salinity. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the narrative Delta flow objective. During annual and periodic reviews, the State Water Board will assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

Water Quality Compliance by Utilities

Regulatory Pathway

Changes in streamflow under the regulatory pathway could affect instream chemical constituent concentrations due to changes in instream dilution. A reduction in streamflows would potentially affect the ability of a waste discharger or drinking water provider to comply with waste discharge requirements and/or water quality standards, which would potentially result in the need to modify treatment operations. Decreases in streamflow could also exacerbate the effects of WWTP discharge on instream water temperature and affect dischargers' ability to meet receiving water temperature requirements.

The regulatory pathway would have similar effects as those evaluated in Section 7.12.1; however, as described in Section 13.4, under the starting point for the regulatory pathway changes in hydrology are expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These adjustments include both watershed-wide adjustments and tributary specific adjustments. As such, the likelihood of degradation of localized water quality under the regulatory pathway would be less than evaluated in Section 7.12.1 due to these refinements. SacWAM results for changes in hydrology show that the reductions in flow during the summer and early fall under the starting point for the regulatory pathway (55 w/WSAs scenario) relative to the reductions described in Chapter 7 varies by river, month, and portion of the distribution of results evaluated. Summer and early fall flow reductions relative to baseline under the 55 w/WSAs scenario (presented in Appendix H1a2) would generally be less than under the 55 scenario and often similar to the summer flow reductions under the Low Flow Alternative (35 and 45 scenarios) evaluated in Chapter 7 (results presented in Appendix A1) due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.1.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway could result in small reductions in streamflow compared to baseline, similar to what is described in Section 9.5.3, *Changes in Hydrology*. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Under the regulatory pathway, lowered river flows, such as reduced Sacramento River flows during summer and fall, could reduce assimilative capacity, creating the potential for violation of waste discharge requirements and potential degradation of water quality near WWTPs' discharge locations. NPDES permits include provisions for reopening waste discharge requirements if new information is received. If changes in river flows and constituent concentrations were to contribute to an exceedance or exceedances of surface water quality objectives, waste discharge requirements would be modified to account for the change in the available dilution.

Drinking water providers also may experience effects due to changes in hydrology. Changes in water quality associated with reduced dilution in a surface supply source could cause changes in water quality near drinking water intakes. Drinking water providers must regularly monitor water quality to ensure that drinking water standards are achieved, but increased concentrations of some constituents may cause temporary violation of drinking water standards if the treatment plant operator is initially unaware of the problem or is unable to address it immediately by modifying facility operations.

Under the VA pathway, small potential reductions in streamflow would be unlikely to substantially affect concentrations of instream chemical constituents in a way that could affect the ability of a WWTP or drinking water treatment plant to maintain compliance with existing or modified waste discharge requirements and drinking water quality standards.

Overall, changes in hydrology could have effects ranging from no impact for the term of the VA pathway to a potentially significant impact under the regulatory pathway due to potential exceedances of waste discharge requirements and/or water quality standards. These impacts could require providers to modify operations or provide additional treatment at WWTPs and drinking water treatment plants to continue to comply with existing or modified waste discharge requirements and drinking water quality standards. Physical modifications to treatment plants are further discussed in Section 13.7.20, *Utilities and Service Systems,* and impacts from the construction of new or modified treatment plants is evaluated in Section 7.22, *New or Modified Facilities*.

Generally, waste dischargers and drinking water providers are highly regulated and are unlikely to violate waste discharge requirements and drinking water quality standards. Drinking water providers must regularly monitor water quality to ensure that drinking water standards are met. However, this impact could require providers to modify operations or provide additional treatment at WWTPs and drinking water treatment plants to continue to comply with existing or modified waste discharge requirements and drinking water standards.

Implementation of Mitigation Measures MM-SW-a,f: 1 and 5 will reduce or avoid violations of waste discharge requirements by wastewater dischargers and water quality standards by drinking water providers. The regulation of water quality constituents is accomplished primarily through waste discharge permits issued by the State and regional water boards, including NPDES permits for point-source discharges, and waste discharge requirements for nonpoint-source discharge. The State Water Board Division of Drinking Water (DDW) implements the Safe Drinking Water Act through measures such as (1) issuance of permits for public water systems and their sources and treatment to ensure compliance with drinking water standards; (2) inspection of water systems; (3) tracking of monitoring requirements of water systems to determine compliance; and (4) enforcement actions. Continued regulation by DDW will protect municipal drinking water quality. A variety of funding programs provide loans and grants for capital improvements to WWTPs and projects that help provide safe drinking water, including the Safe and Affordable Drinking Water Fund established by SB 200. The State and regional water boards will continue to regulate waste discharges and drinking water standards and will continue to promote and support future funding sources as appropriate. However, unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

2025 ROD and 2025 ITP

With the 2025 ROD/ITP, removal of the fall X2 requirements could reduce flows in the American and Feather Rivers during September in wet and above normal years, which would also reduce flow in the Sacramento River downstream of the Feather River for the starting point for the regulatory pathway (55 w/WSAs + 2025 ROD/ITP scenario compared to the 55 w/WSAs scenario and baseline) and VA pathway (VA + 2025 ROD/ITP scenario compared to the VA scenario and baseline) (Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*). These reductions in flow would be larger on the Feather River and, for the

Feather River, would be larger under the VA pathway than under the regulatory pathway. However, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, there is uncertainty in the SacWAM results, and as a result, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results. Although reductions in streamflow would primarily occur in only one month and only occur on the Project tributaries, they could have the same type of effect on water quality compliance by utilities as is described above, including incremental effects on instream chemical constituent concentrations. However, these reductions would generally occur during wetter years with higher flow, when dilution of contaminants and wastewater would be higher.

As described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, the new LTO baseflow balancing provision that would apply under the VA pathway of the revised proposed Plan amendments requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The analyses presented here evaluate the effects of not having the LTO baseflow balancing provision. However, the LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway, which could also reduce changes in streamflows on Project tributaries that could affect instream chemical constituent concentrations. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the narrative interior Delta flow objective. During annual and periodic reviews, the State Water Board will assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

Changes in Water Supply

Changes in Municipal and Managed Wetland Supply

Regulatory Pathway

Similar to what is described in Chapter 7, changes in water supply under the regulatory pathway could lead to reductions in Sacramento/Delta surface water supplies for municipalities, which could result in the use of alternative sources of water for municipal use. Some alternative water sources could be of lower quality, and use of lower quality water may cause drinking water treatment facilities to temporarily exceed maximum contaminant levels for drinking water if the facility operators are either initially unaware of the problem or unable to address it. A drinking water treatment facility operator may need to take additional actions (such as increased monitoring or chemical treatment) to ensure that a new or additional source of water does not result in water quality or related concerns, such as corrosion of pipes, once the new source has been introduced into the distribution system.

The use of other lower quality water supply sources (e.g., groundwater) to replace reduced Sacramento/Delta surface water supply could affect the quality of WWTP influent and effluent. Additionally, reduced Sacramento/Delta supply to municipal use and increased indoor water conservation could lead to a decrease in the production of wastewater and could increase the concentrations of chemical constituents in WWTP influent. If dischargers do not implement proper adjustments, they could risk violating waste discharge requirements.

Reductions in Sacramento/Delta water supplies under the regulatory pathway could affect water quality in managed wetlands if those lands receive some or all of their water supply from the Sacramento/Delta. The effect is likely to be more substantial in the San Joaquin Valley, where water quality is already poor, such as in areas receiving a combination of surface water imports, groundwater pumping, and agricultural drainage (e.g., Grasslands Ecological Area). Reductions in agricultural supply could cause agricultural drainage to become more concentrated and degraded and a decrease in relatively high-quality surface water would cause water quality in the managed wetland to more closely resemble the lower quality of the alternative water sources.

The regulatory pathway would have similar effects as those evaluated in Section 7.12.1; however, as described in Section 13.4.4, *Changes in Surface Water Supply*, under the starting point for the regulatory pathway changes in water supply under the regulatory pathway would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than the 55 scenario in all water-year types (Section 13.4.4) due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.1.

Voluntary Agreement Pathway

Similar to the effects described in Section 9.7.12.1, implementation of the VA pathway could result in a reduction in Sacramento/Delta surface water supplies, both within and outside of the Sacramento/Delta watershed. However, water supply reductions would primarily affect agricultural uses, and it is expected that there would only be a very small reduction in water supply for municipal use. Reductions in water supply to municipalities under the VA pathway would be based on voluntary measures and would not be large enough to potentially require the use of alternative water sources of potentially lower quality. Furthermore, reductions would not be large enough to potentially alter the flow and chemical constituent concentrations of WWTP influent and subsequently affect WWTP effluent discharges to receiving waters in a manner that affects water quality.

Under the VA pathway, reductions in Sacramento/Delta water supplies could indirectly affect water quality in managed wetlands. While Sacramento/Delta water supply to managed wetlands is not expected to be directly affected by implementation of the VA pathway, it is possible that reductions in agricultural supply could cause reductions in the quality of agricultural drainage that supplies some managed wetlands. Because reductions in agricultural water supply under the VA pathway would likely be small compared to each region's total agricultural supply, managed wetlands are unlikely to experience substantial reductions in water supply or water quality due to reductions in agricultural drainage or groundwater levels associated with the VA pathway.

Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Overall, changes in water supply under the revised proposed Plan amendments could have effects on WWTP influent and effluent quality and quantity, and managed wetland water quality ranging from less than significant for the term of the VA pathway to potentially significant under the regulatory pathway. Further, changes in water supply under the regulatory pathway could result in potential temporary exceedances of maximum contaminant levels in municipal drinking water supply, which could be a potentially significant impact.

Implementation of Mitigation Measures MM-SW-a,f: 1 and 5 will reduce or avoid violations of water quality standards or waste discharge requirements for drinking water providers and wastewater dischargers. The State Water Board oversees water quality standards and waste discharge requirements as described under *Water Quality Compliance by Utilities* (*Impact Discussion* section) above.

Implementation of Mitigation Measures MM-SW-a,f: 6 and MM-SW-a,f: 7 can reduce or avoid water quality impacts on managed wetlands. The proposed program of implementation includes measures to prioritize refuge water supplies (see Section 13.3, *Revised Proposed Plan Amendments*). Mitigation also includes measures to reduce lowering of groundwater levels. Many efforts are underway to develop and implement actions to address poor-quality agricultural discharges in the southern San Joaquin Valley, including those described in the Central Valley Salinity Alternatives for Long-Term Sustainability Program. The program is a joint effort of the State Water Board and the Central Valley Water Board to address salinity and nitrate problems in the Central Valley and to adopt long-term solutions that will lead to enhanced water quality and economic sustainability, including source control, best management practices to reduce the introduction of new salts, farmland retirement, and desalination. These efforts have produced some improvements and will likely continue to do so, but considerable challenges will likely persist.

Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Changes in Groundwater

Increased groundwater pumping to replace reductions in Sacramento/Delta surface water supplies and reduced incidental recharge from applied irrigation water could reduce groundwater levels under both the regulatory and VA pathways. Reductions in groundwater levels could reduce streamflow either by increasing surface water percolation to groundwater or by reducing groundwater accretions to surface water. Further, increased groundwater pumping adjacent to streams could accelerate stream depletions more directly. Potential reductions in groundwater accretions could cause increases in water temperature as well as decreases in water quality due to lower cool water input and lower streamflows or, alternatively, could cause improvements in water quality due to less input from low-quality groundwater. Due to the relatively small effect of the VA pathway on water supply, effects associated with groundwater substitution would not be widespread. Nevertheless, impacts could be potentially significant.

Surface water quality effects from lowered groundwater levels can be reduced through implementation of Mitigation Measures MM-SW-a,f: 6 and 8, which incorporate measures to reduce or avoid lowering of groundwater levels. In addition, groundwater impacts and associated impacts

on surface water quality can be reduced through diversification of water portfolios that include sustainable groundwater management, groundwater storage and recovery, increased use of recycled water from existing facilities, and agricultural and municipal water conservation measures.

Impact SW-c: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site

Impact SW-d: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site

The analyses of Impact SW-c and Impact SW-d are closely related and therefore are combined and addressed together.

Changes in Hydrology

Regulatory Pathway

As described in Section 7.12.1, changes in hydrology under the regulatory pathway would not increase surface runoff and, for all streams except Clear Creek, would not increase flows when flood risk is highest.

The regulatory pathway would have similar effects as those evaluated in Section 7.12.1; however, as described in Section 13.4, under the starting point for the regulatory pathway changes would be expected to be smaller and closer to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.1.

Voluntary Agreement Pathway

Similar to the effects described in Section 9.7.12.1, changes in hydrology under the VA pathway would generally result in increased flows in tributaries with HRL commitments during spring (primarily April and May), would generally not increase flows during the winter months, and would not cause flows to increase in Clear Creek. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Increases in short-term peak flows would be prevented through real-time operations, and sediment and channel management practices would continue to maintain channel capacities. Accordingly, implementing the flow requirements under the regulatory pathway would not substantially alter the

existing drainage pattern of an area or alter the course of a stream or river in a manner that would result in adverse sediment transport, streambank erosion, or flooding on-site or off-site.

Clear Creek is unique because some flows that pass from Whiskeytown Lake through Spring Creek Tunnel to Keswick Reservoir under baseline conditions would instead flow out of Whiskeytown Lake into Clear Creek under the regulatory pathway. These flow increases may be in the beneficial range that would improve habitat rather than cause excessive erosion. However, although unlikely, increases in Clear Creek flow downstream of Whiskeytown Lake could increase the risk of adverse erosion and flooding in this area.

Table 13.7.12.1-3 shows 90th percentile flows on Clear Creek for baseline and the 55 w/WSAs scenario as modeled by SacWAM during the high-flow months of January, February, and March. These results indicate that flows during these months under the starting point for the regulatory pathway (55 w/WSAs scenario) would generally be similar to those under the Low Flow Alternative (35 and 45 scenarios; Appendix A1) due to water supply adjustments.

Table 13.7.12.1-3. Changes in Flow (cfs) (90th Percentile) on Clear Creek during High Flow Months under the 55 w/WSAs Scenario

High Flow Months	Baseline	55 w/WSAs Scenario	Percent Change from Baseline
January	305	1,021	235
February	386	1,020	164
March	314	938	199

cfs=cubic feet per second

The VA pathway would provide for only small possible increases in flow during wet water years, which are the year types most likely to produce flows substantial enough to cause deleterious erosion or flooding. Overall, changes in hydrology could potentially increase the risk of erosion and flooding due to increasing flows, with impacts ranging from less than significant for the VA pathway to potentially significant under the regulatory pathway for Clear Creek downstream of Whiskeytown Lake.

Implementation of Mitigation Measure MM-SW-i will mitigate this impact to a less-than-significant level by establishing safe flow levels on Clear Creek that would avoid significant erosion or flooding effects. Specifically, State Water Board staff, in coordination with DWR's Division of Flood Management, Reclamation (owner of Whiskeytown Lake), and local flood management authorities, would develop a flow cap that would activate floodplain habitat while maintaining public safety and protecting property.

Impact SW-i: Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam

Changes in Hydrology

Regulatory Pathway

The revised proposed Plan amendments are unlikely to increase the risk of flooding in Sacramento/Delta rivers, except in Clear Creek. Higher flows in Clear Creek would result from

operating the system to release additional flow from Whiskeytown Lake into Clear Creek rather than diverting the water into the Spring Creek Tunnel. Clear Creek below Clear Creek Road possesses floodplain habitat that could be activated by flows released from Whiskeytown Dam. Release of higher flows to meet flow requirements in this reach could increase the risk of downstream flooding in this area.

The regulatory pathway would have similar effects as those evaluated in Section 7.12.1; however, as described in Section 13.4, and above for Impacts SW-c and SW-d, under the starting point for the regulatory pathway changes in flows, including increases in high flows on Clear Creek, would generally be similar to those expected with the Low Flow Alternative (35 and 45 scenarios) evaluated in Chapter 7 due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.1.

Voluntary Agreement Pathway

Similar to effects discussed in Section 9.7.12.1, changes in hydrology under the VA pathway are unlikely to result in substantial increases in flood risk. Increased flows in tributaries with HRL commitments during spring (primarily April and May), would generally not increase flows during the winter months, and would not cause flows to increase in Clear Creek. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Similar to what is described in Section 7.12.1, the revised proposed Plan amendments are unlikely to increase the risk of flooding in Sacramento/Delta rivers because the flow requirements would generally reduce reservoir storage in the winter and spring and because the flow requirements would not apply to an individual tributary during periods when flows from that tributary could cause or contribute to flooding or other related public safety concerns, as described in the revised proposed program of implementation. However, for Clear Creek, flows could increase substantially above the highest baseline flows. Clear Creek is unique because some flows that pass from Whiskeytown Lake through Spring Creek Tunnel to Keswick Reservoir under baseline conditions would instead flow out of Whiskeytown Lake into Clear Creek under the proposed Plan amendments. For the past several decades, Clear Creek has not experienced flows that would be considered flood levels, so no creek flow level has been established to alert local residents of any potential flooding issues. Clear Creek below Clear Creek Road possesses floodplain habitat that could be activated by flows released from Whiskeytown Dam. Release of new flow requirements in this reach could increase the risk of downstream flooding in this area.

Overall, changes in hydrology could have effects on flood risk that range from less than significant for the VA pathway to potentially significant under the regulatory pathway. Implementation of Mitigation Measure MM-SW-i will mitigate this impact to a less-than-significant level. To establish safe flow levels, State Water Board staff would coordinate with the DWR Division of Flood

Management, Reclamation (owner of Whiskeytown Lake), and local flood management authorities to develop a flow cap that would activate floodplain habitat while maintaining public safety (e.g., on Clear Creek Road) and protecting property (e.g., Win-River Resort and Casino on the Redding Rancheria near the Sacramento River).

2025 ROD and 2025 ITP

With the 2025 ROD/ITP, SacWAM results for the Sacramento and Feather Rivers indicate a few increases in flow at the highest flow levels (90th percentile and maximum) could occur during the months with the highest flows when comparing the 55 w/WSAs + 2025 ROD/ITP and 55 w/WSAs scenarios and the VA + 2025 ROD/ITP and VA scenarios (see Appendix H1a7, *Sacramento Water Allocation Model Results for 2025 Record of Decision and Incidental Take Permit Amendments*). These increases are associated with increases in fall storage resulting from the removal of fall X2 requirements, which can cause some minor increases in flood control releases later in the year. The changes from the 2025 ROD/ITP are unlikely, however, to increase damaging floods because of continued adherence to flood control rules for preserving storage space in reservoirs through the winter and spring. However, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, there is uncertainty in the SacWAM results, and as a result, the actual effects of the 2025 ROD/ITP could differ somewhat from the modeling results. Without the fall X2 requirement that applies during the fall of wet and above normal water year types, it is possible that water stored in reservoirs and used to meet the fall X2 requirement under existing conditions could at times be released from storage earlier in the year, which would reduce the need for increased flood-control releases during the winter months. Accordingly, no additional effects on the risk of flooding are expected beyond what is described above (see *Impact Discussion and Conclusion*).

13.7.12.2 Groundwater

This section describes the potential impacts on groundwater that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements in the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9. This section first describes changes in groundwater levels (Impact GW-b) that could occur from responses to decreased Sacramento/Delta surface water supply. Water quality impacts, including drinking water quality impacts (Impact GW-a and Impact GW-f), are then evaluated together based on the identified possible changes in groundwater quantity.

Potential impacts on groundwater from the revised proposed Plan amendments would result from individual water users' personal and professional decisions in response to reduced Sacramento/Delta supply. These responses likely include increased groundwater pumping as a substitute supply where available and not locally restricted, and reductions in applied irrigation water, including from increased water use efficiencies, which would reduce incidental groundwater recharge.

Groundwater levels in many basins across California have declined steadily over time from agricultural and municipal uses. In some places, groundwater pumping supplements surface water

diversions. Other areas of the state do not have surface water rights or access and are wholly dependent on groundwater. The legislature passed the Sustainable Groundwater Management Act (SGMA) in 2014 to address groundwater overpumping and consequences of that over-extraction, including overdraft. In some areas, surface water, including imported surface water, has been used to alleviate declining groundwater levels through substitution, managed groundwater recharge (percolation or injection into the groundwater basin), or both. The management of surface water supplies and groundwater supplies together is called *conjunctive use* and can be an effective approach in long-term water supply planning, so long as it does not impair the quality and sustainability of either water source. Where the revised proposed Plan amendments require increased instream flows in order to reasonably protect fish and wildlife beneficial uses, less Sacramento/Delta surface water may be available to supplement groundwater.

For a discussion of potential subsidence impacts related to reduced groundwater levels, see Section 13.7.9, *Geology and Soils*. For a discussion of potential impacts on surface water, see Section 13.7.12.1, *Surface Water*.

Impact Analysis

Impact GW-b: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge, such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)

Changes in Hydrology and Water Supply

Regulatory Pathway

As discussed in more detail in Section 7.12.2, *Groundwater*, impacts on groundwater levels could occur as a result of increased groundwater pumping in response to reduced Sacramento/Delta supply, and less incidental recharge from excess applied irrigation water. Responses by individual farmers and ranchers, municipalities, water districts, and other surface water users to a reduction in Sacramento/Delta surface water supply may affect groundwater if those users increase groundwater pumping to replace lost surface water supplies or change irrigation practices (e.g. reducing irrigated acres or increase irrigation efficiencies), thus reducing incidental recharge from applied irrigation water. Additionally, the frequency and severity of critical shortages or dry wells occurring in areas susceptible to prolonged drought periods or within economically disadvantaged communities (DACs) would likely increase.

The regulatory pathway under the revised proposed Plan amendments would have similar effects as those that were evaluated in Section 7.12.2; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in hydrology and water supply would be expected to be smaller and more similar to the Low Flow Alternative (35 to 45 scenarios) than those evaluated in Section 7.12.2 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of the Plan implementation. These adjustments include both watershed-wide adjustments and tributary-specific adjustments. The watershed-wide adjustments would

require flows of 55 percent of unimpaired flow during wetter conditions, with required flows at 45 percent of unimpaired flows during intermediate conditions and flows down to 35 percent of unimpaired flow under the driest conditions. The tributary-specific water supply adjustments would allow for additional adjustments in rainfall-dominated and municipal-supply-dominated tributaries, including Putah Creek and the Mokelumne and Calaveras Rivers, that would allow for more frequent reductions in the required flow levels within this range, as well as no new flow requirements during the driest conditions. As such, potential impacts on groundwater levels resulting from substitute groundwater pumping to replace Sacramento/Delta surface water supplies or from reduced incidental recharge under the starting point for the regulatory pathway for the revised proposed Plan amendments would be less than evaluated in Section 7.12.2 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.2.

Voluntary Agreement Pathway

The VA pathway would result in a total average annual reduction in Sacramento/Delta surface water supply and could also lead to increased groundwater pumping in response to reduced Sacramento/Delta supplies, and a reduction in incidental groundwater recharge from excess irrigation. The VA pathway would have very similar effects as described in Section 9.7.12.2, *Groundwater.* Under the VA pathway, most of the reductions in Sacramento/Delta surface water supplies would occur for users within the Sacramento/Delta watershed. Sacramento/Delta water supply reductions would primarily affect agricultural uses. There could be a very small reduction in water supply for municipal use, and there would be no change in water supply for wildlife refuge uses. The VA pathway also identifies that some flow could be provided through groundwater substitution, including in basins subject to SGMA where that is consistent with local management under SGMA. The Sacramento Water Allocation Model (SacWAM) modeling assumes that some flow could be provided through groundwater substitution in the American River watershed. Flow in other watersheds could also be provided through groundwater substitution, but sufficient information is not available at this time to include additional groundwater substitution in the modeling. Changes in hydrology and water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, the revised proposed Plan amendments likely would reduce the availability of Sacramento/Delta water for diversion by some users. In the past, irrigators, municipalities, and other surface water users with access to groundwater have responded to reductions in surface water supplies by substituting groundwater pumping for some or all of the reduced supply. If, for example, a farmer or rancher responded by fully substituting groundwater, there likely would be little or no change to the amount of water applied to irrigated fields, and the volume of incidental recharge from irrigation water application would remain relatively constant. However, the increased groundwater pumping would result in lower groundwater levels. Since only a portion of the applied water results in recharge (with a considerable amount of the total volume of pumped groundwater lost through

evapotranspiration), there would be a larger reduction in groundwater levels if substitute groundwater pumping is assumed.

Reductions in Sacramento/Delta water supplies would vary by region. Table 13.7.12.2-1 presents SacWAM estimates for regional changes in the total amount of Sacramento/Delta water supplies under the starting point for the regulatory pathway (55 w/WSAs scenario) and under the VA pathway (VA scenario).

Table 13.7.12.2-1. Change from Baseline Conditions: Annual Average Total Sacramento/Delta Supply by Region and Pathway (thousand acre-feet per year)

Region	Annual Average Total Supply	Sacramento/ Delta Supply	Change from Baseline	
			55 w/WSAs Scenario	VA Scenario
Sacramento/Delta watershed	10,404	6,725	-255	-110 to -223
San Joaquin Valley	18,437	2,845	-74	+51 to -62
San Francisco Bay Area, Central Coast, and Southern California	12,034	2,471	-328	+35
Total	40,875	12,041	-657	-137

Sources: Historical water deliveries data (see Section 2.8, *Existing Water Supply*) and SacWAM results (see Section 13.4, *Changes in Hydrology and Water Supply*).
VA = voluntary agreement; WSAs = water supply adjustments

The estimates presented in Table 13.7.12.2-1 show that changes in flow requirements could result in reductions in Sacramento/Delta supply to all regions under the starting point for the regulatory pathway (55 w/WSAs scenario). These reductions in supply would be lower compared to the 55 flow scenario analyzed in Chapter 7. Based on the SacWAM results presented above (Table 13.7.12.2-1) and in Chapter 6*, Changes in Hydrology and Water Supply* (see Table 6.4-1), changes in total Sacramento/Delta water supply under the 55 w/WSAs scenario would be more similar to those under the Low Flow Alternative (35 and 45 scenarios) due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some tributaries, or a combination thereof, and therefore decreases in Sacramento/Delta water supplies could also be as high as those identified in Section 7.12.2.

The VA pathway would also result in a total average annual reduction in Sacramento/Delta surface water supply for the term of the VA pathway as shown above in Table 13.7.12.2-1, although the effects of these changes would vary by region. The total reduction in Sacramento/Delta surface water supplies under the VA pathway would also be less compared to the 55 w/WSAs scenario, for the term of the VA pathway. Under the VA pathway, most of the reductions in Sacramento/Delta surface water supplies would occur within the Sacramento/Delta watershed. For the Sacramento/Delta watershed and San Joaquin Valley regions, Table 13.7.12.2-1 shows a range for the possible change in Sacramento/Delta water supply from baseline under the VA pathway to reflect the potential sources of water provided through unspecified water purchases. As discussed in Section 9.5, *Changes in Hydrology and Water Supply*, under the VA pathway, unspecified water purchases could be provided from willing sellers in the Sacramento/Delta watershed or from export reductions. Unspecified water purchases could also be provided through a combination of willing sellers in the Sacramento/Delta watershed and from export reductions. The actual change from

baseline would be within the range above. Because it is assumed that unspecified water purchases would not be provided from users in the San Francisco Bay Area, Central Coast, and Southern California regions, the results for these regions are not reflected as a range.

When faced with reduced surface water supplies, water users may replace some of that reduction with groundwater and/or local surface water supplies; however, there is often uncertainty about how much groundwater is available. Water users will also weigh the generally higher cost of groundwater against other alternatives. For example, in cases with little or no available groundwater or profitable crop alternatives, growers may instead choose to fallow lands that had been farmed under baseline conditions. To summarize, water users facing reduced surface water supplies may replace all, some, or none of the reduction with groundwater, depending upon a variety of economic or supply factors and regulatory constraints, including SGMA.

There is uncertainty regarding groundwater pumping, groundwater recharge rates, and stream-aquifer interactions in many parts of the study area. Precisely how these physical processes may change, and how water users may respond to reduced Sacramento/Delta surface water supplies is uncertain. In some areas, groundwater pumping may be limited by regulatory requirements (e.g., groundwater adjudications, SGMA implementation). In other areas, it may be locally unrestricted. The dynamic between potential groundwater resources and potential agricultural impacts creates a challenge for the impact analysis since the majority of groundwater pumping in many areas is for agricultural irrigation. In other words, assuming lower groundwater replacement pumping by farmers and ranchers in response to decreased surface water supplies will result in lower impact conclusions for groundwater resources but will increase the severity of impact conclusions for agricultural resources (e.g., levels of potential permanent conversion of important farmland). Conversely, assuming higher groundwater replacement pumping by farmers and ranchers increases the severity of impact conclusions for groundwater resources but assumes that more water is available for agriculture, which reduces the severity of impact conclusions for agricultural resources. Importantly, the analysis cannot assume both “worst-case” scenarios simultaneously; there cannot be both maximum potential impacts on groundwater resources from replacement pumping and maximum potential impacts on agricultural resources.

When water is applied to agricultural lands or for outdoor municipal uses (e.g., landscaping), some of the applied water infiltrates deep into the ground, resulting in incidental recharge to the underlying groundwater basin. As discussed in Section 7.12.2, the portion of applied irrigation water that results in incidental recharge varies based on the underlying geology of specific regions, crop types, and irrigation methods and practices. Therefore, it is not possible to accurately quantify how a change in Sacramento/Delta supply would result in a change in incidental groundwater recharge because a user could respond to a reduced Sacramento/Delta supply in a number of ways, such as by changing irrigation methods or crop types. In general, however, a reduction in applied irrigation water could locally result in a reduction in incidental groundwater recharge.

Section 7.12.2 discusses several groundwater banking projects that store excess water when it is available and extract the water for later use. Decreases in Sacramento/Delta supplies could reduce water supplies for groundwater storage and recovery projects to some extent, which could have localized impacts on groundwater storage. For each unit of Sacramento/Delta water destined for groundwater storage and recovery projects that would not be delivered as a result of the revised

proposed Plan amendments, an equivalent volume of water would not be recharged to the groundwater basins.

As shown above in Table 13.7.12.2-1, reductions in Sacramento/Delta surface water supplies under the revised proposed Plan amendments would vary by region and pathway. Under the 55 w/WSAs scenario, regions that receive relatively small volumes of Sacramento/Delta supply show the smallest volume reduction. Therefore, potential effects on groundwater levels resulting from substitute groundwater pumping to replace Sacramento/Delta surface water supplies and from reduced incidental groundwater recharge that occurs as a byproduct of excess irrigation would also vary by region, with smaller effects on groundwater levels likely to occur in regions that receive relatively small volumes of Sacramento/Delta supply. As described above, because changes in Sacramento/Delta supply under the 55 w/WSAs scenario would be less than under the 55 scenario and would be more similar to changes under the Low Flow Alternative, the impacts on groundwater levels would be expected to be less than under the 55 scenario and more similar to those under the Low Flow Alternative (35 and 45 scenarios) due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.2.

As described above, under the VA pathway, the largest reductions in Sacramento/Delta surface water supplies and therefore the largest effects on groundwater levels would likely occur within the Sacramento/Delta watershed for the term of the VA pathway. Impacts could also occur as a result of flow provided through groundwater substitution, which would increase groundwater pumping at times in certain locations in lieu of use of surface water provided as part of the VA pathway. However, within the Sacramento/Delta watershed, impacts on groundwater levels in the Delta are unlikely, as discussed in Section 7.12.2. In the San Joaquin Valley, the overall effect of changes in Sacramento/Delta surface water supplies would be dependent on the sources of the unspecified water purchases, which are not fully known at this time, but impacts could be potentially significant for the term of the VA pathway. Because the SacWAM modeling estimates that there would not be a decrease in overall Sacramento/Delta supply to the San Francisco Bay Area, Central Coast, or Southern California under the VA pathway, there would be minimal or no impact in these regions for the term of the VA pathway. However, localized impacts may occur on groundwater levels in areas where Sacramento/Delta surface water supplies are used for groundwater storage and recovery projects.

Overall, changes in water supply under the revised proposed Plan amendments could result in potential impacts on groundwater levels resulting from substitute groundwater pumping to replace Sacramento/Delta surface water supplies and from reduced incidental groundwater recharge that occurs as a byproduct of excess irrigation. These impacts could be potentially significant.

Under the regulatory pathway, the proposed Bay-Delta Plan program of implementation encourages and allows for local cooperative solutions. Those local cooperative solutions would be required to include measures to coordinate implementation of the revised proposed Plan amendments with groundwater management activities, including with implementation of SGMA. Local cooperative solutions also may allow flow requirements lower in the range if complementary measures (ecosystem projects) are implemented that provide for equivalent protection of fish and wildlife

beneficial uses. Such projects could reduce the potential impacts associated with decreased consumptive water uses, including impacts on groundwater.

In addition, potential impacts on groundwater levels resulting from substitute groundwater pumping to replace Sacramento/Delta surface water supplies or from reduced incidental recharge could be reduced through implementation of Mitigation Measure MM-GW-b. Implementation of Mitigation Measure MM-GW-b will reduce or avoid groundwater level impacts. Local groundwater management under SGMA could reduce or eliminate impacts, particularly in medium- and high-priority groundwater basins that are subject to SGMA. As noted in Section 7.12.2, the groundwater basins ranked as medium- and high-priority account for 96 percent of California's annual groundwater pumping. In addition, water users can and should diversify their water supply portfolios in an environmentally responsible manner and in accordance with the law to mitigate groundwater impacts. Diversifying water portfolios may include sustainable use of groundwater and groundwater storage and recovery and conjunctive use, water recycling, water transfers, and water conservation and efficiency upgrades. The State Water Board will continue efforts to encourage and promote environmentally sound groundwater storage and recovery (recharge) projects that use surplus surface water, increased use of recycled water, sustainable water transfers, and conservation. While the State Water Board can ensure that mitigation is implemented for actions within its authority, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the Sacramento/Delta updates to the Bay-Delta Plan. The State Water Board cannot guarantee that measures always will be adopted or applied in a manner that fully mitigates the impact. Therefore, unless and until the mitigation is fully implemented, the impact remains potentially significant.

As discussed in more detail in Section 7.12.2, *Hydrology and Water Quality- Groundwater*, DACs often disproportionately experience impacts on their drinking water supplies. DACs are defined as those communities with an annual median household income that is less than 80 percent of the statewide annual median household income. DACs often are served by small public water systems and rely on groundwater either in whole or in part for their water supply. Section 7.12.2 discusses that DACs may be more vulnerable than other municipalities and cities to impacts on groundwater supplies.

Communities that rely on groundwater for drinking water supplies, such as multiple communities in the San Joaquin Valley region, have been facing challenges from declining groundwater levels under baseline conditions, with critical shortages or dry wells occurring in some areas during prolonged drought periods. Their groundwater wells are often shallow and thus are more susceptible to water quality issues or the risk of going dry if the groundwater level is lowered. The frequency and severity of these challenges could increase as a result of the revised proposed Plan amendments, particularly in localized areas, although the magnitude of impacts would be less compared to the 55 scenario evaluated in Section 7.12.2. Although impacts on groundwater during wet and above-normal years would be less than impacts during drier water years, impacts could occur under the revised proposed Plan amendments that would be potentially significant for both the VA pathway and the regulatory pathway.

Drinking water impacts from lowered groundwater levels could be reduced through implementation of Mitigation Measures MM-GW-b and MM-GW-a,f. Local groundwater management under SGMA implementation may address some of the supply issues faced by DACs, depending on how groundwater sustainability plans (GSPs) are developed and how groundwater sustainability

agencies (GSAs) consider impacts on DAC water users from local groundwater management actions. SGMA oversight by the State Water Board will ensure that GSPs are adequate and sufficient.

Additional discussion on DACs and drinking water supplies is provided in Section 7.20, *Utilities and Service Systems*, Section 9.7.20, *Utilities and Service Systems*, and Section 13.7.20, *Utilities and Service Systems*.

Impact GW-a: Violate any water quality standards or waste discharge requirements

Impact GW-f: Otherwise substantially degrade water quality

The analyses of potential violations of water quality standards and waste discharge requirements (WDRs) (Impact GW-a) and other sources of water quality degradation (Impact GW-f) are sufficiently related and therefore are addressed together in the evaluation of potential impacts.

Changes in Hydrology and Water Supply

Regulatory Pathway

As discussed under Impact GW-b, the regulatory pathway under revised proposed Plan amendments could lead to increased groundwater pumping in response to reduced Sacramento/Delta supplies, and a reduction in incidental groundwater recharge from excess irrigation. These changes would not directly affect the concentration of groundwater contaminants. However, at the local scale, there is the potential that increased groundwater pumping could cause a change in the groundwater flow gradient, which could affect groundwater quality through exacerbating the migration of natural and anthropogenic contaminants. The regulatory pathway under the revised proposed Plan amendments would have similar effects as those that were evaluated in Section 7.12.2, *Groundwater*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in hydrology and water supply would be expected to be smaller than those described in Chapter 7 and more similar to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, the likelihood of groundwater quality effects due to increased groundwater pumping or a reduction in groundwater recharge would be less than evaluated in Section 7.12.2 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.12.2.

Voluntary Agreement Pathway

Similar to the regulatory pathway, changes in Sacramento/Delta water supplies under the VA pathway would not directly affect the concentration of groundwater contaminants for the term of the VA pathway. However, at the local scale, there is the potential that increased groundwater pumping could cause a change in the groundwater flow gradient, which could affect groundwater quality through exacerbating the migration of natural and anthropogenic contaminants. The VA pathway under the revised proposed Plan amendments would have similar effects to those that were evaluated in Section 9.7.12.2. Changes in water supply under the VA pathway would result in a total average annual reduction in Sacramento/Delta surface water supply that would be less than under

the regulatory pathway for the term of the VA pathway. Changes in hydrology and water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Impact Discussion and Conclusion

Changes in hydrology and water supply have the potential to affect groundwater levels as discussed above under Impact GW-b. As discussed in Section 13.4, the revised proposed Plan amendments would result in increased instream flows during many months on many Sacramento/Delta tributaries and could lead to increased groundwater pumping in response to reduced Sacramento/Delta supplies.

The revised proposed Plan amendments could lead to greater infiltration of surface water to groundwater (stream-aquifer interactions). Increased infiltration from stream-aquifer interactions in the Sacramento/Delta watershed could improve groundwater quality because rivers and streams in these regions tend to contain waters that are of high quality.

As discussed in Impact GW-b, water users may choose to increase groundwater pumping in response to the revised proposed Plan amendments to replace reduced Sacramento/Delta surface water supplies. These changes would not directly affect the concentration of groundwater contaminants. At the local scale, however, increased groundwater pumping has the potential to cause a change in the groundwater flow gradient, which could affect groundwater quality through exacerbating the migration of natural and anthropogenic groundwater contaminants.

As discussed in Section 7.12.2, groundwater quality degradation from groundwater pumping can arise via two mechanisms: the migration of degraded groundwater caused by local pumping or the drawdown of salt-rich shallow groundwater into deeper, more pristine portions of the aquifer. Increased groundwater pumping in basins that are already in overdraft or in basins that are salt sinks may concentrate salts in groundwater over time. Additional contaminant loading could occur through application of fertilizers and pesticides via agricultural or municipal activities. Changing irrigation volumes and processes can have various results on groundwater quality.

Decreased irrigation water application can result in fewer soil-flushing events, causing levels of salts and nutrients to build up in soil over time; when a flushing event does occur (either through precipitation or excess irrigation water), the water that percolates into the aquifer can be highly concentrated in those salts and nutrients that were previously concentrated in the soil. However, the effects on shallow groundwater quality can be mitigated if there is a concomitant reduction in contaminant loading with the reduction in irrigation water. Excess irrigation sometimes can dilute existing salt and nutrients in the soil but can cause additional groundwater degradation where excess nutrients are applied as part of agricultural practices. In some areas, agricultural land is already being taken out of production due to these water quality issues.

The effects on groundwater quality from water user responses to the revised proposed Plan amendments are expected to be highly variable, with some areas experiencing degraded groundwater quality over time and some areas experiencing little or no change in groundwater quality. Changes to applied water and from transmission losses may result in degraded groundwater

quality. Increased nutrient loading and possible changes in flow direction and gradient of contaminated groundwater could lead to increased groundwater degradation, which could affect drinking water wells. The outcome depends on the volume of water applied; precipitation; and loading of nutrients, salts, and pesticides on individual fields. If Sacramento/Delta surface water supplies are replaced by other supplies that may be of poor quality for agricultural or other non-potable purposes, it is possible that poor quality alternative supplies could affect underlying groundwater quality over time. Overall, the impacts on groundwater quality associated with changes in groundwater levels would be potentially significant under both the regulatory pathway and the VA pathway for the term of the VA pathway.

Some communities may develop replenishment projects to ensure additional higher quality drinking water supplies. Regulations are in place to protect consumers from unsafe drinking water; however, communities with degraded groundwater quality could experience additional costs and financial burdens. Communities dependent on groundwater supplies could face additional costs for wellhead treatment efforts, replacement wells, deepening wells, consolidations, or connecting to surface water sources.

Under the regulatory pathway, the proposed Bay-Delta Plan program of implementation encourages and allows for local cooperative solutions. Those local cooperative solutions would be required to include measures to coordinate implementation of the revised proposed Plan amendments with groundwater management activities, including with implementation of SGMA. Local cooperative solutions also may allow flow requirements lower in the range if complementary measures (ecosystem projects) are implemented that provide for equivalent protection of fish and wildlife beneficial uses. Such projects could reduce the potential impacts associated with decreased consumptive water uses, including impacts on groundwater.

Groundwater quality and associated drinking water impacts could be reduced through implementation of Mitigation Measures MM-GW-b and MM-GW-a,f. Local groundwater management under SGMA implementation may address some of the supply issues faced by DACs, depending on how GSPs are revised and implemented and how GSAs consider impacts on DAC water users from local groundwater management actions. Continuing SGMA oversight by DWR and the State Water Board will help ensure that GSPs are adequate and sufficient. The State Water Board also will continue its commitment to the human right to water through financial assistance, technical assistance, consolidations, and other means, including for communities that may be affected by reduced groundwater supplies or groundwater quality concerns. The Safe and Affordable Drinking Water Fund established under Senate Bill (SB) 200 will enable the State Water Board to provide crucial ongoing operations and maintenance support so once-struggling community water systems can provide a sustainable source of safe drinking water. The fund also established the SAFER program, which supports permanent and sustainable drinking water solutions that ensure all Californians have access to safe, affordable, and reliable drinking water. The State Water Board also prepared a report titled Recommendations for Implementation of a Statewide Low-Income Water Rate Assistance Program regarding feasibility, financial stability, and desired structure of a Low-Income Water Rate Assistance (LIRA) program. Rate relief for low-income ratepayers of water utilities remains a priority for the State of California and the State Water Board. While these efforts are expected to help reduce impacts on communities that rely on groundwater for drinking water supplies, it is not certain that these efforts will always fully mitigate impacts.

Private domestic well owners may be less able to absorb costs associated with declining groundwater elevations or degraded groundwater quality. The State Water Board has provided funding for replacement or deepening of private domestic wells affected by the 2012–2016 drought through its Cleanup and Abatement Account. SB 108 also provided limited funding for replacement of private domestic wells that could no longer be used due to declining groundwater elevations. At this time, however, there are limited funding opportunities from the State Water Board or from other funding entities for private well replacement or treatment of poor water quality. The State Water Board will promote and support future funding sources, as appropriate.

The State Water Board cannot guarantee that measures will always be adopted or applied in a manner that would fully mitigate impacts. Therefore, unless and until the mitigation is fully implemented, the impacts of reduced groundwater levels on groundwater quality and drinking water remain potentially significant. See Section 13.7.20, *Utilities and Service Systems*, for further discussion on municipal water supply.

13.7.13 Land Use and Planning

Potential impacts on land use and planning evaluated in Chapter 7 and Chapter 9 would all be less than significant or have no impact. The no impact and less-than-significant impact conclusions are reflected in Table 13.7.22-1. Because the impact mechanisms and reasons for the significance determinations would not be changed under the revised proposed Plan amendments but would remain as explained in Chapter 7 and Chapter 9, the analysis of these impact topics is not repeated in this chapter.

13.7.14 Mineral Resources

Potential impacts on mineral resources evaluated in Chapter 7 and Chapter 9 would all have no impact. The no impact conclusions are reflected in Table 13.7.22-1. Because the impact mechanisms and reasons for the significance determinations would not be changed under the revised proposed Plan amendments but would remain as explained in Chapter 7 and Chapter 9, the analysis of these impact topics is not repeated in this chapter.

13.7.15 Noise

This section describes the potential impacts on noise that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

13.7.15.1 Impact Analysis

Impact NOI-a: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies

Impact NOI-c: A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project

Impact NOI-d: A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project

The analysis of activities that could expose persons to noise or generate substantial permanent, temporary, or periodic increases in ambient noise levels are closely related and therefore are combined and addressed together under Impacts NOI-a, NOI-c, and NOI-d.

Changes in Water Supply

Regulatory Pathway

Changes in water supply from implementation of the regulatory pathway would result in reductions in Sacramento/Delta surface water supply that could lead to increased groundwater pumping that could expose noise-sensitive receptors to higher noise levels. Effects would be similar to those for the proposed Plan amendments evaluated in Section 7.15, *Noise*, however, as discussed in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in water supply would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. As such, reductions in water supply under the starting point for the regulatory pathway generally would be lower than evaluated in Section 7.15 due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts on water supply could also be as high as those identified in Section 7.15.

Voluntary Agreement Pathway

Changes in water supply from implementation of the VA pathway could also result in reductions in Sacramento/Delta surface water supply that would primarily affect agricultural uses. Increased groundwater pumping under the VA pathway would have very similar effects to those described in Section 9.7.15, *Noise*. Flows under the VA pathway would generally be lower than the regulatory pathway on the tributaries with HRL commitments, so the reductions in Sacramento/Delta water supplies would be less, groundwater pumping would be less, and resulting noise levels from groundwater pumping would be lower than under the regulatory pathway for the term of the VA pathway. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water

rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, implementation of the revised proposed Plan amendments would result in reductions in Sacramento/Delta supply, which could lead to increased groundwater pumping to replace supply and could expose noise-sensitive receptors to higher noise levels.

As discussed in Section 7.15, noise levels associated with pumps vary based on the size and type of equipment. Increased groundwater pumping may result in a permanent, temporary, or periodic increase in ambient noise that could be considered substantial, depending on the existing ambient noise, the noise generated by the pump, noise levels of future activities, and the proximity to noise-sensitive land uses. Noise from these pumps is expected to be minor and intermittent. Additionally, groundwater pumps often are not close to noise-sensitive (e.g., residential) land uses. However, because it is not known where increased pumping will occur, impacts associated with noise levels in excess of established local general plan or noise ordinance standards, a substantial permanent increase in ambient noise levels in the project vicinity above existing levels, and a substantial temporary or periodic increase in ambient noise levels in the project vicinity above existing levels could occur. These impacts would be potentially significant.

Entities or agencies that increase groundwater pumping should implement Mitigation Measure MM-NOI-a,c,d to reduce potential operations noise impacts on noise-sensitive land uses. Implementation of this mitigation measure could reduce noise impacts through compliance with applicable regulations and incorporation of noise-reduction measures such that operational noise does not exceed applicable local noise standards or limits. Unless and until Mitigation Measure MM-NOI-a,c,d is implemented, the impacts remain potentially significant.

13.7.16 Population and Housing

Potential impacts on population and housing evaluated in Chapter 7 and Chapter 9 would all have no impact. The no impact conclusions are reflected in Table 13.7.22-1. Because the impact mechanisms and reasons for the significance determinations would not be changed under the revised proposed Plan amendments but would remain as explained in Chapter 7 and Chapter 9, the analysis of these impact topics is not repeated in this chapter.

13.7.17 Public Services

Potential impacts on public services evaluated in Chapter 7 and Chapter 9 would all have no impact. The no impact conclusions are reflected in Table 13.7.22-1. Because the impact mechanisms and reasons for the significance determinations would not be changed under the revised proposed Plan amendments but would remain as explained in Chapter 7 and Chapter 9, the analysis of these impact topics is not repeated in this chapter.

13.7.18 Recreation

This section describes the potential impacts on recreation that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes

impact conclusions from previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

The Staff Report identifies HABs as a statewide water quality issue that exists independently of potential incremental impacts from the revised proposed Plan amendments. The 2023 draft Staff Report Section 7.18, *Recreation*, impact analysis under Impact REC-a identified that under the proposed Plan amendments, changes in hydrology could lead to increased HAB production in reservoirs and Delta channels and could interfere with recreation, including causing temporary closures to recreation in some waterbodies. Section 7.18 concluded that these changes would not exceed the recreation threshold for a potentially significant impact because the potential increased frequency of closures would not be expected to result in a substantial number of recreationists moving to alternate recreational locations to the extent that it would substantially physically deteriorate those alternate locations. Accordingly, Section 7.18 concluded that these impacts would be less than significant. Section 9.7.18, *Recreation*, reached the same impact conclusion. Public comments on the 2023 draft Staff Report expressed concerns that increasing HAB production in reservoirs and Delta channels could cause significant impacts on recreational users of water, especially in the Delta. In response to public comments, and in recognition of recreation as an important public use of these Delta channels and reservoirs and as a beneficial use of water in the Bay-Delta Plan and other basin plans, this impact conclusion is revised to potentially significant below in this section (13.7.8) and has been revised in Sections 7.18 and 9.7.18. Mitigation measures are identified to reduce or avoid impacts on recreation.

13.7.18.1 Impact Analysis

Impact REC-a: Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated

Changes in Hydrology

Reservoir Levels

Regulatory Pathway

Changes in hydrology would result in changes in water levels at some reservoirs, which could affect access to the water from established recreational facilities (e.g., boat ramps, piers) or reduce the reservoir surface area, potentially resulting in increased recreational use (e.g., boating, sportfishing) in other locations. The regulatory pathway under the revised proposed Plan amendments would have similar effects as evaluated in Section 7.18, *Recreation*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in reservoir levels would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These adjustments include both watershed-wide adjustments and tributary-specific adjustments. As such, reservoir levels under the starting point for the regulatory

pathway would remain at higher elevations more frequently than evaluated in Section 7.18 due to these refinements. SacWAM results show that average annual changes in water surface elevations in reservoirs would generally be smaller under the 55 w/WSAs scenario (see Section 13.4 and Table H1a2-136 in Appendix H1a2, *Sacramento Water Allocation Model Results for Revised Proposed Plan Amendments*) than under the 55 scenario and more similar to the changes under the Low Flow Alternative (35 and 45 scenarios) presented in Appendix A1 (see Table A1-145 in Appendix A1, *Sacramento Water Allocation Model Methods and Results*). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.18.

Voluntary Agreement Pathway

Changes in hydrology under the VA pathway would also result in changes in water levels at some reservoirs on tributaries with HRL commitments, which could affect recreational facilities and opportunities. These effects on recreational facilities would be similar to the effects described in Section 9.7.18, *Recreation*. Flows would generally be lower on the tributaries with HRL commitments than under the regulatory pathway, so the impact on reservoir levels would be less than under the regulatory pathway for the term of the VA pathway. Actual reservoir operation could vary to some degree from modeled outcomes, but overall, these changes would be smaller than the changes that would occur under the regulatory pathway. SacWAM results show that the average annual change in water surface elevation under the VA pathway would be the same as or similar to baseline (see Section 13.4 and Appendix H1a2, Table H1a2-136). Changes in hydrology, including changes in reservoir levels, with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, changes in reservoir water levels at some reservoirs could be large enough to affect boat ramp accessibility resulting in effects on recreation opportunities at some reservoirs. Surface water elevations for reservoirs normally fluctuate throughout the year and from year to year. Most of the changes in reservoir elevations would be within the historical ranges; however, elevations could be lower more frequently than under baseline for some reservoirs. As flow requirements increase, additional releases from reservoirs in the winter and spring are larger, potentially leading to greater changes in reservoir levels relative to baseline. Because flows under the VA pathway would generally be lower than the regulatory pathway, the magnitude of these impacts would be less during the term of the VA pathway.

In the Sacramento/Delta, upper watershed reservoirs and rim reservoirs historically experience substantial changes in water elevation based on operational needs and hydrology. Most of the changes under the revised proposed Plan amendments would be within the historical ranges; however, during the May through September recreation season, especially under the regulatory pathway, elevations could be lower more frequently, which could in turn lead to some boat ramps being inaccessible more frequently. While lower water levels at any of the reservoirs could affect the

recreational facilities and activities by precluding or limiting lake access from existing facilities, users would be unlikely to shift to other locations in sufficient numbers to substantially degrade those facilities.

Similarly, in the Bay Area and in other geographic regions south of the Delta that receive Sacramento/Delta supply, the levels of some export reservoirs used for recreation may be reduced, depending on operational needs. Export reservoirs likely would still have water levels high enough to accommodate recreational uses, and lower water levels likely would not be so severe that users would shift to other reservoirs in sufficient numbers to result in substantial physical deterioration of facilities there. However, recreational access could be more limited, and recreation is an important public use of these reservoirs and is considered a beneficial use of water in the Bay-Delta Plan and other basin plans. Reservoir operators in the Sacramento/Delta will be required to avoid or reduce impacts on recreation in their long-term strategies and annual operations plans for cold water habitat objective implementation. However, while implementation of the cold water habitat objective under the regulatory pathway would reduce changes in reservoir drawdown, some uncertainty exists regarding the precise implementation measures for the cold water habitat objective. In addition, export reservoirs receiving Sacramento/Delta supplies are not subject to the narrative cold water habitat objective and would not be required to develop and implement a long-term strategy and annual plan for reservoir operations that would consider recreation. Therefore, the overall impact of the revised proposed Plan amendments on boating opportunities in the study area would range from less-than-significant under the VA pathway to potentially significant under the regulatory pathway.

Implementation of Mitigation Measures MM-REC-a: 1 and 2 will reduce or avoid recreation impacts associated with reservoir levels in the Sacramento/Delta. Mitigation Measure MM-REC-a: 1.ii incorporates Mitigation Measure MM-AQUA-a,d: 1i–ii. Reservoir operators in the Sacramento/Delta will be required to avoid or reduce impacts on recreation in their long-term strategies and annual operation plans for cold water habitat objective implementation. All reservoir owners and operators are subject to existing regulatory requirements that protect water quality in reservoirs and streams below reservoirs. In exercising its regulatory authorities, the State Water Board will consider recreation and ensure that any recreation impacts are avoided or reduced. Reservoir owners and operators also should implement other recreation management actions to further minimize potential impacts. In limited instances, recreation impacts may result even with mitigation or where mitigation activities take time to implement effectively. Therefore, recreation impacts from changes in reservoir levels remain potentially significant.

To the extent that implementation of Mitigation Measure MM-REC-a: 2 results in actions to modify or rebuild boat ramps, there could be temporary effects similar to those of construction actions addressed in Section 7.22, *New or Modified Facilities*. Section 7.22 describes standard mitigation measures for construction activities that could reduce the impacts to a less-than-significant level. However, unless and until the mitigation measures are fully implemented, the impacts remain potentially significant.

Harmful Algal Blooms

Regulatory Pathway

As discussed in Section 7.12.1, *Surface Water*, harmful algal blooms (HABs) and the proliferation of invasive aquatic plants affect surface waterbodies in Delta channels and reservoirs under existing conditions. Implementation of the regulatory pathway under the revised proposed Plan amendments could incrementally increase the chances of HAB formation and bloom size and the production of invasive aquatic plants in some Delta channels at some times, particularly in the southern Delta, and in reservoirs due to a reduction in storage. HABs can limit recreational opportunities in and adjacent to surface waterbodies in the Delta, both due to interference with boat and other watercraft access to recreation areas and with fishing and swimming due to concerns about public exposure to cyanotoxins. In addition, lower reservoir levels could increase the production of HABs, potentially limiting recreational activities in those waterbodies. These effects were determined to be less than significant in Section 7.18 of the 2023 draft Staff Report because incremental increases in closures are not expected to result in a substantial number of recreationists moving to alternate recreational locations to the extent that it would physically deteriorate those alternate locations. This conclusion has been revised in Section 7.18 consistent with the *Impact Discussion and Conclusion* below. As described in Section 13.4, under the starting point for the regulatory pathway changes in reservoir levels would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could be as high as those evaluated in Section 7.18.

Voluntary Agreement Pathway

Changes in hydrology under the VA pathway would also result in changes in water levels at some reservoirs, which could increase the production of HABs, potentially limiting recreational activities in those waterbodies. These effects on recreational facilities were determined to be less than significant in Section 9.7.18 of the 2023 draft Staff Report because incremental increases in closures are not expected to result in a substantial number of recreationists moving to alternate recreational locations and lead to physical deterioration of alternative locations. This conclusion has been revised in Section 9.7.18 consistent with the *Impact Discussion and Conclusion* below. Changes would generally be expected to be smaller under the VA pathway compared to the changes that would occur under the regulatory pathway, for the term of the VA pathway. Actual reservoir operation could vary to some degree from modeled outcomes, but overall, these changes would be smaller than the changes that would occur under the regulatory pathway. Changes in hydrology, including changes in reservoir levels, with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach.*

Impact Discussion and Conclusion

Under the revised proposed Plan amendments, changes in hydrology could lead to increased HAB production in reservoirs and Delta channels and can interfere with contact recreation, including causing temporary closures to recreation in some waterbodies. These effects were determined to be less than significant in Section 7.18 because the potential increased frequency of closures is not expected to result in a substantial number of recreationists moving to alternate recreational locations to the extent that it would substantially physically deteriorate those alternate locations given the number of other available recreational areas in the Delta and north of the Delta or San Francisco Bay Area and the temporary nature of potential closures. In addition, in the Delta channels, potential changes in hydrology during the summer through fall HAB season would be expected to have only incremental effects on HAB formation and severity (see Section 13.7.12.1, *Surface Water*). Due to significant public input on this topic, this impact conclusion is revised. Recreational access could be more limited, and recreation is an important public use of these Delta channels and reservoirs and is considered a beneficial use of water in the Bay-Delta Plan and other basin plans.

The revised proposed Plan amendments include new monitoring and special studies requirements, and coordination with the regional water boards, state and federal agencies, and others on improving research and identifying possible management and mitigation measures to control HABs in the Delta (see Section 13.3.9.2, *Harmful Algal Blooms*). In addition, implementation of the cold water habitat objective under the regulatory pathway would reduce changes in reservoir drawdown. Some uncertainty exists regarding the precise implementation measures for the cold water habitat objective. In addition, export reservoirs receiving Sacramento/Delta supplies are not subject to the narrative cold water habitat objective and would not be required to develop and implement a long-term strategy and annual plan for reservoir operations that would consider recreation. Therefore, the overall impact of the revised proposed Plan amendments on recreation from incremental increases in HAB production would be potentially significant.

Implementation of Mitigation Measure MM-REC-a: 3 incorporates measures to avoid or reduce HABs and invasive aquatic weeds (Mitigation Measures MM-SW-a,f: 1, 3 through 5, and 7). HABs are a statewide water quality issue that exists independently of potential incremental impacts from the revised proposed Plan amendments. Several ongoing activities to address HABs, such as those coordinated by the Freshwater and Estuarine Harmful Algal Bloom (FHAB) Program, also could be employed to mitigate the impacts of the revised proposed Plan amendments. The most immediate response efforts include public education and notification efforts to minimize exposure of pets and people to waterbodies containing HABs. The California Water Quality Monitoring Council maintains a website for the California Cyanobacteria and Harmful Algal Bloom (CCHAB) Network that tracks HABs and provides information about how to respond to HABs, including information from U.S. Environmental Protection Agency (USEPA) on measures that should be implemented to prevent and respond to HABs in surface waters and drinking water supplies. The State Water Board and regional water boards also regulate discharges of nitrogen and phosphorus, which help control these discharges that contribute to HAB formation. While the State Water Board and others are engaged in efforts to address HABs, those efforts will take time and may not fully resolve HAB issues, including the incremental impacts associated with the revised proposed Plan amendments, to a less-than-significant level. Unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

2025 ROD and 2025 ITP

With the 2025 LTO ROD and 2025 CDFW ITP (collectively, 2025 ROD/ITP), there could be small changes in reservoir storage for Folsom Lake, Oroville Reservoir and Shasta Lake (see Appendix H1a6, *Sensitivity Analysis for 2025 Record of Decision and Incidental Take Permit Amendments*). These small changes would not be expected to affect contact recreation due to HABs beyond the effects evaluated above (see *Impact Discussion and Conclusion*). In Delta channels, reductions in Delta inflows and Delta outflows during wet and above normal years that could occur due to the removal of the fall X2 requirements could cause incremental increases in HABs; however, these changes would generally occur during wetter years, when HABs are less of a concern (see Section 13.7.12.1, *Surface Water*). As such, it is unlikely that the 2025 ROD/ITP would result in additional effects on contact recreation due to HABs.

As described in Section 13.7.1.5, *2025 Record of Decision and 2025 Incidental Take Permit*, the new LTO baseflow balancing provision that would apply under the VA pathway of the revised proposed Plan amendments requires an increase in HRL flow commitments to make up for reductions in Delta outflows caused by changes in SWP and CVP operations compared to base conditions analyzed in the Staff Report and Scientific Basis Report Supplement in support of the VA pathway. The analyses presented here evaluate the effects of not having the LTO baseflow balancing provision. However, the LTO baseflow balancing provision would be expected to eliminate reductions in Delta outflows under the VA pathway that could affect HABs in Delta channels. In addition, the State Water Board has the authority to impose specific water right requirements if needed to implement the narrative interior Delta flow objective. During annual and periodic reviews, the State Water Board will assess the need for any changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses, including in response to the 2025 ROD/ITP or future changes.

Impact REC-b: Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment

Changes in Hydrology

Regulatory Pathway

As discussed in Impact REC-a, changes in hydrology from implementation of the regulatory pathway would result in changes in water levels at some reservoirs, and some reservoirs could experience periods of lower water elevation that would result in associated boat ramps or docks becoming inaccessible. These locations may require construction or expansion of recreational facilities. Any replacement or modification of ramps would be under the control of individual reservoir operators.

Voluntary Agreement Pathway

Changes in hydrology under the VA pathway would generally be lower on tributaries with HRL commitments than under the regulatory pathway, so the changes in reservoir levels would be less for the term of the VA pathway. These changes would not be substantial enough to significantly affect recreational facilities such that construction or expansion of recreational facilities would be required. Changes in hydrology and water supply with implementation of the VA pathway for HRL

water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, changes in hydrology could have effects that range from no impact for the term of the VA pathway to potential need to build new or expand boat ramps or docks in some locations under the regulatory pathway. Construction related to any replacement or modification of boat ramps could result in adverse physical effects on the environment. Impacts would be potentially significant.

Implementation of Mitigation Measure MM-REC-b, which incorporates mitigation measures from Section 7.22, will reduce or avoid impacts associated with construction of new or modified boat ramps. Construction of new or modified facilities, including new or modified boat ramps, is evaluated in Section 7.22. Appendix H3, *Mitigation Measures for the Revised Proposed Plan Amendments* (Section H3.3, *Mitigation Measures – New or Modified Facilities*) describes standard mitigation measures for construction activities that could reduce potential impacts to a less-than-significant level. Table 13.7.22-3 identifies the impact conclusions and mitigation measures for the new or modified facilities evaluated in Section 7.22. However, unless and until the mitigation measures are fully implemented, the impacts remain potentially significant.

13.7.19 Transportation and Traffic

Potential impacts on transportation and traffic conditions evaluated in Chapter 7 and Chapter 9 would all be less than significant or have no impact. The no impact and less-than-significant impact conclusions are reflected in Table 13.7.22-1. Because the impact mechanisms and reasons for the significance determinations would not be changed under the revised proposed Plan amendments but would remain as explained in Chapter 7 and Chapter 9, the analysis of these impact topics is not repeated in this chapter.

13.7.20 Utilities and Service Systems

This section describes the potential impacts on utilities and service systems that may result from changes in hydrology or changes in water supply under the revised proposed Plan amendments. This section summarizes previous environmental analyses described in Chapters 7 and 9 and describes any differences in potential impacts with the refinements to the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

13.7.20.1 Impact Analysis

Impact UT-a: Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board

Changes in Hydrology and Water Supply

Regulatory Pathway

Changes in hydrology and water supply from implementation of the regulatory pathway under the revised proposed Plan amendments could alter the chemical composition of the existing water supply, assimilative capacity of streams, or could encourage the use of other water supply sources, creating the potential for exceedances of discharge requirements. Changes in water supply could result in the use of other lower quality water supply sources (e.g., groundwater) to replace reduced Sacramento/Delta supply that could affect the quality of wastewater treatment plant (WWTP) influent and effluent. Additionally, reduced Sacramento/Delta supply to municipal use and increased indoor water conservation could lead to a decrease in the volume of wastewater and increase the concentrations of chemical constituents in WWTP influent.

The regulatory pathway would have similar effects as those that were evaluated in Section 7.20, *Utilities and Service Systems*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in hydrology and water supply would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those described in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These adjustments include both watershed-wide adjustments and tributary-specific adjustments. The watershed-wide adjustments would require flows of 55 percent of unimpaired flow during wetter conditions, with required flows at 45 percent of unimpaired flows during intermediate conditions and flows down to 35 percent of unimpaired flow under the driest conditions. The tributary-specific water supply adjustments would allow for additional adjustments in rainfall-dominated and municipal-supply-dominated tributaries, including Putah Creek and the Mokelumne and Calaveras Rivers, that would allow for more frequent reductions in the required flow levels within this range, as well as no new flow requirements during the driest conditions. The likelihood of exceedances of wastewater treatment standards under the starting point for the regulatory pathway for the revised proposed Plan amendments would be less than evaluated in Section 7.20 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.20.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway also could result in small changes in streamflow compared to baseline, similar to the effects described in Section 9.7.20, *Utilities and Service Systems*, and would be unlikely to affect instream chemical constituent concentrations that could affect the ability of a treatment plant to meet waste discharge requirements or water quality standards. Additionally, Sacramento/Delta water supply reductions would be based on voluntary measures that would be largely from agricultural land fallowing or from reservoir reoperations or

groundwater substitution that would not be expected to result in any meaningful municipal supply reductions. The SacWAM results for the Sacramento/Delta watershed show that there would likely be no or a very small reduction in water supply for municipal use (see Section 13.4). Reductions in water supply to municipalities under the VA pathway would not be large enough to potentially alter the flow and chemical constituent concentrations of WWTP influent and subsequently affect WWTP effluent discharges to receiving waters in a manner that affects water quality. Under the VA pathway, changes in hydrology and water supply would not result in exceedances of wastewater treatment requirements. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, changes in hydrology and water supply could have effects ranging from no impact for the term of the VA pathway to potential exceedances of treatment requirements under the regulatory pathway. Generally, waste dischargers and drinking water providers are highly regulated and are unlikely to violate waste discharge requirements and drinking water quality standards. Drinking water providers must regularly monitor water quality to ensure that drinking water standards are met. However, a potential change in quality of municipal supply source water could result in some reduction of water quality that could affect WWTP effluent. These impacts could be potentially significant.

Implementation of Mitigation Measure MM-UT-a will reduce or avoid exceedances of wastewater treatment requirements that could occur as a result of implementing the regulatory pathway under the revised proposed Plan amendments. The State and regional water boards will continue to regulate waste discharges and drinking water standards and will continue to promote and support future funding sources as appropriate. Increased coordination between water suppliers and wastewater agencies will help WWTPs become better prepared for short- and long-term changes in WWTP influent characteristics from changes to lower quality water sources, projected indoor water conservation, and other factors. Mitigation Measure MM-UT-a: 4 and 5 incorporate Mitigation Measures MM-SW-a,f and MM-GW-a,f to avoid or reduce impacts on surface water and groundwater quality that may contribute to effects on WWTPs. However, unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Impact UT-b: Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects

Changes in Hydrology and Water Supply

Regulatory Pathway

Changes in hydrology and water supply under the regulatory pathway could result in construction to modify or expand existing treatment facilities to prevent or mitigate exceedances of drinking water

standards and wastewater discharge water quality objectives (see also discussions under Section 13.7.12.1, *Surface Water*, and Section 13.7.2.2, *Groundwater*).

The regulatory pathway would have similar effects as those evaluated in Section 7.20; however, as described in Section 13.4, under the starting point for the regulatory pathway changes would be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.20.

Voluntary Agreement Pathway

As discussed for Impact UT-a above, changes in hydrology and water supply under the VA pathway would not result in exceedances of wastewater treatment requirements. Accordingly, construction to modify or expand existing treatment facilities to avoid exceedances and come into or continue compliance with treatment requirements would not be necessary under the VA pathway. Changes in hydrology and water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Overall, changes in hydrology and water supply could have effects that range from no impact for the term of the VA pathway to potential need to build new or expand facilities under the regulatory pathway. These impacts could be potentially significant.

Drinking water treatment plant operators would be required to continue to comply with drinking water standards, including modifying operations if necessary, to ensure that the water supply continues to meet drinking water standards. In some locations that are more vulnerable to reduced Sacramento/Delta supply, modification or expansion of the drinking water treatment facility or consolidation of domestic well owners with municipal water suppliers could be needed or hastened. As described for Impact UT-a, the quality and quantity of water entering WWTPs could be affected by changes in hydrology and water supply. The potential need to construct new or expand existing treatment facilities depends on site-specific conditions, including the chemical composition of the replacement water supply; the assimilative capacity of the receiving waters; types and capacities of treatment processes at the WWTP; the existing amount of redundancy and operational flexibility at the facility; and the magnitude of the change in receiving water flow, wastewater plant discharge flow, and plant effluent and receiving water chemical constituent concentrations. If ground is disturbed, there could be environmental impacts. Impacts associated with construction projects are evaluated in Section 7.22, *New or Modified Facilities*.

Implementation of Mitigation Measure MM-UT-b will avoid or reduce the impacts of new construction of new or expanded treatment facilities. Mitigation Measure MM-UT-b: 1 incorporates Mitigation Measure MM-UT-a to avoid or reduce the potential for exceedances of WWTP requirements. If construction of new water or wastewater treatment facilities or expansion of existing facilities is necessary, implementation of mitigation measures described in Section 7.22 will

reduce or avoid construction-related impacts. However, unless and until the mitigation is fully implemented and proven effective, the impacts remain potentially significant.

Impact UT-d: Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed

Changes in Water Supply

Reduced Sacramento/Delta Supply to Municipal Use

Regulatory Pathway

Changes in water supply under the regulatory pathway could result in reduced Sacramento/Delta supply to municipal use. The regulatory pathway under the revised proposed Plan amendments would have similar effects to those evaluated in Section 7.20; however, as described in Section 13.4, reductions in Sacramento/Delta water supply from implementation of the regulatory pathway would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Section 7.20 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. Section 13.4 shows the SacWAM results for the starting point for the regulatory pathway (55 w/WSAs scenario) on changes in surface water supply for municipal use. The effects of reduced Sacramento/Delta water supply on municipal surface water sources under the starting point for the regulatory pathway would be less than evaluated in Section 7.20 due to the new water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could be as high as those identified in Section 7.20.

Voluntary Agreement Pathway

Changes in water supply under the VA pathway would result in reductions in Sacramento/Delta surface water supplies within the Sacramento/Delta watershed; these reductions would primarily affect agricultural uses with effects that would be very similar to those described in Section 9.7.20. The reductions in Sacramento/Delta supply under the VA pathway would be from voluntary reductions in water supplies that would be largely or entirely from agricultural land fallowing or from reservoir reoperations or groundwater substitution that would not be expected to result in any meaningful municipal supply reductions. SacWAM results for the Sacramento/Delta watershed show that there could be no or a small reduction in water supply for municipal use (Section 13.4). Any water supply reductions to municipal water users would be very small and would not be expected to result in the need to obtain new water supplies. Impacts of reduced Sacramento/Delta supplies to municipal water users would be less under the VA pathway than under the regulatory pathway (Table 13.7.20-1). Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Impact Discussion and Conclusion

Reductions in Sacramento/Delta water deliveries to municipal users would vary by region. Table 13.7.20-1 presents SacWAM estimates for regional changes in the amount of Sacramento/Delta water supplied to municipal users under the starting point for the regulatory pathway (55 w/WSAs scenario) and the VA pathway (VA scenario). These estimates show that changes in flow requirements could result in reductions in municipal supply to all regions under the starting point for the regulatory pathway and minimal or no impact under the VA pathway. These reductions in supply would be lower compared to the 55 scenario analyzed in Chapter 7 (Table 7.20-6, Chapter 7). Based on the SacWAM results presented below (Table 13.7.20-1), changes in Sacramento/Delta water supply to municipal use under the starting point for the regulatory pathway (55 w/WSAs scenario) are expected to be more similar to those under the Low Flow Alternative (35 and 45 scenarios in Table 7.20-6) due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.20.

Regions that receive relatively small volumes of Sacramento/Delta supply for municipal use, such as the Delta eastside tributaries, Delta, San Joaquin Valley, and Central Coast regions show the smallest volume reductions (see Section 13.4.4, *Changes in Surface Water Supply*). In the populous Bay Area and Southern California regions, reductions in municipal supply would be greater than in other regions.

Table 13.7.20-1. Change from Baseline Conditions: Annual Average Sacramento/Delta Supply for Municipal Use by Region and Pathway (thousand acre-feet per year)

Region	Annual Average Total Municipal Supply*	Sacramento/ Delta Supply	Change from Baseline	
			55 w/WSAs Scenario	VA Scenario
Sacramento River watershed, Delta eastside tributaries, Delta (Sacramento/Delta)	1,117	584	-33	-11
San Joaquin Valley	1,054	100	-13	3
San Francisco Bay Area, Central Coast, Southern California	5,886	2,391	-325	33
Total	8,057	3,075	-370	25

VA = voluntary agreement; WSAs = water supply adjustments
Sources: *Annual average supply estimates based on historical water deliveries data, 2005–2015 described in Appendix A1b, *Methodology for Estimating Existing Water Supply from Historical Water Deliveries Data*.

The effects of reductions in Sacramento/Delta supply to municipal suppliers can vary substantially across regions. As Sacramento/Delta supply presents only a portion of the municipal supply portfolios, the overall impact depends on what portion of the total municipal supply is from Sacramento/Delta supply compared to other supplies.

Sacramento River Watershed, Delta, and Delta Eastside Tributaries

Table 13.7.20-2 displays SacWAM-estimated reductions in Sacramento/Delta supply for municipal use in the Sacramento River watershed, Delta, and Delta eastside tributaries regions

(Sacramento/Delta watershed) for the starting point for the regulatory pathway (55 w/WSAs scenario) and VA pathway (VA scenario) by water year type. These results show that annual average reductions in Sacramento/Delta supply for municipal uses could range from 8 thousand acre-feet per year (TAF/yr) under the VA pathway to 32 TAF/yr under the starting point for the regulatory pathway (55 w/WSAs scenario). The largest reduction in supply under either the VA pathway or the starting point for the regulatory pathway would be expected to occur in dry and critical years (Table 13.7.20-2). These reductions under the revised proposed Plan amendments would be lower compared to the 55 scenario analyzed in Chapter 7 across the Sacramento River watershed, Delta, and Delta eastside tributaries regions (e.g., as compared to the sum of total values from Tables 7.20-9, 7.20-11, and 7.20-13 in Chapter 7). Based on the SacWAM results presented below (Table 13.7.20-2), changes in Sacramento/Delta supply to municipal use in these regions under the 55 w/WSAs scenario are expected to be more similar to changes under the Low Flow Alternative (e.g., as compared to the sum of total values from Tables 7.20-9, 7.20-11, 7.20-13 for the 35 and 45 scenarios) due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some tributaries, or a combination thereof, and therefore impacts could also be as high as those identified in Section 7.20.

Table 13.7.20-2. Annual Average Sacramento/Delta Supply to Municipal and Industrial Uses in the Sacramento River Watershed, Delta, and Delta Eastside Tributaries Regions: Change from Baseline (thousand acre-feet per year)

Water Year Type	Baseline	55 w/WSAs Scenario	VA Scenario
Critical	547	-91	-21
Dry	575	-47	-32
Below normal	586	-17	0
Above normal	593	-13	-3
Wet	604	-9	-2
All	584	-33	-11

Source: SacWAM results (See Section 13.4, *Changes in Hydrology and Water Supply*)
VA = voluntary agreement; WSAs = water supply adjustments

San Joaquin Valley

Table 13.7.20-3 displays SacWAM-estimated change in Sacramento/Delta supply for municipal use in the San Joaquin Valley region for the starting point for the regulatory pathway (55 w/WSAs scenario) and VA pathway (VA scenario) by water year type. These results show that annual average change in Sacramento/Delta supply for municipal uses within the San Joaquin Valley region could range from an increase of 2 TAF/yr under the VA pathway (VA scenario) to a reduction of 12 TAF/yr under the starting point for the regulatory pathway (55 w/WSAs scenario). The largest reduction in supply under the starting point for the regulatory pathway would be expected to occur in dry years (Table 13.7.20-3). These reductions in average annual supply would be smaller than those under the 55 scenario analyzed for the San Joaquin Valley region in Chapter 7 (Table 7.20-17). Based on the SacWAM results presented below (Table 13.7.20-3), changes in Sacramento/Delta supply to municipal use in the San Joaquin Valley region under the 55 w/WSAs scenario are expected to be more similar to changes under the Low Flow Alternative (35 and 45 scenarios from Table 7.20-17) due to water supply adjustments. However, as discussed above, the water supply adjustments could

be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some tributaries, or a combination thereof, and impacts could also be as high as those identified in Section 7.20.

Table 13.7.20-3. Annual Average Sacramento/Delta Supply to Municipal and Industrial Uses in the San Joaquin Valley Region: Change from Baseline (thousand acre-feet per year)

Water Year Type	Baseline	55 w/WSAs Scenario	VA Scenario
Critical	48	-5	1
Dry	89	-28	3
Below normal	102	-16	3
Above normal	108	-11	3
Wet	132	-3	4
All	100	-13	3

Source: SacWAM results (See Section 13.4, *Changes in Hydrology and Water Supply*)
VA = voluntary agreement; WSAs = water supply adjustments

In addition, the revised proposed Plan amendments would be implemented consistent with the water right priority system through curtailments that would apply to water rights under both the regulatory pathway and VA pathway. It is possible that implementation of the water right priority system could result in small reductions to municipal water supply in the San Joaquin Valley region.

San Francisco Bay Area, Central Coast, and Southern California

Table 13.7.20-4 displays SacWAM-estimated changes in Sacramento/Delta supply for municipal use in the San Francisco Bay Area, Central Coast, and Southern California regions for the starting point for the regulatory pathway (55 w/WSAs scenario) and VA pathway (VA scenario) by water year type. These results show that the annual average change in Sacramento/Delta supply for municipal uses within the San Francisco Bay Area, Central Coast, and Southern California regions could range from an increase of 35 TAF/yr under the VA pathway to a reduction of 311 TAF/yr under the starting point for the regulatory pathway (55 w/WSAs scenario). The largest reduction in supply under the starting point for the regulatory pathway would be expected to occur in dry and below normal years. These reductions in average annual supply for municipal use would be much smaller than under the 55 scenario analyzed for the San Francisco Bay Area, Central Coast, and Southern California regions in Chapter 7 (e.g., as compared to the sum of total values from Tables 7.20-15, 7.20-19, 7.20-21). Based on the SacWAM results presented below (Table 13.7.20-4), changes in Sacramento/Delta supply to municipal use in those regions under the starting point for the regulatory pathway (55 w/WSAs scenario) are expected to be more similar to changes under the Low Flow Alternative (e.g., as compared to the sum of total values from Tables 7.20-15, 7.20-19, and 7.20-21 in Chapter 7 for the 35 and 45 scenarios) due to water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.20.

Table 13.7.20-4. Annual Average Sacramento/Delta Supply to Municipal and Industrial Uses in the San Francisco Bay Area, Central Coast, and Southern California Regions: Change from Baseline (thousand acre-feet per year)

Water Year Type	Baseline	55 w/WSAs Scenario	VA Scenario
Critical	1,363	-149	7
Dry	2,135	-606	29
Below normal	2,434	-409	37
Above normal	2,557	-255	55
Wet	3,036	-185	41
All	2,391	-325	33

Source: SacWAM results (See Section 13.4, *Changes in Hydrology and Water Supply*)
VA = voluntary agreement; WSAs = water supply adjustments

If the supply of water to urban water suppliers is reduced as a result of implementing the regulatory pathway under the revised proposed Plan amendments, service providers could respond in a variety of ways, if necessary. Regional water service reliability assessments presented in Section 7.20.3, *Impact Analysis*, indicate that many municipal suppliers are well prepared to address water supply reductions of up to 10 percent.

The response by individual municipalities will vary depending on the extent of their reliance on Sacramento/Delta surface water relative to other sources of water, and on the balance between supplies and existing demand. For example, for municipalities with extensive supply that outpaces demand, the revised proposed Plan amendments would not be likely to result in an impact. However, agencies that rely solely or almost solely on Sacramento/Delta water and have limited water supply portfolios, and agencies that already have demand that outpaces supply could experience impacts with reductions in the Sacramento/Delta supply. Communities that rely solely on Sacramento/Delta supply and already have unmet demands, and communities with no other water supplies of suitable quality would need to obtain new water entitlements to satisfy demands.

Given the overwhelming importance of municipal water, agencies—on their own or in concert with others—may develop new supply through additional groundwater wells, water recycling, desalination, groundwater storage and recovery, and/or surface storage projects; these are the types of projects that this Staff Report considers to be likely responses to the revised proposed Plan amendments. Because local responses to the revised proposed Plan amendments are unknown, the specific magnitude and locations of potential impacts cannot be specifically determined. Projecting the specific ways that all municipal users may respond to reduced surface supply would require undue speculation. However, it is likely that at least some municipalities may need to obtain new water supplies. Although refinements to the starting point for the regulatory pathway for the revised proposed Plan amendments were designed to reduce water supply impacts, impacts could occur (i.e., new entitlements could be needed) if suppliers could not meet demand with a combination of reduced Sacramento/Delta supply and demand management measures, and because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some tributaries, or a combination thereof, impacts could be similar to those identified in Section 7.20.

Overall, changes in water supply under the revised proposed Plan amendments could result in effects on municipal supply ranging from less-than-significant impacts under the VA pathway for the

term of the VA pathway, to potentially significant impacts under the regulatory pathway. Reductions of Sacramento/Delta supply to municipal uses under the regulatory pathway could result in insufficient water supply for municipal suppliers, and therefore new or expanded entitlements might be necessary. These impacts could be potentially significant.

The State Water Board is committed to the human right to water and to exercising its authority to ensure supplies for all users. The regulatory pathway program of implementation promotes local cooperative solutions that could amplify the ecological benefit of new and existing flows with physical habitat restoration and other complementary ecosystem measures. Local cooperative solutions also may reduce the volume of water that needs to be dedicated for instream purposes, resulting in less water supply reductions for municipal use. In addition, implementation of Mitigation Measure MM-UT-d: 1 through 7 can avoid or reduce impacts on municipal supplies that could occur as a result of implementing the regulatory pathway under the revised proposed Plan amendments. Water users can and should diversify their water supply portfolios to the extent possible, in an environmentally responsible manner and in accordance with the law. This diversification includes sustainable conjunctive use of groundwater and surface water, water transfers, water conservation and efficiency upgrades, and increased use of recycled water.

Municipal water users are already implementing efficiency and conservation measures and are likely to implement additional efficiency and conservation measures on their own initiative in response to reduced supply. For example, as required by the 2018 Water Conservation Legislation, each urban wholesale and retail water supplier is to develop an effective water shortage contingency plan (WSCP) that specifies opportunities to reduce demand and augment supplies under numerous, and even unpredictable, water shortage conditions. The State Water Board will continue to work with municipal suppliers to develop and implement programs to increase water use efficiency and conservation to maximize the beneficial use of Sacramento/Delta supply, including through conditions on discretionary approvals for funding and other approvals as appropriate. Additionally, the program of implementation includes a provision to ensure that minimum health and safety needs are met. Entities that are already implementing local water shortage policies should prioritize water supplies for health and safety.

Additional mitigation measures may provide assistance to communities with limited supplies or impaired quality. These programs may not reach every community and may not be sufficient to resolve all flawed systems. Moreover, for some entities, notably in DACs, acquisition or development of new supplies may be fiscally infeasible. Water users—households—in these places may be subject to water shortages and high-cost transported water. Accordingly, the State Water Board cannot guarantee that measures will always be adopted or applied to fully mitigate potential impacts. Therefore, unless and until the mitigation is fully implemented, the impacts remain potentially significant.

Effects on Communities that Rely Primarily on Groundwater

Regulatory Pathway

Implementation of the regulatory pathway could result in reduced groundwater levels which could affect water supplies for communities that rely on groundwater as their primary municipal water source, including economically disadvantaged communities (DACs). Although the revised proposed

Plan amendments would not directly affect these supplies, there could be indirect effects on groundwater supply and quality, because groundwater levels may lower as a result of increased replacement groundwater pumping and reduced incidental and managed recharge of groundwater in response to reduced Sacramento/Delta supply. These effects could result in higher exposure to groundwater contaminants. The regulatory pathway would have similar effects as those evaluated in Section 7.20; however, as described in Section 13.7.12.2, under the starting point for the regulatory pathway reductions in groundwater levels would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow on some or all tributaries in the future, impacts could also be as high as those identified in Section 7.20.

Voluntary Agreement Pathway

Implementation of the VA pathway could result in lower groundwater levels in localized areas if HRL flows are provided through groundwater substitution, or from reduced incidental recharge from the application of applied irrigation water (see Section 13.7.12, *Hydrology and Water Quality*). Effects on drinking water supplies in communities, including DACs, that rely on groundwater as their primary water supply source would be very similar to the effects described in Section 9.7.20. Changes in groundwater levels with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*. While the magnitude of impacts would be less than under the regulatory pathway for the term of the VA pathway, the frequency and severity of groundwater availability and quality challenges could increase in localized areas.

Impact Discussion and Conclusion

Many communities in the study area rely on groundwater as their primary source of supply, either as municipal supply or supply from private domestic wells. As flow requirements increase, reductions in groundwater levels and quality increase relative to baseline because of increased replacement groundwater pumping and reduced incidental and managed recharge of groundwater in response to reduced Sacramento/Delta supply. Because flows under the VA pathway would generally be lower than under the regulatory pathway, the magnitude of this impact would be less during the term of the VA pathway. Reduced groundwater levels and quality could affect water supplies for communities that rely on groundwater as their primary municipal water source, including DACs. Lower groundwater levels could potentially affect communities in the Sacramento River watershed, Delta eastside tributaries, and San Joaquin Valley regions that rely on groundwater as their primary water supply source. As discussed in Section 7.20, communities that rely on groundwater for drinking water supplies in the San Joaquin Valley region have been facing challenges from declining groundwater levels under existing conditions, with critical shortages or dry wells occurring in some areas during prolonged drought periods. DACs that rely solely on groundwater often disproportionately experience impacts on their drinking water supplies. Their groundwater wells are often shallow and thus are more susceptible to water quality issues or the risk of going dry if the groundwater level is lowered. Impacts could be potentially significant.

Sustainable Groundwater Management Act (SGMA) implementation may address some of the supply issues faced by DACs, depending on how groundwater sustainability plans are developed and how groundwater sustainability agencies consider impacts on DAC water users from local groundwater management actions.

As discussed under *Reduced Sacramento/Delta Supply to Municipal Use*, the State Water Board is committed to the human right to water and to exercising its authority to ensure supplies for all users. Mitigation Measures MM-UT-d: 6 and 7 can avoid or reduce impacts on municipal groundwater supplies that could occur as a result of the revised proposed Plan amendments. Implementation of groundwater mitigation will reduce municipal impacts associated with lower groundwater levels and quality. Additional mitigation measures may provide assistance to communities with limited supplies or impaired quality. These programs may not reach every community and may not be sufficient to resolve all flawed systems. Accordingly, the State Water Board cannot guarantee that measures will always be adopted or applied to fully mitigate potential impacts. Therefore, unless and until the mitigation is fully implemented, the impacts remain potentially significant.

Changes in Hydrology

Regulatory Pathway

Changes in hydrology under the regulatory pathway could result in reduced streamflows and water levels at some locations, which at some times for some streams could affect the ability of existing diversion intakes to access and divert water and could affect municipal supplies. This is particularly true on regulated tributaries during summer in drier years because flows on regulated streams are generally stored during winter and spring and released in summer and fall for water supply purposes. Under the baseline condition, flows can be higher during summer and fall than the flow levels that would be required under the regulatory pathway in some locations, particularly on regulated tributaries because as described in Chapter 2, *Hydrology and Water Supply*, water development under existing conditions has resulted in reduced spring flows and artificially high summer flows compared with unimpaired conditions. In locations where water users are not coordinating their diversions, reduced water levels below existing diversion intakes could result in inadequate access to water supply for municipalities. Changes in reservoir levels also could result in conditions where storage levels drop below levels needed for water supply intake diversions and could result in reduced availability of municipal supply (e.g., at San Luis Reservoir). Increased frequency of water level reductions could lead to construction to modify diversion intake structures to ensure access to water supply. Impacts associated with larger construction projects are evaluated in Section 7.22, *New or Modified Facilities*.

The regulatory pathway under the revised proposed Plan amendments would have similar effects as evaluated in Section 7.20; however, as described in Section 13.4, changes in streamflow and reservoir levels under the starting point for the regulatory pathway would be expected to be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those evaluated in Section 7.20 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be

higher in the range of unimpaired flow on some or all tributaries in the future, impacts could also be as high as those identified in Section 7.20.

Voluntary Agreement Pathway

Changes in hydrology from implementation of the VA pathway also could result in changes in streamflows and reservoir levels that could affect the ability of existing diversion intakes to access and divert water and could affect municipal supplies. These effects under the VA pathway would be very similar to those described in Section 9.7.4, *Agriculture and Forest Resources*. Under the VA pathway, increases in flow are generally expected during the spring months and occasional decreases are expected at some locations during some summer or early fall months. Changes in flow and reservoir levels with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*. Changes in flows would be less than under the regulatory pathway; the changes in flow would be expected to be within the historical range of flows seen on tributaries with HRL commitments under the baseline condition with limited effects on water levels. Similarly, the impact on reservoir levels, including export reservoirs, would be less than under the regulatory pathway for the term of the VA pathway. As a result, it is unlikely that the VA pathway would significantly affect use of existing diversion structures and would not affect access to municipal water supply.

Impact Discussion and Conclusion

Overall, changes in hydrology under the revised proposed Plan amendments could have effects that range from less than significant for the term of the VA pathway, to potentially significant impacts under the regulatory pathway due to reduced access to divert water for municipal use at some times and at some locations. In the absence of coordination among diverters and, potentially, modifications to diversion intakes at some locations, reduced water volumes in streams during low-flow conditions could bring water levels below intakes. This would limit diversions and potentially affect the amount of water available for municipal supply during some high-demand, low-flow periods, particularly under the regulatory pathway. These impacts could be potentially significant.

Mitigation Measure MM-UT-d: 7 identifies actions to help ensure the effectiveness of diversion intakes under the regulatory pathway, including monitoring and coordination activities among water users and modifying intakes. Drinking water suppliers are strongly encouraged to implement these actions. The revised proposed Plan amendments do not include any State Water Board action that would require them to do so. Therefore, unless and until these mitigation measures are implemented, the impacts remain potentially significant.

13.7.21 Cumulative Impacts, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes

This section describes the cumulative impacts associated with the revised proposed Plan amendments together with other projects and programs that could cause related impacts. The revised proposed Plan amendments could result in cumulative impacts that are already discussed in Section 7.23, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible*

Environmental Changes, and in Section 9.7.21, *Cumulative Impacts, Growth-Inducing Effects, and Significant Irreversible Environmental Changes*. This section also discusses the ways in which the revised proposed Plan amendments could directly or indirectly foster economic or population growth or the construction of additional projects. (Cal. Code Regs., tit. 14, §15126.2, subd. (e).) Finally, this section discloses any significant irreversible environmental changes that could result from implementation of the revised proposed Plan amendments. (Cal. Code Regs., tit. 14, § 15126.2, subd. (d).) This section summarizes the previous analyses in Chapters 7 and 9 and describes any differences in potential impacts with the revised proposed Plan amendments, including under the regulatory pathway and the VA pathway that have both been modified and refined from what was described in Chapters 7 and 9.

13.7.21.1 Cumulative Impact Analysis

The State CEQA Guidelines define significant cumulative impacts as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." (Cal. Code Regs., tit. 14, § 15355). The individual effects may be changes resulting from a single project or more than one project. (Cal. Code Regs., tit. 14, § 15355(a)). Cumulative impacts may result from individually minor but collectively significant projects taking place over a period of time. (Cal. Code Regs., tit. 14, § 15355(b)). A project with a less-than-significant individual impact can nonetheless contribute to a significant cumulative impact. The cumulative analysis considers adverse effects of the revised proposed Plan amendments that are potentially significant or less than significant. If an impact has been determined to have no effect, it would not contribute to any cumulative effects and is not discussed in this section.

Due to the size and complexity of Sacramento/Delta water supply and use, and the range of flexibility included in the program of implementation, the environmental analyses are already necessarily broad to cover the wide range of foreseeable compliance measures and responses that may result from implementation of the revised proposed Plan amendments. The revised proposed Plan amendments provide a framework that would encourage or directly provide for implementation of complementary ecosystem restoration projects in addition to flow requirements under both the regulatory pathway and the VA pathway.

The evaluation of reasonably foreseeable methods of compliance and response actions that may be taken in response to the revised proposed Plan amendments are organized into the following categories:

- Changes in hydrology (e.g., changes in streamflows and reservoir levels) (Sections 13.7.3 through 13.7.20).
- Changes in water supply (e.g., reduced Sacramento/Delta supply for agricultural, municipal, and wildlife refuge use, increased groundwater pumping, other water management actions that do not involve construction [groundwater storage and recovery, water transfers, water recycling, and water conservation]) (Sections 13.7.3 through 13.7.20).
- Habitat restoration and other complementary ecosystem actions (described in Section 7.21, *Habitat Restoration and Other Ecosystem Projects*).

- New or modified facilities that involve construction (e.g., new or modified dams/reservoirs and points of diversion; groundwater wells and groundwater storage and recovery projects; new or modified drinking water treatment plants, including desalination plants and wastewater treatment plants) (described in Section 7.22, *New or Modified Facilities*).

Table 13.7.22-1 details potentially significant environmental impacts and less-than-significant impacts from changes in hydrology and changes in supply under the revised proposed Plan amendments that include both a regulatory pathway, which provides for flow requirements with water supply adjustments at the outset of Plan implementation, and a VA pathway (see Section 13.7.22, *Impact Summary*). The impact determinations presented in Table 13.7.22-1 reflect the highest level of potential impact for the revised proposed Plan amendments, including mitigation measures as necessary and appropriate; however, for some impact mechanisms, implementation of the VA pathway may have a different impact conclusion compared to the regulatory pathway for the term of the VA pathway. Potential impact conclusions and proposed mitigation measures that apply only to the regulatory pathway and not the VA pathway are identified by superscript "1" in Table 13.7.22-1, and potential impact conclusions and proposed mitigation measures that apply only to the VA pathway and not the regulatory pathway are identified by superscript "2." As explained in Section 13.7.1.3, *Impact Conclusions That Do Not Change Under the Revised Proposed Plan Amendments*, certain categories for which the impact mechanisms and impact conclusions would not be changed by the refinements under the revised proposed Plan amendments and are not revisited in Chapter 13, including impacts associated with other water management actions that entities may take to offset reductions in Sacramento/Delta surface water supply and less-than-significant impacts. These and other impact conclusions from Sections 13.7.3 through 13.7.20 are all reflected in Table 13.7.22-1.

The other two main categories of reasonably foreseeable methods of compliance and response actions are physical habitat restoration and other complementary ecosystem projects, and new and modified facilities that involve construction. Descriptions and analysis of potential environmental impacts of these actions are evaluated in Section 7.21, *Habitat Restoration and Other Ecosystem Projects*, and Section 7.22, *New or Modified Facilities*, respectively, and are not repeated here. Many of the actions evaluated in Sections 7.21 and 7.22 would involve construction, and in some cases, large construction projects that would require site-specific environmental impact analyses. All project alternatives evaluate the types of projects considered in Sections 7.21 and 7.22. Because the potential combination of future actions such as restoration actions or development of new or modified water facilities is unknown, these actions are discussed generally and qualitative comparisons to baseline conditions are made. While the number of these types of projects may be less, the same, or similar under the revised proposed Plan amendments to what is described in Sections 7.21 and 7.22, the impact mechanisms and the reasons for the significance determinations presented in Sections 7.21 and 7.22 would not be changed under the revised proposed Plan amendments. Tables 13.7.22-2 and 13.7.22-3 detail potentially significant impacts and less-than-significant impacts from construction of habitat restoration and other complementary ecosystem actions (Section 7.21) and new or modified facilities (Section 7.22), respectively.

The cumulative project list in Section 7.23.1.2, *Cumulative Project List*, includes relevant projects, programs, and categories of projects (referred to as *projects*); individual projects are detailed in Table 7.23-1 in Section 7.23, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant*

Irreversible Environmental Changes. Project categories (e.g., Federal Energy Regulatory Commission [FERC] projects) group together similar types of projects that may interact with the revised proposed Plan amendments in a way that could result in cumulatively significant impacts. In addition, individual projects are included and evaluated that do not fit into an obvious category or have particular relevance and interaction with the revised proposed Plan amendments (e.g., the Sustainable Groundwater Management Act [SGMA]). Development of the list focused on projects that involve water supplies, actions in the Delta including restoration, projects that could affect agriculture or municipal water supply, and water quality. The list also focused on projects or project classes with similar goals, or that propose or have taken similar actions to achieve their goals, although some projects may have different goals for the same resources evaluated for the revised proposed Plan amendments.

In response to comments received on the 2023 draft Staff Report, several project descriptions in Table 7.23-1 have been updated for the final Staff Report to reflect current project information. For example, Sacramento Area Sewer District (SacSewer) submitted comments on the 2023 draft Staff Report stating that the Staff Report contains outdated information on the EchoWater Resource Recovery Facility (EchoWater Facility) and Harvest Water Program. In response to this comment, Table 7.23-1 has been revised to include updated EchoWater Facility and Harvest Water Program descriptions. These edits to project descriptions in Table 7.23-1 do not affect the analysis of cumulative impacts presented in Sections 7.23, *Cumulative Impacts, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes*, 9.7.21, *Cumulative Impacts, Growth-Inducing Effects, and Significant Irreversible Environmental Changes*, and 13.7.21, *Cumulative Impacts, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes*.

There are some redundancies between the projects included on the cumulative project list (Table 7.23-1) and those that are discussed in the existing environmental analyses, including Sections 7.21 *Habitat Restoration and Other Ecosystem Projects*, and 7.22, *New or Modified Facilities*. Many of the projects or types of projects in the cumulative project list include reasonably foreseeable compliance methods and response actions to the revised proposed Plan amendments but also are considered as past, present, and probable future projects that need to be reviewed cumulatively.

The analysis in Section 7.23.1.3, *Cumulative Impacts*, describes and analyzes the potential cumulative impacts of changes in hydrology and water supply as appropriate for each resource area with the projects and project categories detailed in Table 7.23-1. In addition, impacts from construction and operation of habitat and other ecosystem projects and new or modified facilities evaluated in Sections 7.21 *Habitat Restoration and Other Ecosystem Projects*, and 7.22, *New or Modified Facilities*, are described and analyzed in combination with the projects and project categories detailed in Table 7.23-1. The analysis in Section 9.7.21.1 *Cumulative Impacts*, concludes that similar cumulative impacts could occur as those identified in Section 7.23 with some differences in magnitude and scope for changes in hydrology and supply, habitat projects, and new and modified facilities.

Changes in Hydrology

Regulatory Pathway

Changes in hydrology under the regulatory pathway could result in cumulative impacts to multiple resource areas. The starting point for the regulatory pathway under the revised proposed Plan

amendments (55 w/WSAs) would have similar effects as those evaluated in Section 7.23, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, under the starting point for the regulatory pathway changes in hydrology would be smaller and more similar to changes under the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These adjustments include both watershed-wide adjustments and tributary-specific adjustments. The watershed-wide adjustments would require flows of 55 percent of unimpaired flow during wetter conditions, with required flows at 45 percent of unimpaired flows during intermediate conditions and flows down to 35 percent of unimpaired flow under the driest conditions. The tributary-specific water supply adjustments would allow for additional adjustments in rainfall-dominated and municipal- supply-dominated tributaries, including Putah Creek and the Mokelumne and Calaveras Rivers, that would allow for more frequent reductions in the required flow levels within this range, as well as no new flow requirements during the driest conditions. The likelihood of changes in hydrology resulting in cumulative impacts under the starting point for the regulatory pathway for the revised proposed Plan amendments would be less than evaluated in Section 7.23 due to the water supply adjustments. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.23.

Voluntary Agreement Pathway

Changes in hydrology under the VA pathway could result in cumulative impacts to multiple resource areas. The VA pathway under the revised proposed Plan amendments would have very similar effects as those evaluated in Section 9.7.21, *Cumulative Impact Analysis, Growth-Inducing Effects, and Significant Irreversible Environmental Changes*. Changes in hydrology under the VA pathway would generally be less than those under the starting point for the regulatory pathway (55 w/WSAs). The likelihood of changes in hydrology resulting in cumulative impacts under the VA pathway for the revised proposed Plan amendments would be less than evaluated in Section 7.23. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Cumulative Impact Discussion and Conclusion

Changes in hydrology under the regulatory pathway and the VA pathway could result in potentially significant cumulative impacts to multiple resource areas. Generally, the changes in hydrology under both the starting point for the regulatory pathway (55 w/WSAs) and VA pathway are smaller than the changes in hydrology that would occur under the 55 scenario evaluated in Chapter 7, *Environmental Analysis*.

Section 13.4, *Changes in Hydrology and Water Supply*, presents Sacramento Water Allocation Model (SacWAM) modeling results for changes in flows and reservoir storage under the starting point for the regulatory pathway (55 w/WSAs scenario) and the VA pathway (VA scenario). Overall, changes in hydrology under the starting point for the regulatory pathway (55 w/WSAs scenario) would be

much smaller than under the 55 scenario, and are expected to be more similar to changes under the Low Flow Alternative (35 and 45 scenarios) due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Chapter 7. The SacWAM modeling presented in Section 13.4 show that changes in hydrology under the VA scenario are generally smaller than the changes in hydrology that would occur under the proposed Plan amendments evaluated in Chapter 7, *Environmental Analysis*. Changes in hydrology with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Changes in hydrology (flows and reservoir levels) under the revised proposed Plan amendments would result in potentially significant impacts on the following resource areas: aesthetics, agriculture and forest resources, biological resources (terrestrial and aquatic), cultural resources, energy, hydrology and water quality (surface water), recreation, and utilities and service systems. Changes in streamflows would improve water quality from dilution and flushing of some contaminants and reduction in electrical conductivity (EC) (a measure of salinity), bromide, and chloride in the Delta associated with reduced seawater intrusion. Water quality for fish would be enhanced by increases in flow (e.g., increased low-salinity habitat in the Delta) and other beneficial effects associated with higher flows (e.g., reduced water temperature). However, streamflows could be lower on some Sacramento/Delta tributaries (including regulated tributaries), particularly in summer and early fall compared to artificially high baseline conditions due to reduced exports of stored Sacramento/Delta water supplies out of the Delta during these times. In addition, streamflows could be reduced at times in some streams below reservoirs receiving export supplies. These reductions in streamflows could result in potentially significant environmental impacts, such as reducing dilution of local contaminants, either from wastewater treatment plant (WWTP) discharges, other types of contaminated discharges, or uncontrolled and natural sources of contaminants. Reduced streamflows during summer months could result in a decrease in hydropower generation in summer, which could be significant for an individual project or community.

Lower reservoir levels in some locations could result in potentially significant environmental impacts, including exposure of more unvegetated ground (or “bathtub rings”) and previously inundated cultural resources to increased wave action, erosion, and human activity; and an inability to access boat ramps which could reduce recreation opportunities. Changes in reservoir levels could exacerbate existing water quality issues associated with reservoirs, including bioaccumulation of methylmercury in fish and production of harmful algal blooms (HABs) in some locations. Changes in reservoir levels and lowered streamflows below reservoirs could result in increased temperature in some locations and times of year, particularly while specific cold water habitat implementation measures are refined. Although changes in hydrology would result in potentially significant environmental impacts, these changes in hydrology also would provide environmental benefits to native aquatic and aquatic-dependent species, aquatic and riparian habitats and natural communities, and ecosystem functions in the Sacramento/Delta that are supported by a natural flow regime.

Impacts from changes in hydrology under the revised proposed Plan amendments could interact with the projects listed in Table 7.23-1 that could alter streamflow and reservoir levels resulting in cumulative impacts similar to those described in Section 7.23, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes*, in each applicable resource section, although impacts would be more limited in magnitude and geographic scope than the cumulative impacts described in Section 7.23 for the proposed Plan amendments. However, under the regulatory pathway, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.23. In addition, impact conclusions that are less than significant or no impact for the regulatory pathway or VA pathway only could interact less with the projects listed in Table 7.23-1, or not at all. However, because the environmental analysis considers a range of potential outcomes, including the most conservative for evaluating potentially significant effects on the physical environment, the most conservative impact conclusions are assumed. Therefore, cumulative impacts could be potentially significant. Mitigation measures to avoid or reduce potentially significant environmental impacts identified in Tables 13.7.22-1, 13.7.22-2 and 13.7.22-3 should be considered for the referenced cumulative projects as well as the revised proposed Plan amendments.

Additional discussion is provided below regarding the cumulative effects of water supply projects on Delta outflow, cumulative effects on water quality associated with Yolo County Flood Control and Water Conservation District (YCFCWCD) HRL commitments, and cumulative effects on recreation associated with increases in HABs.

Cumulative Effects of New or Modified Water Supply Projects on Delta Outflow

Section 7.22, *New or Modified Facilities,* addresses actions that entities may take that would involve construction to modify or build new facilities and infrastructure to supplement or conserve surface water supplies and other construction projects. Among other actions, Section 7.22 identifies impacts from construction and operations of new or modified water facilities, including new or modified dams/reservoirs and points of diversion. These projects or types of projects are included in the environmental analysis as reasonably foreseeable response actions to reductions in Sacramento/Delta supply under the revised proposed Plan amendments but also are considered as past, present, and probable future projects that need to be reviewed cumulatively. The cumulative impact analysis presented in Section 7.23, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes*, has not changed for most resource areas and need not be repeated here.

The environmental analysis in Chapter 13 for aquatic biological resources reflects changes in interior Delta flows and Delta outflows for the regulatory pathway and the VA pathway that differ compared with the impact determinations identified in Chapters 7 and 9. As discussed in Section 13.7.6.2, *Aquatic Biological Resources*, both the regulatory pathway and VA pathway will increase Delta outflow during the January through June period in all water year types except wet years under the VA pathway, and in all months during the January through June period except February under the regulatory pathway and February and May under the VA pathway. These increases in Delta outflow during the January through June period would benefit native fish species. During the July through December period, Delta outflow would decrease under the VA pathway during all water year types except for dry years and under the regulatory pathway in below normal and above normal years.

Chapter 13 identifies less-than-significant impacts on native fish species due to decreases in Delta outflow during January through June during wet years under the VA pathway, decreases in July through December under both the regulatory pathway and the VA pathway, and slight decreases during February under the regulatory pathway and during February and May under the VA pathway. In addition, increases in the frequency of negative Old and Middle River (OMR) flows under both the regulatory pathway and VA pathway are expected as a result of other non-State Water Board actions, as discussed in more detail below.

Changes in interior Delta flows and Delta outflow can occur as a result of changes in existing water diversions and new water supply projects. This section describes potential cumulative impacts on aquatic species and water quality from these changes. Baseline flows include unprotected Delta outflows that are not currently regulatorily required and as such could be diminished in the future as a result of (1) changes to existing diversions; or (2) new water supply projects, as discussed further below.

Changes to Existing Water Diversions

Water diversions under existing water rights and claims of right may be changed in the future in ways that would affect Delta outflows and interior Delta flows compared to baseline conditions, including in ways that could decrease Delta outflows and increase negative OMR flows and in ways that could increase Delta outflows and decrease negative OMR flows.

Existing water rights may be exercised more fully, including with or without new infrastructure and in ways that would or would not require new regulatory approvals that could reduce Delta outflows and increase OMR reverse flows in the interior Delta. Section 2.7, *Existing and Future Water Rights in the Sacramento/Delta Watershed*, presents a water right demand data summary for the Sacramento/Delta watershed. As discussed in more detail in Section 2.7, a review of the water right records in the Sacramento/Delta watershed shows that the total face value of water rights and claims of rights in the Sacramento/Delta watershed is much greater than baseline diversion levels. While it is unlikely (and in many instances not possible because the face value amounts exceed unimpaired flow levels in most years) that all of these rights and claims would be fully exercised up to these higher amounts, or that this would occur at the same time, it is possible that diversions would increase under existing water rights and claims of right in ways that would reduce Delta outflows and increase negative OMR flows.

As discussed in Section 13.4, *Changes in Hydrology and Water Supply*, changes to other regulatory requirements have affected Delta outflows and OMR flows compared to the baseline for this project. Specifically, modified operational constraints included in the Record of Decision (ROD) for the Long-Term Operations (LTO) of the Central Valley Project (CVP) and State Water Project (SWP) have resulted in reductions in Delta outflows and increase in negative OMR flows at times relative to the baseline for this project (Reclamation 2019; ^NMFS 2019 BiOp; ^USFWS 2019; DWR 2020; ^2020 ITP; DWR 2024; Reclamation 2024; USFWS 2024; NMFS 2024; CDFW 2024). As discussed in Section 13.4, the baseline for this project assumes LTO ROD operations as they have largely existed for the majority of this planning process up until the end of 2024 when LTO ROD operations were changed. Section 6.2.1, *Baseline Assumptions*, provides a detailed description of the approach used to simulate baseline conditions in SacWAM, and Section 13.4.2.2, *Baseline Condition*, describes that since the planning process for the Sacramento/Delta updates started, there have been changes as the result of

the 2024 LTO ROD that allow for higher Delta exports due to the removal of the more stringent San Joaquin inflow to export (I:E) restrictions in April and May (the less stringent D-1641 I:E constraints remain in place). The implementation of the removal of the more stringent I:E constraints for the CVP largely began in 2025 and under the 2024 LTO ROD will continue with or without implementation of HRL export reductions that partially replace some of these I:E export reductions. The 2024 LTO ROD also removes the more stringent I:E limitations for the SWP with implementation of HRL export reductions that partially replace some of these I:E export reductions.

In addition to the 2024 LTO ROD, in January 2025, the federal administration issued Executive Order (EO) 14181, "Emergency Measures to provide Water Resources in California and Improve Disaster Response in Certain Areas." Section 2 of the EO directs multiple federal agencies to take immediate actions to maximize water deliveries. Consistent with EO 14181, the U.S. Bureau of Reclamation (Reclamation) is proposing changes to CVP LTO ROD to fulfill EO 14181. Overall, Action 5 would be expected to increase Delta exports and decrease Delta outflows compared to baseline and the 2024 LTO ROD.

Existing water diversions may also be reduced due to changes in other regulatory requirements, conservation, instream flow dedications (under Wat. Code, § 1707), or cessation of diversions in ways that could increase Delta outflows and reduce OMR reverse flows. For example, the Tuolumne River Trust/River Partners filed petitions for change with the State Water Board pursuant to Water Code sections 1701 and 1707 to dedicate flows instream, including to Delta outflow (SWRCB 2023). If approved, these petitions could increase instream flows and Delta outflows. It is possible that additional petitions for instream flow dedications that increase stream flows and Delta outflows would also be filed in the future.

New Water Supply Projects

In addition to changes in existing diversions, new diversions could also be approved and implemented in the Bay-Delta watershed which could further reduce Delta outflow. Section 2.7, *Existing and Future Water Rights in the Sacramento/Delta Watershed*, discusses that a review of water right records shows that overall in the Bay-Delta watershed, there are 147 pending appropriative water right applications. Sixty-three consist of regular applications and applications associated with pending petitions for assignment of water held in reservation under state filed applications and have a combined face value of approximately 7.1 million acre-feet.[3] The remaining 84 applications consist of unassigned or partially assigned state filed applications that have a combined face value of approximately 111.1 million acre-feet.[4] These applications are fundamentally linked to prospective water diversion and use projects but are not currently subject to any petitions requesting assignment of water held in reservation under these filings to any specific water diversion and use projects.

[3] State Water Resources Control Board (SWRCB). 2026. SWRCB_2026.01.13_*CalWATRS Pending Applications.xlsl*. Unpublished data.

[4] State Water Resources Control Board (SWRCB). 2019. *Water Rights Applications: State Filed Applications*. Last revised: September 6, 2019. Available: https://www.waterboards.ca.gov/waterrights/water_issues/programs/applications/state_filed_applications/.

The potential effects of pending applications on other water users and beneficial uses would be evaluated and considered during individual administrative water right proceedings. Pending applications will also be considered as part of the annual and periodic review process for the Bay-Delta Plan to ensure consistency with the scientific basis of the Bay-Delta Plan for flow and flow-dependent water quality requirements (e.g., Delta outflow, tributary flows, interior Delta flows, cold water habitat), base flow protection, and overall reasonable protection of beneficial uses.

Below is a summary of the major proposed new water supply projects with available environmental documents, including the Delta Conveyance Project, Shasta Dam Raise and Reservoir Enlargement Project, B.F. Sisk Dam Raise and San Luis Reservoir Expansion Project, Sites Reservoir, and Del Puerto Canyon Reservoir. In many cases, the environmental documentation and related analyses prepared for these projects assume somewhat different to very different baseline conditions than this project due to the specific circumstances of those projects. The individual hydrologic analyses for these projects also do not reflect these projects operated in combination, other conditions of approval that may be placed on these projects, if the projects are approved and implemented, and other important considerations relative to understanding possible cumulative impacts that cannot be known at this time.

The Delta Conveyance Project proposes to construct water diversion facilities and divert Sacramento River flows in the north Delta, immediately downstream of the Sacramento River at Freeport, with a maximum diversion capacity of 6,000 cubic feet per second (cfs) (DWR 2023). The California Department of Water Resources (DWR) estimated that implementation of the Delta Conveyance Project could result in average annual changes in Delta outflows of -477 thousand acre-feet (TAF) compared to the baseline for that project and changes in January through June Delta outflows of -345 TAF, with larger changes in wet (average annual: -709 TAF and average January through June: -512 TAF) and above normal years (average annual: -825 TAF and average January through June: -681 TAF), and smaller changes in below normal (average annual: -518 TAF and average January through June: -351 TAF), dry (average annual: -264 TAF and average January through June: -177 TAF), and critical years (average annual: -96 TAF and average January through June: -70 TAF) (DWR 2025).

The Sites Reservoir Project proposes construction and operation of an off-stream reservoir with a 1.5 MAF capacity with a combined maximum diversion rate of 4,190 cfs from the Sacramento River near Red Bluff and Hamilton City. The Sites Project Authority estimated that implementation of the Sites Project under the Incidental Take Permit (ITP) issued by the California Department of Fish and Wildlife (CDFW) would result in average annual changes to Delta outflow of -190 TAF compared to the baseline for that project and changes in average January through June Delta outflow of -181 TAF with larger changes to Delta outflow in wet (average annual: -416 TAF, average January through June: -336 TAF), above normal (average annual -287 TAF, average January through June: -293 TAF), and below normal water years (average annual -137 TAF, average January through June: -167 TAF), and smaller changes to Delta outflow in dry (average annual -32 TAF, average January through June: -65 TAF) and critical years (average annual -28 TAF, average January through June: -37 TAF). Sites Reservoir Project effects on Delta outflow were estimated and reported in the Final Environmental Impact Report (Sites Project Authority and Reclamation 2023, Appendix 5B3) and updated in a supplemental analysis (Jacobs Engineering 2025, CalSim3 Modeling for Sites Project). 2023

The Shasta Dam and Reservoir Enlargement Project is a proposal to raise Shasta Dam by 6.5 feet, 12.5 feet, or 18.5 feet and enlarge total storage space by 256,000 to 634,000 acre-feet (Reclamation 2020). Reclamation estimated that implementation of the Shasta Dam and Reservoir Enlargement Project with an 18.5-feet dam raise could result in average annual changes in Delta outflow of -59 TAF compared to the baseline for that project and changes in average January through June Delta outflow of -37 TAF with larger changes in above normal (average annual: -135 TAF, average January through June: -126 TAF) and below normal years (average annual: -108 TAF, average January through June: -33 TAF), smaller changes in wet (average annual: -38 TAF, average January through June: -27 TAF) and dry years (average annual: -41 TAF, January through June: -22 TAF), and minimal changes in critical years (average annual: +1 TAF, January through June: +5 TAF) (Reclamation 2020).

Sisk Dam impounds San Luis Reservoir, located on the west side of the Central Valley near the town of Los Banos in Merced County. The Sisk Dam Raise and Reservoir Expansion Project would raise the dam an additional 10 feet to create an extra 130,000 acre-feet of storage in San Luis Reservoir (Reclamation and SLDMWA 2020). Reclamation and San Luis Delta Mendota Water Authority (SLDMWA) estimated that implementation of the Sisk Dam Raise and Reservoir Expansion Project could result in average annual changes in Delta outflow of -14 TAF compared to the baselines for that project and changes in January through June Delta outflow of -14 TAF with larger changes in Delta outflow in wet (average annual: -32 TAF, average January through June: -30 TAF) and above normal years (average annual: -35 TAF, average January through June: -27 TAF) and smaller changes in below normal (average annual: +7 TAF, average January through June: 0 TAF), dry (average annual: +2 TAF, January through June: 0 TAF), and critical years (average annual: 1 TAF, January through June: 0 TAF).

The Del Puerto Canyon Reservoir Project (82 TAF capacity) proposes to construct and operate a new off-stream reservoir in the Coast Range mountains, west of the City of Patterson and Interstate 5 (Woodard & Curran 2020). The modeling results and analyses presented in the environmental documentation for the Del Puerto Canyon Reservoir Project do not provide sufficient information to estimate the effect of this project on Delta outflow; however, this project could result in additional increases in Delta exports and reductions in Delta outflows at times as it would receive water exported from the Delta.

Conclusion

As explained above, changes to existing water diversions or new water diversions could occur that would interact with the revised proposed Plan amendments and could affect interior Delta flows, Delta outflows, and water quality to varying degrees compared to baseline that could possibly result in potentially significant cumulative impacts on aquatic biological resources and hydrology and water quality depending on the specific actions that are implemented.

Water diversions at the SWP and CVP export facilities (in combination with other conditions) can cause changes in interior Delta flows, including OMR flows and net flows in the San Joaquin River at Jersey Point (QWEST). As discussed in Section 13.7.6.2, *Aquatic Biological Resources*, higher frequency of net negative OMR flows and lower Delta outflows could impact candidate, sensitive, or special-status species and could interfere with the movement of native resident or migratory fish in the Delta. More negative OMR flows increase risks of outmigrating juvenile salmonids straying into

the interior Delta where they experience poor habitat conditions, including higher predation, and are more likely to be entrained into the SWP and CVP pumping facilities. Net negative flows at QWEST could also potentially decrease the survival of fall-run Chinook salmon smolts migrating through the lower San Joaquin River in April and May. Longfin smelt juveniles are also at risk of entrainment at the CVP and SWP pumping facilities due to OMR reverse flows during April and May. In addition, Delta smelt may be entrained by OMR reverse flows when larvae migrate downstream to the low salinity zone in late spring.

The revised proposed Plan amendments include a narrative objective for interior Delta flows to maintain water quality conditions, including flow conditions in the interior Delta, together with other measures in the watershed, sufficient to support and maintain the natural production of viable native fish populations (see Section 13.3.6, *Interior Delta Flows*). The program of implementation for this objective identifies that this objective is implemented through compliance by SWP and CVP with the numeric interior Delta flow objectives and implementation measures included in the Bay-Delta Plan and State and federal Endangered Species Act requirements for the operations of the CVP and SWP export facilities. The program of implementation identifies that as appropriate, during the annual or periodic review of the Bay-Delta Plan and its implementation, the State Water Board will evaluate the effectiveness of the interior Delta flow objectives and implementation actions and any needed changes to the Bay-Delta Plan or its implementation to ensure the reasonable protection of fish and wildlife beneficial uses. These provisions can reduce impacts of changes in interior Delta flows resulting from other regulatory requirements if the State Water Board determines it is appropriate for the reasonable protection of fish and wildlife, including considerations regarding water supply effects.

In addition, the 2024 LTO ROD and 2024 CDFW ITP include measures that are expected to avoid jeopardy to listed species, including provisions for real-time decision making to manage SWP and CVP operations in a way that reduces impacts on listed species. These provisions may reduce the potential impacts of changes in interior Delta flows on native fish species under the regulatory and VA pathways. However, there is still a possibility of potentially significant cumulative impacts on some fish species during the spring of some years from increased south of Delta exports that increase the frequency of reverse flows in Old and Middle Rivers and reduced QWEST flows.

The VA pathway includes other measures that may mitigate these impacts from changes in interior flows including unspecified water purchases that could come from export reductions during April and May (see Section 9.5.3.9, *Delta Inflows, Exports, Interior Delta Flows, and Delta Outflow Results*). These possible export reductions are reflected in the VA High Export Cuts scenario evaluated in Chapter 9 and could have similar effects on exports and interior Delta flows as the I:E constraint included in baseline. If the unspecified water purchases come from reduced exports, as shown in the VA High Export Cuts scenario, differences in exports and interior Delta flows between the VA scenario and the baseline are expected to be relatively small. In addition, habitat restoration in the Delta may reduce the potential impacts associated with net negative flows in the interior Delta by improving other environmental conditions that could support populations of native estuarine and anadromous fish species, including through potentially increasing physical habitat, improving water quality, and increasing food supply.

Due to its importance in preventing seawater intrusion, the most important hydrologic driver for Delta water quality is Delta outflow. Impacts could occur if there were substantial reductions in

Delta outflow. Decreases in Delta inflows and outflows during January through June can further modify flows from the natural flow regime to which native species have adapted, including but not limited to, Chinook salmon, steelhead, green and white sturgeon, Sacramento splittail, Delta smelt, and longfin smelt. Reduced winter-spring (January through June) outflows can also affect the low salinity zone, referred to as X2 for native fishes, and the frequency of achieving flows associated with survival and population growth of native fish species as further explained in Chapter 3 and Section 13.5. Reduced Delta outflows can also reduce dilution and flushing of some contaminants and increase salinity, bromide, and chloride concentrations in the Delta associated with increased seawater intrusion. Decreases in Delta inflows and outflows during July through December would have less impacts on aquatic species, because changes in inflow and outflow during this period are relatively small and less influential on candidate, sensitive, or special-status anadromous and estuarine fish species than changes during January through June.

New water supply projects are defined as 1) water rights obtained after December 31, 2025, including any permits issued after that date pursuant to applications filed by the State under Water Code section 10500, and 2) water right change petitions that would increase diversions from the Delta watershed and decrease Delta outflows compared to conditions existing as of December 31, 2025. New water supply projects would be subject to the regulatory pathway without water supply adjustments unless future modifications to the Plan are approved as part of periodic review based on any necessary supporting environmental and scientific documentation. New water supply projects are not included under the VA pathway. Substantive modifications to the list of HRL water rights or the application of WSAs to new supply projects could be considered for approval by the Board as part of the annual or periodic review process, along with any necessary supporting environmental and scientific documentation developed through a public process with opportunity for public review and comment. That documentation would need to evaluate the effects of possible new HRL proposals or application of water supply adjustments to new projects on Delta outflows and meeting the new narrative inflow and outflow objectives and other issues associated with reasonable protection of fish and wildlife.

The HRL flows are intended to be additive to required flows under D-1641 and resulting flows under the 2024 BiOps/ROD, including flows required under the regulatory pathway and from the 2018 Update to the Bay-Delta Plan, and non-regulatory flows that were analyzed as part of the Scientific Basis Report Supplement and this Staff Report. However, water diversions from new water supply projects that are on the regulatory pathway would not be included in determination of the base flows to which the HRL flow commitments are required to be additive. To help ensure that water quality conditions, including existing flows, together with other measures in the watershed, continue to support and maintain natural production of viable native fish populations, in future water right actions the revised proposed Plan amendments state that the State Water Board would consider imposing requirements, based on the record established during the administrative proceeding, including any hearing, to ensure that the use of water is consistent with and supports the salmon protection, fish viability, inflow, inflow-based Delta outflow, and interior Delta flow objectives. In addition, the revised proposed Plan amendments include provisions for regular annual and periodic review to evaluate whether any changes are needed to the Bay-Delta Plan to provide for the reasonable protection of beneficial uses. Consideration of new water supply projects and Bay-Delta Plan requirements is identified as a priority topic for periodic review.

These provisions are expected to reduce possible cumulative impacts from changes in project operations and new water supply projects on Delta outflow.

In addition, mitigation measures to avoid or reduce impacts on aquatic biological resources and surface water quality found in the *Aquatic Biological Resources* and *Hydrology and Water Quality* sections of Tables 13.7.22-1, 13.7.22-2 and 13.7.22-3 should be considered for the referenced cumulative projects as well as the revised proposed Plan amendments.

Cumulative Effects on Water Quality Associated with YCFCWCD HRL Commitments

As described in Section 13.2, *Planning Process*, after release of the 2023 draft Staff Report, a proposal for HRL commitments by YCFCWCD was submitted to the State Water Board. The HRL commitment involves YCFCWCD providing flows from either Putah Creek sources or surface water flows from Cache Creek to lower Putah Creek, either directly or via groundwater recharge and banking. Providing these flow commitments from Cache Creek is dependent on YCFCWCD HRL participants obtaining a new water right permit to divert water from Cache Creek. The State Water Board has not made any decision on approving a water right application that would provide for the diversion of water from Cache Creek for use in Putah Creek which would be considered as part of a separate State Water Board decision-making process from the Sacramento/Delta update to the Bay-Delta Plan and would include a separate environmental review process. If the water right application to divert water from Cache Creek is approved and water is provided from Cache Creek to Putah Creek, it is possible that water quality could be degraded in Putah Creek because Cache Creek can have worse water quality conditions than Putah Creek at times for certain constituents. For example, high levels of boron are known to occur naturally in the Cache Creek watershed.

The environmental analysis presented in Section 13.7.12.1, *Surface Water*, evaluates potential water quality impacts from the YCFCWCD HRL proposal. Projects listed in Table 7.23-1 that could alter streamflow and reservoir levels (FERC Projects, Water Supply Projects, Flood Control Projects, Habitat Restoration Projects, SGMA, LSJR/Southern Delta Plan Amendments, BiOp/ITP Projects) could interact with the revised proposed Plan amendments, resulting in cumulative impacts on hydrology and water quality that would be potentially significant. Mitigation measures to avoid or reduce impacts on surface water quality found in the *Hydrology and Water Quality* sections of Tables 13.7.22-1, 13.7.22-2 and 13.7.22-3 should be considered for the referenced cumulative projects as well as the revised proposed Plan amendments.

Cumulative Effects on Recreation associated with Increases in HABs

Sections 7.18, *Recreation*, and 9.7.18, *Recreation*, in the 2023 draft Staff Report discuss that increased HABs could occur where there would be a substantial reduction in storage in reservoirs. Sections 7.18 and 9.7.18 also discuss that implementation of new flow requirements could incrementally increase the chances of HAB formation and bloom size and the production of invasive aquatic plants in some Delta channels at some times, particularly in the southern Delta. Increased HABs can interfere with contact recreation, including causing temporary closures to recreation in some waterbodies; however, potential increased frequency of closures is not expected to result in a substantial number of recreationists moving to alternate recreational locations to the extent that it would substantially physically deteriorate those alternate locations. Accordingly, Sections 7.18 and 9.7.18 in the 2023 draft Staff Report conclude that the impacts to recreation associated with HABs

would be less than significant. In response to a substantial number of public comments received on the 2023 draft Staff Report, including comments from tribal and environmental justice communities stating that HABs cause significant impacts to recreational users of water, this impact conclusion has been conservatively revised to potentially significant and mitigation measures have been identified.

Cumulative impacts to recreation from an incremental increase in potential HABs were already identified in Section 7.23 of the 2023 draft Staff Report. Projects listed in Table 7.23-1 that could alter streamflow and reservoir levels (FERC Projects, Water Supply Projects, Flood Control Projects, Habitat Restoration Projects, SGMA, LSJR/Southern Delta Plan Amendments, BiOp/ITP Projects) could interact with the revised proposed Plan amendments, resulting in cumulative recreation impacts from closures to recreation in some waterbodies. These impacts would be potentially significant. Mitigation measures to avoid or reduce recreation impacts found in the *Recreation* sections of Tables 13.7.22-1, 13.7.22-2, and 13.7.22-3 should be considered for the referenced cumulative projects as well as the revised proposed Plan amendments.

Changes in Water Supply

Regulatory Pathway

Changes in water supply under the regulatory pathway could result in cumulative impacts to multiple resource areas. The starting point for the regulatory pathway under the revised proposed Plan amendments (55 w/WSAs) would have similar effects as evaluated in Section 7.23, *Cumulative Impact Analysis, Growth-Inducing Impacts, and Significant Irreversible Environmental Changes*; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, changes in water supply would be expected to be smaller and more similar to changes under the Low Flow Alternative (35 and 45 scenarios) due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. The likelihood of changes in water supply resulting in cumulative impacts under the starting point for the regulatory pathway for the revised proposed Plan amendments would be less than evaluated in Section 7.23 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.23.

Voluntary Agreement Pathway

Changes in water supply under the VA pathway could result in cumulative impacts to multiple resource areas. The VA pathway under the revised proposed Plan amendments would have very similar effects as those evaluated in Section 9.7.21, *Cumulative Impact Analysis, Growth-Inducing Effects, and Significant Irreversible Environmental Changes*. Changes in water supply under the VA pathway would generally be less than those under the starting point for the regulatory pathway (55 w/WSAs). The likelihood of changes in water supply resulting in cumulative impacts under the VA pathway for the revised proposed Plan amendments would be significantly less than evaluated in Section 7.23. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Cumulative Impact Discussion and Conclusion

Changes in water supply under the regulatory pathway and the VA pathway could result in potentially significant cumulative impacts to multiple resource areas. Generally, the changes in supply under both the starting point for the regulatory pathway (55 w/WSAs) and VA pathway are smaller than the changes in supply that would occur under the 55 scenario evaluated in Chapter 7, *Environmental Analysis*. Additional analysis is provided below regarding the cumulative effects of water supply projects.

Other water sources are already being developed and utilized in response to water shortages that occur as a result of many factors, including multiple projects identified in Table 7.23-1 and above under the discussion of changes in hydrology. Some of these projects to develop other water supply sources could reduce the effects of reduced Sacramento/Delta surface water supplies as a result of the revised proposed Plan amendments. In addition, in response to public comments expressing concerns that the inflow requirements of the proposed Plan amendments would have significant water supply impacts and could result in drawing down reservoir storage, modifications to the starting point for the flow requirements under the regulatory pathway were incorporated into the revised proposed Plan amendments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.23.

Section 13.4, *Changes in Hydrology and Water Supply*, presents SacWAM results for changes in water supply under the 55 w/WSAs scenario and the VA scenario. Changes in water supply under the 55 w/WSAs scenario would be much smaller than under the 55 scenario, and are expected to be comparable to changes under the Low Flow Alternative (35 and 45 scenarios) under the starting point for the regulatory pathway due to water supply adjustments. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Chapter 7. The SacWAM modeling presented in Section 13.4, *Changes in Hydrology and Water Supply*, show that changes in water supply under the VA scenario are generally smaller than the changes in water supply that would occur under the proposed Plan amendments evaluated in Chapter 7, *Environmental Analysis*. Changes in water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

Changes in water supply (reduced agricultural, municipal, and refuge water supplies, changes in groundwater, other water management actions) under the revised proposed Plan amendments would result in potentially significant impacts on the following resource areas: agriculture and forest resources, air quality, biological resources (terrestrial and aquatic), energy, geology and soils, greenhouse gas (GHG) emissions, hydrology and water quality (surface water and groundwater), noise, and utilities and service systems. Reduced Sacramento/Delta supply to agriculture could lead to changes in the distribution of crop types and acreage and conversion of farmland to nonagricultural use. Reduced Sacramento/Delta supply to wildlife refuges and agricultural lands

could affect habitat for special-status species, including giant gartersnake, Swainson's hawk, greater sandhill crane, tricolored blackbird, and California black rail. In addition, reduced Sacramento/Delta supply for wildlife refuges and agricultural lands could decrease the amount of habitat available for resident and migratory waterfowl and shorebirds. Reduced municipal supply and increased indoor water conservation could lead to a decrease in the production of wastewater and increase chemical constituent concentrations in WWTP influent and effluent. Changes in water supply sources could result in temporary exceedances of maximum contaminant levels in municipal water supply. Changes in water supply could result in the use of other lower quality water supply sources that also affect WWTP influent and effluent, leading to construction to modify or expand existing treatment facilities.

Reduced Sacramento/Delta supply also could result in potentially significant impacts related to lower groundwater levels and groundwater quality from increased groundwater pumping as a substitute supply (where available and not locally restricted) and reduced incidental recharge from reductions in applied irrigation water. Lower groundwater levels could reduce groundwater available for agricultural use and could affect water supplies for communities that rely on groundwater as their primary municipal water source, including economically disadvantaged communities. Lower groundwater levels could affect groundwater quality and potentially affect drinking water wells in some areas. Lower groundwater levels also could affect riparian and wetland habitat, and sensitive groundwater-dependent natural communities and wetlands.

In response to changes in Sacramento/Delta supply, water users may modify their water supply portfolios by increasing the use of other sources of water and maximizing the use of existing water supplies. These other water management actions include groundwater storage and recovery, water transfers, water recycling, and water conservation. Other water management actions could result in potentially significant impacts on the following resource areas: agriculture and forest resources, biological resources (terrestrial and aquatic), energy, GHG emissions, hydrology and water quality (surface water and groundwater), and utilities and service systems. Diversion of flows for groundwater recharge, transfers, and recycling could diminish the instream ecological benefits of high-flow events that provide ecological and habitat functions (e.g., floodplain inundation) or diminish the ecological benefits of instream flows on riparian and wetland habitat, especially in dry seasons and in low flow conditions where streamflow is dependent on wastewater discharges. Groundwater substitution water transfers and agriculture water conservation could result in lower groundwater levels, which could exacerbate groundwater quality impairments or contribute to contaminant loading in localized areas.

Groundwater recharge could enhance groundwater levels, including recharge using recycled water. Recharge with high-quality water may provide an effective strategy to maintain or improve groundwater quality. Conversely, recharge with poor-quality water could contribute to salt and nutrient loading or introduce contaminants to the underlying aquifer. Groundwater storage and recovery projects based on the capture of stormwater runoff could reduce streamflow during storm events to some extent but would improve surface water quality by reducing contaminants. Agriculture to urban water transfers could further incentivize farmland conversion, particularly in rapidly urbanizing areas. Water transfers based on cropland idling could affect special-status species that use agricultural fields and result in conversion of crop types that provide foraging habitat for migratory waterfowl and shorebirds. Groundwater recharge, water transfers, and water recycling

could result in emissions associated with energy use. Water conservation could result in a reduction in energy use and GHG emissions.

Impacts from changes in water supply, including impacts from other water management actions and lower groundwater levels, under the revised proposed Plan amendments could interact with the projects listed in Table 7.23-1 that could also result in changes in water supply, including projects that could result in lower groundwater levels and other water management actions resulting in cumulative impacts similar to those described in Section 7.23, in each applicable resource section, although impacts would be more limited in magnitude and geographic scope than the cumulative impacts described in Section 7.23 for the proposed Plan amendments. The water supply adjustments under the regulatory pathway could reduce or avoid some impacts associated with changes in water supplies. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.23. In addition, impact conclusions that are less than significant or no impact for the regulatory pathway or VA pathway only could interact less with the projects listed in Table 7.23-1, or not at all. However, because the environmental analysis considers a range of potential outcomes, including the most conservative for evaluating potentially significant effects on the physical environment, the most conservative impact conclusions are assumed. Therefore, cumulative impacts could be potentially significant. Mitigation measures to avoid or reduce potentially significant environmental impacts identified in Tables 13.7.22-1, 13.7.22-2 and 13.7.22-3 should be considered for the referenced cumulative projects as well as the revised proposed Plan amendments.

13.7.21.2 Growth-Inducing Impacts

CEQA requires a discussion of "the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment." (Cal. Code Regs., tit. 14, § 15126.2, subd. (e).) Growth-inducing projects include projects that have the potential to remove obstacles that inhibit population growth or encourage and facilitate other activities that can significantly affect the environment, either individually or cumulatively.

Induced growth is any growth that exceeds planned growth and results from new development that would not have taken place without implementation of the proposed project. Growth or population concentration that exceeds those levels included in pertinent master plans, land use plans, or projections made by regional planning authorities could contribute to significant environmental effects.

The evaluation of potential growth-inducing effects in this section qualitatively discusses the possible ways the revised proposed Plan amendments could foster economic, population, or housing growth; remove obstacles to growth; or encourage and facilitate activities that could significantly affect the environment, either individually or cumulatively. (Cal. Code Regs., tit. 14, § 15126.2, subd. (e).) The evaluation of potential growth-inducing effects in this section is informed by the analysis in Section 7.23.2, *Growth-Inducing Impacts*, and Section 9.7.21.2, *Growth-Inducing Effects,* in the 2023 draft Staff Report. Growth-inducing impacts are not to be construed as necessarily beneficial, detrimental, or of little significance to the environment.

A proposed project may have "direct" or "indirect" growth inducement potential. Direct growth inducement would result if a project involves construction of a substantial amount of new housing that would support increased population in a community. This additional population would, in turn, increase demands for public utilities, public services, roads, and other infrastructure. A project may result in indirect growth if it establishes substantial new permanent employment opportunities (e.g., commercial, industrial, or governmental enterprises). Indirect growth inducement also would result if a project stimulates economic activity that requires physical development or removes an obstacle to growth and development (e.g., increasing infrastructure capacity that would enable new or additional development).

If the induced growth is consistent with or provided for by adopted land use plans and growth management policies for the area affected (e.g., city and county general plans, specific plans, transportation management plans), those plans may identify measures to ensure that environmental impacts are avoided or mitigated to the extent feasible.

Section 7.23.2, *Growth-Inducing Impacts,* discusses California growth trends, and describes that a variety of factors may influence new development or population growth. These factors include (1) economic conditions such as job growth within California and outside of California, income growth, changing demographics, mortgage interest rates, and available housing stock and developable land; and (2) factors affecting demand for housing, including location environmental attributes, affordability, proximity to job centers, adopted land use plans and growth management policies, and the availability of adequate infrastructure. Economic conditions are generally the primary factor. However, water supply is an important public service that supports urban development and affects the growth potential of a community. Lack of a reliable water supply could constrain future development. Conversely, improving reliability of water supplies serving an area could make that area more likely to develop in the future.

The revised proposed Plan amendments do not require construction of new housing or commercial or industrial development and would not directly include growth. Therefore, this section qualitatively discusses whether the revised proposed Plan amendments, along with reasonably foreseeable actions that water managers, users, or other individual entities may implement in response to the revised proposed Plan amendments, may indirectly induce growth by removing obstacles to growth. The evaluation of reasonably foreseeable methods of compliance and response actions that may be taken in response to changed flow requirements are organized into four main categories: (1) changes in hydrology; (2) changes in water supply; (3) physical habitat restoration and other complementary ecosystem projects; and (4) new or modified facilities.

Below is a discussion of whether each of these categories could potentially induce growth indirectly by removing obstacles to growth or encourage and facilitate other activities that can significantly affect the environment, either individually or cumulatively.

Changes in Hydrology

The revised proposed Plan amendments would result in changes in hydrology, including changes in streamflows and reservoir levels. These changes would not result in the provision of any new housing, businesses, or infrastructure to support or induce economic, population, or housing growth.

Therefore, changes in hydrology would not result in indirect growth inducement or remove any obstacles to growth.

Changes in Water Supply

Section 13.4, *Changes in Hydrology and Water Supply*, presents SacWAM results for changes in Sacramento/Delta surface water supply under the starting point for the regulatory pathway (55 w/WSAs scenario) and the VA scenario. Changes in flow requirements could result in reductions in Sacramento/Delta supply to all regions under the starting point for the regulatory pathway (55 w/WSAs scenario). Overall, these reductions in supply would be lower compared to the 55 flow scenario analyzed in Chapter 7, and would be more similar to those under the Low Flow Alternative (35 and 45 scenarios) due to water supply adjustments. However, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some tributaries, or a combination thereof, and therefore decreases in Sacramento/Delta water supplies could also be as high as those identified in Chapter 7.

The VA pathway would also result in a total average annual reduction in Sacramento/Delta surface water supply for the term of the VAs as shown in Section 13.4, although the effects of these changes would vary by region. The total reduction in Sacramento/Delta surface water supply under the VA pathway would also be less compared to the 55 w/WSAs scenario, for the term of the VAs. Under the VA pathway, most of the reductions in Sacramento/Delta surface water supplies would occur within the Sacramento/Delta watershed.

Reductions in Sacramento/Delta water supply to municipal uses would not directly or indirectly encourage growth. Reductions in Sacramento/Delta water supply to agricultural uses could result in some agricultural lands being taken out of production, and it is possible that such lands could then be converted to housing or other economic uses. However, conversion of agricultural lands to nonagricultural uses are governed by many factors, including the proximity of land to a developed area and other factors that affect its potential profitability as housing development. Local general plan and zoning patterns make it probable that a new housing use would require discretionary decisions by local agencies, such as general plan amendments, rezoning, subdivisions, or conditional use permits. Given the uncertainty and individual and governmental decisions involved, the possibility that the revised proposed Plan amendments would lead agricultural lands to be converted to housing or other economic uses that would indirectly induce growth is speculative.

Groundwater

In response to reduced Sacramento/Delta surface water supply, individual water users could respond by increasing groundwater pumping as a substitute supply, where available and not locally restricted. Such a change in water supply source would not directly or indirectly affect growth as the increased pumping would replace the Sacramento/Delta supply. Therefore, a reduction in Sacramento/Delta surface water supply and the subsequent changes in groundwater pumping would not result in growth-inducing impacts under either the regulatory pathway or VA pathway.

The VA pathway also identifies that some flow could be provided through groundwater substitution. Groundwater substitution would not directly or indirectly affect growth as the increased pumping would replace the Sacramento/Delta supply. Therefore, a reduction in Sacramento/Delta surface

water supply and the subsequent changes in groundwater pumping would not result in growth-inducing impacts.

Other Water Management Actions

Other water management actions include groundwater storage and recovery, water transfers, water recycling, and water conservation. The use of other water management actions would likely result in an increase in the reliability of users' existing water supply portfolios rather than an overall increase in water supply. These actions therefore would not result in growth-inducing impacts under either the regulatory pathway or VA pathway.

Habitat Restoration and Other Ecosystem Projects

Habitat restoration and other ecosystem projects include physical habitat restoration projects, as well as predation and invasive species control measures. They also could include certain activities related to cold water management such as reservoir temperature management facilities or fish passage facilities. These types of projects are described in detail and analyzed in Section 7.21, *Habitat Restoration and Other Ecosystem Projects*.

Habitat restoration and other ecosystem projects would not result in growth-inducing impacts. Habitat restoration and other ecosystem projects could result in short-term employment opportunities for construction and operation of these projects; however, the work would be largely temporary and seasonal. Project features would not lead to population growth or remove potential obstacles to future development. Moreover, habitat restoration or other ecosystem projects would not result in additional infrastructure that would create new sources of water that would foster population or housing growth or remove obstacles to such growth.

New or Modified Facilities

Actions that could be undertaken by water users and other entities to expand water supplies include infrastructure projects involving construction such as new or modified reservoirs and points of diversion; new groundwater wells and groundwater storage and recovery projects; new or modified WWTPs for water recycling; and new or modified drinking water treatment facilities, including desalination facilities. Other water management actions that involve construction of new or modification of existing infrastructure are described in detail and evaluated in Section 7.22, *New or Modified Facilities.*

Some new or modified facilities could result in increased water supply to specific areas that could encourage some growth in some locations. As explained in more detail in Section 7.23.2, *Growth-Inducing Impacts,* water availability is not the limiting factor preventing or slowing population growth in California, with the exception of a few, mostly coastal, areas that have imposed development or water connection moratoria because of limited municipal water supply. Any additional water supply resulting from new or modified facilities is more likely to result in an increase in the reliability of existing water supply portfolios than an increase in water supply that would foster growth. Construction of new or modified facilities would result in employment opportunities for construction and operation of the facilities, but these employment opportunities would be unlikely to significantly induce population growth. Overall, although new or modified

facilities could encourage some growth in some locations, they would not cause substantial population growth.

13.7.21.3 Significant Irreversible Environmental Changes

Section 15126.2(d) of the State CEQA Guidelines directs a discussion of the significant irreversible environmental changes that would be caused by a proposed project. Section 15127(a) of the State CEQA Guidelines requires information about irreversible changes to be included in connection with the adoption, amendment, or enactment of a plan of a public agency.

A significant irreversible environmental change to resources is the permanent loss or damage of resources for future or alternative purposes. Irreversible changes to resources result in resources that cannot be recovered or recycled, or those that are consumed or reduced to unrecoverable forms. These impacts can be caused by the use of natural resources, so that they cannot be restored or returned to their original condition.

Section 7.23.3, *Significant Irreversible Environmental Changes*, identifies the significant irreversible changes that could result directly from implementing the flow scenarios and indirectly through potential related habitat restoration projects and/or new or modified facilities. Similar to the significant and irreversible environmental changes identified in Section 7.23.3.1, *Proposed Plan Amendments*, the revised proposed Plan amendments could lead to conditions or other actions that (1) could result in the permanent loss or damage of resources for future or alternative purposes; or (2) could use natural resources associated with agriculture, cultural resources, energy, geology and soils, and groundwater resources such that they may not be recovered or recycled or may be used or affected such that they cannot be restored or returned to their original condition.

Under the starting point for the regulatory pathway (55 w/WSAs), changes in hydrology and water supply would generally be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) compared to the changes that would occur under the 55 scenario evaluated in Chapter 7 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. These adjustments include both watershed-wide adjustments and tributary-specific adjustments. As such, the level of loss or consumption of the resource would be incrementally less under the starting point for the regulatory pathway compared to the proposed Plan amendments evaluated in Chapter 7 due to these refinements. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some tributaries, or a combination thereof, impacts could also be as high as those identified in Section 7.23.3.

Under the VA pathway, the level of loss or consumption of the resource would be incrementally less compared to the 55 scenario evaluated in Chapter 7, and changes in hydrology and water supply would generally be less compared to the starting point for the regulatory pathway (55 w/WSAs scenario). The VA pathway would have very similar effects as described in Section 9.7.21.3, *Significant Irreversible Environmental Changes*. Changes in hydrology and water supply with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway

added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*. Impacts of construction from habitat restoration and other ecosystem projects would be similar to the proposed Plan amendments evaluated in Chapter 7, and new and modified facilities would be the same or less than the proposed Plan amendments evaluated in Chapter 7.

13.7.22 Impact Summary

The environmental analyses in the Staff Report are organized following the State Water Board's environmental checklist (Cal. Code Regs, tit. 23, §§ 3720-3781, Appendix A). The CEQA environmental checklist questions presented in Table 13.7.22-1 are listed in the same order as they are addressed in the resource sections in Chapter 7, *Environmental Analysis,* Chapter 9, *Proposed Voluntary Agreements,* and this chapter. Some impact questions are sufficiently related and are addressed together. The completed CEQA environmental checklists for the revised proposed Plan amendments are provided in Appendix H2.

Table 13.7.22-1 identifies potential impacts and beneficial environmental effects from changes in hydrology and supply under the revised proposed Plan amendments which include a regulatory pathway based on the proposed Plan amendments with modifications and a VA pathway that would provide a pathway for implementation of the Healthy Rivers and Landscapes (HRL) commitments. Table 13.7.22-2 summarizes impacts and mitigation measures identified for habitat restoration and other ecosystem projects. Table 13.7.22-3 summarizes impacts and mitigation measures identified for new or modified facilities.

The impact determinations presented in the impact and mitigation measure summary tables (Tables 13.7.22-1, 13.7.22-2, and 13.7.22-3) reflect the highest level of potential impact for the revised proposed Plan amendments, including mitigation measures as necessary and appropriate; however, for some impact mechanisms, implementation of the VA pathway may have a different impact significance compared to the regulatory pathway for the term of the VA pathway. Beneficial effects and potentially significant impact conclusions and proposed mitigation measures that apply only to the regulatory pathway and not the VA pathway are identified by superscript "1". Potential impact conclusions and proposed mitigation measures that apply only to the VA pathway and not the regulatory pathway are identified by superscript "2".

Section 13.7.1.3, *Summary of Revisions*, explains changes to the environmental analyses presented in Chapter 13 that reflect revisions since publication of the 2023 draft Staff Report and 2025 partially recirculated draft Staff Report. Revisions were made to impact significance conclusions for some impact mechanisms, including identification of new mitigation measures when needed, and modifications to mitigation measures that incorporated certain elements of the Bay-Delta Plan program of implementation as mitigation strategies. These revisions are included in Table 13.7.22-1 and Table 13.7.22-2. Table 13.7.22-1 has also been revised with additional minor changes, including clarifying edits, corrections, and editorial changes. The impact and mitigation measure summary tables for the revised proposed Plan amendments replace the impact and mitigation measure summary tables in Chapter 1, *Executive Summary*, (Tables 1-1 and 1-2); Chapter 7, *Environmental Analysis*, (Table 7.1-2) and Chapter 9, *Proposed Voluntary Agreements*, (Table 9.7-13). The full text of the mitigation measures is provided in Appendix H3, *Mitigation Measures for the Revised Proposed Plan Amendments,* and replaces the detailed mitigation measure text presented in Chapter 7 Sections 7.3 through 7.22.

Mitigation measures are identified for all potentially significant impacts. Some potentially significant impacts can be mitigated to less-than-significant levels. Because the State Water Board has authority to ensure that mitigation is implemented for certain actions, these impacts could be reduced to less-than-significant levels with mitigation incorporated. These impacts are listed as potentially significant followed by an asterisk symbol (*).

Many other identified potentially significant environmental impacts could be reduced to less-than-significant levels with mitigation incorporated; however, due to the large scope of the project and wide range of possible response actions, sufficient information is not available to conclude with certainty that the mitigation measures will reduce all impacts to less-than-significant levels in all circumstances. Some mitigation activities are within the State Water Board's jurisdiction. However, other mitigation measures are largely within the jurisdiction and control of other agencies or depend on how water users respond to the project. Accordingly, the State Water Board cannot guarantee that measures will always be adopted or applied fully to mitigate potentially significant impacts. Therefore, unless and until the mitigation is fully implemented, the impacts remain potentially significant.

In addition, the environmental analysis often considers a range of potential outcomes, including the most conservative for evaluating potentially significant effects on the physical environment. In many cases, there may be no impact. For each resource area, the analysis assumes a worst-case scenario. Some impacts are inversely proportional, and it is not possible for a worst-case scenario to occur for every environmental resource area.

While Table 13.7.22-1 provides some general indication of beneficial effects on the aquatic ecosystem and related biological and other resources that could occur under the revised proposed Plan amendments, the comprehensive scientific bases for the revised proposed Plan amendments and anticipated benefits are presented in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, the 2017 Scientific Basis Report (Appendix B) and in the Scientific Basis Report Supplement (Appendix G2). Section 13.5, *Beneficial Environmental Effects*, summarizes and updates these findings.

It is important that the CEQA impact conclusions be understood in the context of the nature of the proposed project, which is intended to be a restoration action. The Porter-Cologne Act is California's comprehensive water quality control statute, which implements portions of the federal Clean Water Act. The primary purpose of the federal Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Clean Water Act § 101(a).) The revised proposed Plan amendments were developed to improve flow and water quality conditions over a large geographic area, and particularly for fish and wildlife beneficial uses in the Sacramento/Delta. The impacts that could potentially result from implementation occur in a system that has been highly altered, and the project would be expected to improve conditions for native fish and wildlife in the Sacramento/Delta watershed over time. However, changes in hydrology and changes in water supply could result in some environmental impacts at certain times and locations that must be analyzed under CEQA. These potential environmental impacts should be viewed in light of the overall purpose and goals of the Sacramento/Delta update to the Bay-Delta Plan.

Table 13.7.22-1. Impact and Mitigation Measure Summary—Changes to Hydrology and Supply

Impact	Impact Conclusions	Proposed Mitigation
AESTHETICS		
Impact AES-a: Have a substantial adverse effect on a scenic vista **Impact AES-b:** Substantially damage scenic resources, including, but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway **Impact AES-c:** Substantially degrade the existing visual character or quality of the site and its surroundings	**Potentially Significant** Reservoir level changes may result in exposure of more unvegetated ground or "bathtub rings" Agriculture land conversion could affect aesthetic resources if properties are developed or neglected	**MM-AES-a–c: Mitigate impacts of the project that could have a substantial adverse effect on a scenic vista or could substantially damage a scenic resource or degrade the existing visual character or quality of the site and its surroundings** 1. Reservoir Management (MM-AQUA-a,d: 1) 2. Measures to Mitigate Conversion of Agricultural Land (MM-AG-a,e)
	Less than Significant Altered streamflows could affect water levels and appearance Reduced Sacramento/Delta supply to municipalities could affect the visual quality of the urban environment Reduced Sacramento/Delta supplies to wildlife refuges could result in slight changes to the visual character of these areas[1] Municipal water conservation measures could cause a change in the visual character of localized settings	—
Impact AES-d: Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area	**No Impact** —	—
AGRICULTURE AND FOREST RESOURCES		
Impact AG-a: Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Important Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and	**Potentially Significant** Reduced Sacramento/Delta supply to agriculture could lead to changes in distribution of crop types and acreage and conversion of farmland to nonagricultural use	**MM-AG-a,e: Mitigate impacts related to the conversion of Prime and Unique Farmland and Farmland of Statewide Importance (important farmland) to**

Impact	Impact Conclusions	Proposed Mitigation
Monitoring Program of the California Resources Agency, to nonagricultural use **Impact AG-e:** Involve other changes in the existing environment that, due to their location or nature, could result in conversion of important farmland to nonagricultural use	Increased use of water transfers could further incentivize farmland conversion, particularly in rapidly urbanizing areas Lower groundwater levels could reduce groundwater available for agricultural use Reduced streamflow and water levels at some locations could affect the ability of existing diversion intakes to divert water for agricultural use[1] Increased inundation in the Sutter and Yolo Bypasses during the planting season could affect crop acreage[1]	**nonagricultural use** 1. Diversify Water Portfolios 2. Increase Efficiency of Agricultural Water Use 3. Impose Conditions on Land Use Changes or Other Discretionary Approvals 4. Reduce Impacts on Groundwater (MM-GW-b) 5. Oversight and Approval of Water Transfers 6. Ensure Effectiveness of Diversion Intakes[1] 7. Minimize Disruptions to Agriculture in the Sutter and Yolo Bypasses from Increased Floodplain Inundation[1]
Impact AG-b: Conflict with existing zoning for agricultural use or conflict with a Williamson Act contract	**No Impact** —	—
Impact AG-c: Conflict with existing zoning for, or cause rezoning of forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))	**No Impact** —	—
Impact AG-d: Result in the loss of forest land or conversion of forest land to non-forest use	**No Impact** —	—
AIR QUALITY		
Impact AQ-a: Conflict with or obstruct implementation of the applicable air quality plan **Impact AQ-b:** Violate any air quality standard or contribute substantially to an existing or projected air quality violation	**Potentially Significant** Increased groundwater pumping using diesel pumps and generators could result in emissions	**MM-AQ-a–c: Mitigate impacts from criteria air pollutant emissions from groundwater pumping**

Impact	Impact Conclusions	Proposed Mitigation
Impact AQ-c: Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)	**Less than Significant** Lower streamflows and reservoir levels could result in exposure to increased windblown dust emissions Agricultural land fallowing could result in exposure to increased fugitive dust Post-harvest rice burning could result in exposure to air pollutant emissions	—
	Beneficial Water conservation could result in a reduction in emissions	—
Impact AQ-d: Expose sensitive receptors to substantial pollutant concentrations	**Less than Significant** Lower reservoir levels could result in exposure to increased windblown dust emissions Agricultural land fallowing could result in exposure to increased fugitive dust on lands where soil is exposed Post-harvest rice burning, groundwater pumping, and the use of other water management actions could result in exposure to pollutant emissions	—
Impact AQ-e: Create objectionable odors affecting a substantial number of people	**Less than Significant** Formation of harmful algal blooms from reduced flows and reservoir levels could produce odor compounds Reductions in overall wastewater flow and increased use of recycled water could result in increases in odors Increases in odors from increased groundwater pumping and other water management actions	—
BIOLOGICAL RESOURCES—TERRESTRIAL		
Impact TER-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or	**Potentially Significant** Increased inundation in flood bypasses during the planting season could affect crop acreage,	**MM-TER-a: Mitigate impacts on special-status species**

Impact	Impact Conclusions	Proposed Mitigation
special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service	which could affect special-status wildlife species that use croplands as habitat[1] Reduced Sacramento/Delta supply to agricultural lands could affect habitat for special-status species, including giant gartersnake, Swainson's hawk, greater sandhill crane, tricolored blackbird, and California black rail Reduced Sacramento/Delta supply to wildlife refuges could affect habitat for special-status species, including giant gartersnake, Swainson's hawk, greater sandhill crane, tricolored blackbird, and California black rail[1] Reduced Sacramento/Delta supply to municipal use could affect special-status plant and wildlife species[1] Capturing flood flows for groundwater storage and recovery could diminish instream ecological benefits of high-flow events* Water transfers based on cropland idling could affect special-status species that use agricultural fields Increased use of recycled water that would otherwise discharge to streams could diminish ecological benefits of instream flows, especially in dry seasons and in low-flow conditions where streamflow is dependent on wastewater discharges* **Less than Significant** Increased winter flows on the Sacramento and Feather Rivers could affect bank swallow habitat Changes in reservoir water levels could affect habitat for bald eagle, American white pelican, western pond turtle, and amphibians Changes in streamflow below export reservoirs could affect habitat for special-status terrestrial	1. Minimize Impacts on Sutter and Yolo Bypass Agricultural Lands (MM-AG-a,e: 3, MM-AG-a,e: 7)[1] 2. Habitat Protection and Restoration Actions 3. Special-Status Species Management Measures 4. Diversify Water Portfolios 5. Regulation of Waste Discharges to Streams (MM-SW-a,f: 1)[1] 6. Support and Approval of Water Recycling 7. Support and Approval of Groundwater Storage and Recovery 8. Oversight and Approval of Water Transfers —

Impact	Impact Conclusions	Proposed Mitigation
	species[1] Lower groundwater levels could affect natural communities that are dependent on groundwater and sensitive species that are reliant on groundwater-dependent ecosystems	
	Beneficial	
	Restoration and maintenance of natural flow would improve conditions for special-status plants and wildlife Increased frequency and duration of floodplain inundation would improve habitat for wintering waterfowl and other wildlife species Changes in Delta inflows and Delta outflows would improve habitat conditions for freshwater and tidal marsh species in the Delta and Suisun Marsh	—
Impact TER-b: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service **Impact TER-c:** Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marshes, vernal pools, coastal wetlands, etc.) through direct removal, filling, hydrological interruption, or other means	**Potentially Significant** Changes in Sacramento/Delta reservoir levels could affect associated riparian and wetland habitat Reduced Sacramento/Delta supply to wildlife refuges could decrease wetland areas over time[1] Reduced Sacramento/Delta supply could affect water quality in managed wetlands[1] Reduced Sacramento/Delta supply to municipal and agricultural use could affect sensitive riparian and wetland habitat, and other natural communities[1] Lower groundwater levels could affect riparian and wetland habitat, and sensitive groundwater-dependent natural communities and wetlands Capturing flood flows for groundwater storage and recovery could diminish the instream ecological benefits of high-flow events*	**MM-TER-b,c: Mitigate impacts on riparian habitats or other sensitive natural communities, including wetlands** 1. Reservoir Management (MM-AQUA-a,d: 1) 2. Reduce Impacts on Groundwater-Dependent Ecosystems (MM-GW-b) 3. Agricultural Drainage Control (MM-SW-a,f: 7)[1] 4. Implement Mitigation Measure MM-TER-a elements to reduce impacts on riparian habitats and other sensitive natural communities, including wetlands: • Habitat Protection and Restoration Actions (MM-TER-a: 2) • Regulation of Waste Discharges to Streams (MM-TER-a: 5)

Impact	Impact Conclusions	Proposed Mitigation
	Increased use of water transfers could affect groundwater-dependent natural communities and some perennial wetlands in some areas, and could exacerbate effects from lower groundwater levels on riparian and wetland habitat and sensitive natural communities Increased use of water recycling could diminish riparian and wetland habitat, especially in dry seasons and in low-flow conditions where streamflow depends on wastewater discharges*	• Support and Approval of Water Recycling (MM-TER-a: 6) • Support and Approval of Groundwater Storage and Recovery (MM-TER-a: 7) • Oversight and Approval of Water Transfers (MM-TER-a: 8)
	Less than Significant	
	Reduced streamflows below export reservoirs could affect riparian and wetland habitat	—
	Beneficial	
	A more natural flow regime and providing higher flows would restore and maintain natural processes, such as sediment deposition, marsh accretion, nutrient transport, seed dispersal, and flow-related disturbance, which would benefit riverine and associated wetland and riparian habitat Increased frequency and duration of floodplain inundation would benefit riparian and wetland habitat and associated natural communities Changes in Delta inflows and Delta outflows would benefit freshwater marshes and tidal marshes Increased use of water recycling and municipal water conservation measures could reduce municipal discharges and support conditions favorable to wetlands and sensitive natural communities adapted to the natural flow regime	—

Impact	Impact Conclusions	Proposed Mitigation
Impact TER-d: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites	**Potentially Significant** Reduced Sacramento/Delta supply for wildlife refuges and agriculture could decrease the amount of habitat available for resident and migratory waterfowl and shorebirds[1] Increased use of water transfers could result in conversion of crop types that provide foraging habitat for migratory waterfowl and shorebirds	**MM-TER-d: Mitigate impacts on wildlife movement or wildlife nurseries** 1. Implement Mitigation Measure MM-TER-a and Mitigation Measure MM-TER-b,c elements to mitigate impacts on the movement of native resident or migratory fish or wildlife species, migratory wildlife corridors, and native wildlife nursery sites. • Habitat Protection and Restoration Actions (MM-TER-a: 2)[1] • Oversight and Approval of Water Transfers (MM-TER-a: 8) • Reduce Impacts on Groundwater-Dependent Ecosystems (MM-TER-b,c: 2)
	Less than Significant Changes in reservoir levels could affect the amount of breeding habitat for resident or migratory waterfowl populations	—
	Beneficial A more natural flow regime and providing higher flows would benefit native resident and migratory wildlife that use riverine and associated wetland and riparian habitat and natural communities as migratory corridors or nursery sites	—
Impact TER-e: Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance	**No Impact** —	—

Impact	Impact Conclusions	Proposed Mitigation
Impact TER-f: Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan	**Less than Significant** Reduced Sacramento/Delta supply could affect habitat goals of some habitat conservation plans[1]	—
	Beneficial Changes in Sacramento/Delta tributary flows, Delta inflows, and Delta outflows would complement actions identified in some habitat conservation plans	—
BIOLOGICAL RESOURCES—AQUATIC		
Impact AQUA-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service **Impact AQUA-d:** Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites	**Potentially Significant** Changes in reservoir levels could affect downstream flows and water temperatures below some reservoirs Changes in interior Delta flows could affect native anadromous and estuarine fish species residing in or migrating through the Delta Reduced Sacramento/Delta supply to agriculture could affect habitat for special status species that depend in part on Sacramento/Delta water supply for habitat (i.e., irrigation runoff in agricultural drain for desert pupfish)[1] Changes in water supply could affect WWTP effluent discharge which could result in effects on water quality and flow that could affect special-status aquatic species occurring in these locations[1] Lower groundwater levels could affect stream-aquifer interactions and streamflows in some locations Diversion of surface water for groundwater storage and recovery could reduce peak flows that provide ecological and habitat functions (e.g., floodplain inundation)*	**MM-AQUA-a,d: Mitigate impacts on aquatic special-status species and wildlife movement or wildlife nurseries** 1. Implement Existing Laws that Protect and Mitigate Impacts from Dams and Diversions 2. Habitat Protection and Restoration Actions 3. Special-Status Species Management Measures 4. Regulation of Waste Discharges to Streams (MM-SW-a,f: 1)[1] 5. Support and Approval of Recycled Water 6. Reduce Impacts on Groundwater (MM-GW-b) 7. Diversify Water Portfolios 8. Support and Approval of Groundwater Storage and Recovery 9. Oversight and Approval of Water Transfers 10. Implement Existing Laws to Protect and Mitigate Fisheries Impacts from Changes in Interior Delta Flows

Impact	Impact Conclusions	Proposed Mitigation
	Water transfers could alter hydrologic patterns and affect aquatic biological resources in some locations Increased water recycling could decrease the volume of treated wastewater effluent discharge into water bodies that are migratory corridors for fish*	
	Less than Significant	
	Reductions in Delta inflow and outflow during July-December could affect native anadromous, estuarine, and resident fish species Changes in wet season flows (geomorphic flows) on regulated tributaries in the Sacramento/Delta regions could cause some erosion, but would also result in ecological benefits of floodplain inundation Changes in reservoir levels could affect native reservoir fish species, such as minnows and suckers[1]	—
	Beneficial	
	A more natural flow regime would support a connected and functioning ecosystem and benefit native fish in the Sacramento/Delta Changes in Delta inflows and outflows during January–June would benefit native anadromous, estuarine, and resident fish species Increased frequency and duration of floodplain inundation, including in the Bear River, Feather River, Mokelumne River, Yuba River, and Yolo Bypass would benefit aquatic species	—
Impact AQUA-f: Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan	**Less than Significant**	
	Reduced Sacramento/Delta supply could frustrate certain conservation plan management actions[1]	—

Impact	Impact Conclusions	Proposed Mitigation
CULTURAL RESOURCES		
Impact CUL-a: Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5 **Impact CUL-b:** Cause a substantial adverse change in the significance of an archaeological resource as defined in Section 15064.5	**Potentially Significant** Changes in reservoir levels could expose previously inundated cultural resources and/or significant historic or archaeological resources to increased wave action, erosion, and human activity	**MM-CUL-a,b: Mitigate impacts of project that could cause a substantial adverse change in the significance of a historical or archaeological resource** 1. Reservoir Management (MM-AQUA-a,d: 1) 2. Implement or Adhere to Cultural Resource Management Measures for Lands Surrounding Reservoirs 3. Unanticipated Discoveries
	Less than Significant Changes in streamflows could result in inundation and exposure of historic or archaeological resources	—
Impact CUL-c: Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature	**No Impact** —	—
Impact CUL-d: Disturb any human remains, including those interred outside of dedicated cemeteries	**Potentially Significant** Changes in reservoir levels could expose previously inundated land containing human burials, which could result in the disturbance of the burial and impacts from human activity	**MM-CUL-d: Mitigate impacts of project that could disturb any human remains, including those interred outside of dedicated cemeteries** Implement Mitigation Measure MM-CUL-a,b
	Less than Significant Changes in river flows could alter the baseline conditions of human burials interred within or outside of dedicated cemeteries	—
ENERGY		
Impact EN-a: The effects of the project on energy resources	**Potentially Significant** Changes in hydrology would result in a decrease in hydropower generation in the summer which could be significant for an	**MM-EN-a–e: Mitigate the project effects on energy resources[1]**

Impact	Impact Conclusions	Proposed Mitigation
Impact EN-b: The effect of the project on peak and base period demands for electricity and other forms of energy **Impact EN-c:** The effects of the project on local and regional energy supplies and requirements for additional capacity **Impact EN-d:** The degree to which the project complies with existing energy standards **Impact EN-e:** Energy requirements and energy use efficiencies by amount and fuel type for each stage of the project	individual project or community[1] Changes in water supply could cause an increase in energy use, to replace Sacramento/Delta supplies from actions such as increased groundwater pumping and other water management actions[1]	1. Reservoir Management (MM-AQUA-a,d: 1ii) 2. Coordination with Existing Requirements 3. Diversify Water Portfolios 4. Increase Water Use Efficiency 5. Promote the Use of Renewable Energy 6. Implement Greenhouse Gas Emissions Mitigation (MM-GHG-a and MM-GHG-b)
	Beneficial	
	Changes in water supply could result in a reduction in the energy used to export water from the Delta[1] Water conservation could result in a reduction in energy use	—
Impact EN-f: The project's projected transportation energy use requirements and its overall use of efficient transportation alternatives	**Less than Significant**	
	Reduction in agricultural production could increase energy use for transportation	—
GEOLOGY AND SOILS		
Impact GEO-a: Expose people or structures to potential substantial adverse effects including the risk of loss, injury, or death involving: rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure including liquefaction, or landslides	**No Impact**	
	—	—
Impact GEO-b: Result in substantial soil erosion or the loss of topsoil	**Less than Significant**	
	Agriculture fallowing could temporarily increase erosion and sedimentation	—
Impact GEO-c: Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse	**Potentially Significant**	
	Lower groundwater levels could exacerbate existing problems associated with ground subsidence	**MM-GEO-c: Mitigate impacts associated with unstable soils and steep slopes (landslide, lateral spreading, subsidence, liquefaction, or collapse)**

Impact	Impact Conclusions	Proposed Mitigation
		1. Actions to Reduce Subsidence 2. Reduce Impacts on Groundwater (MM-GW-b)
I**mpact GEO-d:** Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property	**No Impact** —	—
Impact GEO-e: Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater	**No Impact** —	—
GREENHOUSE GAS EMISSIONS		
Impact GHG-a: Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment	**Potentially Significant** Increased groundwater pumping from wells with diesel-powered pumps could generate additional greenhouse gas emissions Groundwater storage and recovery, water transfers, and water recycling could result in emissions associated with energy use	**MM-GHG-a: Mitigate impacts from greenhouse gas emissions** 1. Water Use Efficiency 2. Water Conservation 3. Energy Efficiency 4. Irrigation Systems 5. Restoration, Pricing Strategies, and Mitigation Credits 6. Implement Energy Mitigation (Mitigation Measure MM-EN-a–e: 1-5) 7. Implement Mitigation Measure MM-GHG-b, Comply with applicable greenhouse gas emissions reduction plans, policies, or regulations
	Less than Significant Reductions in hydropower generation could result in additional energy generation at fossil-fuel facilities	—

Impact	Impact Conclusions	Proposed Mitigation
	Increased groundwater pumping from wells with electric fuel pumps could generate additional greenhouse gas emissions	
	Beneficial	
	Changes in water supply could result in a reduction in the energy used to export water from the Delta and a corresponding reduction in greenhouse gas emissions[1] Water conservation could result in a reduction in energy use and greenhouse gas emissions	
Impact GHG-b: Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases	**Potentially Significant**	
	Increased groundwater pumping from wells with diesel-powered pumps could result in emissions in excess of existing thresholds and could conflict with the state's long-term emission reduction trajectory	**MM-GHG-b: Comply with applicable greenhouse gas emission reduction plans, policies, or regulations** 1. Implement Air Quality Plans and Programs 2. Renewable Energy 3. Implement Mitigation Measure MM-GHG-a: 1–6, Mitigate impacts from greenhouse gas emissions
	Beneficial	
	Water use efficiency, water recycling, and reuse of urban runoff would be beneficial in meeting other state and local GHG goals	—
HAZARDS AND HAZARDOUS MATERIALS		
Impact HAZ-a: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials	**No Impact** —	—
Impact HAZ-b: Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment	**No Impact** —	—

Impact	Impact Conclusions	Proposed Mitigation
Impact HAZ-c: Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school	**No Impact** —	—
Impact HAZ-d: Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment	**No Impact** —	—
Impact HAZ-e: For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area	**No Impact** —	—
Impact HAZ-f: For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area	**No Impact** —	—
Impact HAZ-g: Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan	**No Impact** —	—
Impact HAZ-h: Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands	**Less than Significant** Changes in reservoir levels in areas likely to continue experiencing forest fires could affect wildland fire suppression practices	—
HYDROLOGY & WATER QUALITY—SURFACE WATER		
Impact SW-a: Violate any water quality standards or waste discharge requirements **Impact SW-f**: Otherwise substantially degrade water quality	**Potentially Significant** Reduced streamflows could result in less dilution and increased concentration of contaminants in some locations Flow commitments could increase contaminant (e.g., boron, nitrate, and mercury) concentrations to harmful levels and could increase cyanobacteria, cyanotoxins, or HABs*[2]	**MM-SW-a,f: Avoid or reduce violations of water quality standards or waste discharge requirements, and/or degradations of water quality** 1. Water Quality Contaminants and Regulation of Waste Discharges

Impact	Impact Conclusions	Proposed Mitigation
	Increased flows could result in increased input of mercury and methylmercury production downstream in some locations Increases in water level fluctuation at some reservoirs could result in increased bioaccumulation of methylmercury in fish Changes in reservoir levels and lowered streamflows below reservoirs could result in increased water temperature in some locations and times of year Changes in reservoir levels could result in increased production of HABs in some locations Lower summer and fall flows in some Delta channels could result in incremental increased production of HABs and invasive aquatic plants[1] Reduced streamflows could result in temporary exceedances of waste discharge requirements and/or water quality standards[1] Changes in water supply could result in temporary exceedances of maximum contaminant levels in municipal water supply[1] Changes in water supply, including use of alternative lower water quality sources in response to reduced Sacramento/Delta supply to municipal use could result in site-specific exceedances of waste discharge requirements due to changes in wastewater treatment plant (WWTP) influent and effluent quality and quantity[1] Reductions in delivery of higher quality Sacramento/Delta supplies to managed wetlands, including wildlife refuges could affect water quality[1] Reductions in groundwater accretions could cause decreases in water quality associated with lower streamflows or higher temperatures Diversion of surface water for groundwater	2. Minimize Mercury Impacts 3. Reservoir Management (MM-AQUA-a,d: 1) 4. Avoid or Reduce Harmful Algal Blooms and Invasive Aquatic Weeds 5. Protect Municipal Water Quality 6. Reduce Impacts on Groundwater (MM-GW-b) 7. Agricultural Drainage Control 8. Diversify Water Portfolios 9. Support and Approval of Groundwater Storage and Recovery 10. Oversight and Approval of Water Transfers 11. Support and Approval of Water Recycling 12. Water Quality Monitoring and Management in Putah Creek[2]

Impact	Impact Conclusions	Proposed Mitigation
	storage and recovery could limit the dilution effect of existing flows and exacerbate existing water quality impairments*	
	Increased use of water transfers could affect water quality in some locations	
	Increased water recycling could reduce instream flows, which could reduce dilution of local sources of contaminants*	
	Less than Significant	
	Changes in flows could result in moderately elevated turbidity and total suspended solids (TSS) levels in some locations, and reduced occurrence of the highest turbidity and TSS levels	—
	Increased Delta outflow would result in little change or beneficial reductions in electrical conductivity (EC) in the Delta	
	Increased Delta outflow would result in little change or beneficial reductions in chloride and bromide at municipal intakes in the Delta	
	Increased floodplain inundation could affect nutrients, organic material, invasive aquatic plants, and HABs	
	Beneficial	
	Reduced seawater intrusion could result in water quality improvements in the Delta, including dilution and flushing of some contaminants and reductions in EC, bromide, and chloride[1]	—
	Increased flows would enhance water quality for fish	
	Increased flows could dilute certain constituents in waterbodies that would provide a water quality benefit	
	Increased Delta outflows could reduce HABs and invasive vegetation	

Impact	Impact Conclusions	Proposed Mitigation
Impact SW-c: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site **Impact SW-d:** Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site	**Potentially Significant** Increases in Clear Creek flow downstream of Whiskeytown Lake could increase risk of erosion and flooding in this area*[1] **Beneficial** A more natural flow regime could contribute to the restoration of beneficial geomorphic processes (i.e., those that clean fine sediment from spawning gravels, maintain a diversity of bed forms, and help maintain functional floodplain and riparian habitats through floodplain inundation) Changes in Delta inflows would provide for floodplain inundation to benefit native species	**MM-SW-i: Avoid or reduce exposure of people or structures to flood risk on Clear Creek**[1] —
Impact SW-e: Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff	**No Impact** —	—
Impact SW-g: Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map **Impact SW-h:** Place within a 100-year flood hazard area structures which would impede or redirect flood flows	**No Impact** —	—
Impact SW-i: Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam	**Potentially Significant** Increases in Clear Creek flow downstream of Whiskeytown Lake could increase the risk of downstream flooding in this area*[1]	**MM-SW-i: Avoid or reduce exposure of people or structures to flood risk on Clear Creek**[1]
Impact SW-j: Inundation by seiche, tsunami, or mudflow	**No Impact** —	—

Impact	Impact Conclusions	Proposed Mitigation
HYDROLOGY & WATER QUALITY—GROUNDWATER		
Impact GW-b: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge, such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)	**Potentially Significant** Increased groundwater pumping and reductions in incidental groundwater recharge from applied irrigation could lower groundwater levels and contribute to groundwater overdraft Lower groundwater levels could result in an increase in frequency and severity of critical shortages or dry wells occurring in some areas for communities that rely on groundwater, including economically disadvantaged communities Reduced Sacramento/Delta supplies could have localized impacts on groundwater storage in areas where Sacramento/Delta supplies are used for groundwater banking Surface water transfers through groundwater substitution could result in lower groundwater levels in basin of origin Agricultural conservation measures could reduce incidental groundwater recharge that would lower groundwater levels	**MM-GW-b: Mitigate the substantial depletion of groundwater supplies or the substantial interference with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level** 1. Implement the Sustainable Groundwater Management Act (SGMA) 2. SGMA Oversight 3. Diversify Water Portfolios 4. Support and Approval of Groundwater Storage and Recovery 5. Support and Approval of Water Recycling Projects 6. Oversight and Approval of Water Transfers
	Less than Significant Reduced flows downstream of reservoirs could affect stream-aquifer interactions Increased water recycling could have effects on groundwater levels Municipal water conservation measures could reduce incidental groundwater recharge from urban runoff	—
	Beneficial Groundwater storage and recovery could enhance groundwater levels	—

Impact	Impact Conclusions	Proposed Mitigation
	Water recycling could increase groundwater levels in some areas if a portion of the recycled water reaches the aquifer or if the recycled water offsets a use that previously was supplied by groundwater	
Impact GW-a: Violate any water quality standards or waste discharge requirements **Impact GW-f:** Otherwise substantially degrade water quality	**Potentially Significant** Lower groundwater levels can result in changes in groundwater flow direction and gradients in localized areas, which could exacerbate the migration of contaminants In some locations, lower groundwater levels may concentrate salts and nutrients in groundwater over time through evaporative enrichment Lower groundwater levels could affect groundwater quality and potentially affect drinking water wells in some areas, including economically disadvantaged communities Lower groundwater levels could have localized effects on groundwater quality by concentrating pollutants where groundwater contamination already exists Groundwater storage and recovery projects that use poor quality water to recharge groundwater basins could contribute to salt and nutrient loading or introduce contaminants to the underlying aquifer* Other water management actions (water transfers through groundwater substitution and agriculture water conservation) could result in lower groundwater levels, which could exacerbate groundwater quality impairments or contribute to contaminant loading in localized areas	**MM-GW-a,f: Mitigate impacts to groundwater quality from depletion of groundwater supplies or the substantial interference with groundwater recharge** 1 Drinking Water Programs 2. Implement the State and Regional Board's Irrigated Lands Regulatory Program 3. Reduce Impacts on Groundwater (MM-GW-b)

Impact	Impact Conclusions	Proposed Mitigation
	Less than Significant	
	Recycled water may percolate into the underlying groundwater basin, and could affect groundwater quality	—
	Beneficial	
	Increased infiltration from stream-aquifer interactions from increased flows in the Sacramento/Delta could improve groundwater quality	—
	Groundwater storage and recovery projects that use high-quality water to recharge groundwater basins may provide an effective strategy to maintain or improve groundwater quality	
LAND USE AND PLANNING		
Impact LU-a: Physically divide an established community	**No Impact**	
	—	—
Impact LU-b: Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect	**No Impact**	
	—	—
Impact LU-c: Conflict with any applicable habitat conservation plan or natural community conservation plan	**Less than Significant**	
	See also Section 7.6.1, *Terrestrial Biological Resources*, and Section 9.7.6.1, *Terrestrial Biological Resources*, Impact TER-f	—
MINERAL RESOURCES		
Impact MIN-a: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state	**No Impact**	
	—	—
Impact MIN-b: Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	**No Impact**	
	—	—

Impact	Impact Conclusions	Proposed Mitigation
NOISE		
Impact NOI-a: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies **Impact NOI-c:** A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project **Impact NOI-d:** A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project	**Potentially Significant** Increased groundwater pumping for replacement water supply, groundwater storage and recovery, or groundwater substitution transfers could result in higher noise levels	**MM-NOI-a,c,d: Mitigate exposure of persons to or generation of noise levels in excess of established standards and to substantial permanent or temporary increases in ambient noise levels in the project vicinity** 1. Applicable Policies and Regulations 2. Noise-Reduction Consideration in Operations
Impact NOI-b: Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels	**Less than Significant** Increased groundwater pumping could result in localized and intermittent perceptible vibration	—
Impact NOI-e: For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels	**No Impact** —	—
Impact NOI-f: For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels	**No Impact** —	—
POPULATION AND HOUSING		
Impact POP-a: Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)	**No Impact** —	—
Impact POP-b: Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere	**No Impact** —	—

Impact	Impact Conclusions	Proposed Mitigation
Impact POP-c: Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere	**No Impact** —	—
PUBLIC SERVICES		
Impact PS-a: Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services: fire protection, police protection, schools, parks, or other public facilities	**No Impact** —	—
RECREATION		
Impact REC-a: Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated	**Potentially Significant** Changes in reservoir levels could affect boat ramp accessibility affecting recreation opportunities at some reservoirs[1] Incremental increase in potential harmful algal blooms could cause closures to recreation in some waterbodies	**MM-REC-a: Mitigate recreation impacts associated with reservoir level changes** 1. Reservoir Management (MM-AQUA-a–d: 1)[1] 2 Recreation Management Measures[1] 3. Protect Water Quality and Avoid or Reduce Harmful Algal Blooms and Invasive Aquatic Weeds (MM-SW-a,f: 1, 3–5, and 7)
	Less than Significant Reduced summer flows could affect the boating difficulty of rapids for rafting and kayaking at some locations Increased spring and early summer flows could reduce opportunities for swimming or wading in rivers at some locations	—

Impact	Impact Conclusions	Proposed Mitigation
	Changes in reservoir water surface area and elevation could affect sportfish populations and reduce fishing opportunities at some locations Reduced deliveries to wildlife refuges and agricultural lands could affect recreational opportunities (e.g., wildlife viewing) Reduced municipal water supply could affect municipal recreational opportunities at parks, playfields, and swimming pools[1]	
	Beneficial	
	Changes in flow could improve recreational opportunities	—
Impact REC-b: Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment	**Potentially Significant**	
	Changes in reservoir levels could affect boat ramp accessibility and lead to modification of existing or development of new boat ramps in some locations[1]	**MM-REC-b: Mitigate impacts from construction or expansion of recreational facilities (boat ramps)**[1] 1. Implement MM-REC-a 2. If construction of new or modified boat ramps is necessary, implement mitigation measures described in Appendix H3, *Mitigation Measures for the Revised Proposed Plan Amendments*
TRANSPORTATION/TRAFFIC		
Impact TRA-a: Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation, including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to, intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit **Impact TRA-f:** Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise	**Less than Significant**	
	Increased intermittent inundation of floodplains bounded by levees where roads and pedestrian and bicycle paths exist could affect transportation Increased closures of the Delta Cross Channel (DCC) gates could affect recreational boat navigation[1] Changes in agricultural land use or fallowing could lead to changes in agricultural product-related transportation	—

Impact	Impact Conclusions	Proposed Mitigation
decrease the performance or safety of such facilities		
Impact TRA-b: Conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures or other standards established by the county congestion management agency for designated roads or highways	**No Impact** —	—
Impact TRA-c: Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks	**No Impact** —	—
Impact TRA-d: Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)	**No Impact** —	—
Impact TRA-e: Result in inadequate emergency access	**No Impact** —	—
UTILITIES AND SERVICE SYSTEMS		
Impact UT-a: Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board	**Potentially Significant** Changes in hydrology and water supply could alter the assimilative capacity of some streams where treated wastewater is discharged[1] Changes in water supply could result in the use of other lower quality water supply sources that affect WWTP influent and effluent[1] Reduced municipal supply and increased indoor water conservation could lead to a decrease in the production of wastewater and increase chemical constituent concentrations in WWTP influent[1] Groundwater storage and recovery or water transfers could increase concentrations of some pollutants of concern in WWTP influent, if the	**MM-UT-a: Avoid or reduce potential to exceed wastewater treatment requirements** 1. Water Quality Contaminants and Regulation of Waste Discharges[1] 2. Protect Municipal Water Quality[1] 3 Increased Coordination between Water Suppliers and Wastewater Agencies[1] 4. Minimize Surface Water Quality Effects on Wastewater Treatment Plants (MM-SW-a,f)[1] 5. Minimize Groundwater Quality Effects on Wastewater Treatment Plants (MM-GW-a,f)

Impact	Impact Conclusions	Proposed Mitigation
	source of the stored groundwater or transfer is of lower quality	
Impact UT-b: Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects	**Potentially Significant** Changes in hydrology and water supply could result in construction to modify or expand existing treatment facilities in order to prevent or mitigate exceedances of drinking water standards and wastewater discharge water quality objectives[1]	**MM-UT-b: Avoid or reduce impacts from the construction of new water or wastewater treatment facilities or expansion of existing facilities**[1] 1. Implement Mitigation Measure MM-UT-a 2. If construction of new water or wastewater treatment facilities or expansion of existing facilities is necessary, implement mitigation measures described in Appendix H3, *Mitigation Measures for the Revised Proposed Plan Amendments*
Impact UT-c: Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects	**No Impact** —	—
Impact UT-d: Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed	**Potentially Significant** Reduced Sacramento/Delta supply to municipal use could affect municipal water supplies[1] Reduced groundwater levels could affect water supplies for communities that rely on groundwater as their primary municipal water source, including economically disadvantaged communities Reduced streamflows and water levels at some locations could affect the ability of existing diversion intakes to divert water, which could affect municipal water supplies[1]	**MM-UT-d: Avoid or reduce impacts on municipal supplies** 1. Diversify Water Portfolios 2. Increase Water Use Efficiency 3. Human Health and Safety Provision[1] 4. Prioritize Water Supplies for Health and Safety 5. Reduce Impacts on Groundwater (MM-GW-b) 6. Protect Municipal Water Supplies (MM-UT-a)[1]

Impact	Impact Conclusions	Proposed Mitigation
		7. Ensure Effectiveness of Diversion Intakes (MM-AG-a,e: 6)[1]
	Beneficial	
	Other water management actions (groundwater storage and recovery, water transfers, water recycling, water conservation) could contribute to meeting water demands for municipal use	—
Impact UT-e: Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments	**No Impact**	
	—	—
Impact UT-f: Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs **Impact UT-g:** Comply with federal, state, and local statutes and regulations related to solid waste	**Less than Significant**	
	Changes to agricultural crop type or production resulting from changes in water supply could generate solid waste[1]	—
	Increased water recycling could lead to an increase in solid waste byproducts	

[1] Beneficial effects and potentially significant impacts and proposed mitigation measures that apply only to the regulatory pathway and not the VA pathway.
[2] Potential impacts and proposed mitigation measures that apply only to the VA pathway and not the regulatory pathway.
DCC = Delta Cross Channel; EC = electrical conductivity; HAB = harmful algal bloom; HRL = Healthy Rivers and Landscapes; TSS = total suspended solids; WWTP = wastewater treatment plant

Table 13.7.22-2. Impact and Mitigation Measure Summary— Habitat Restoration and Other Ecosystem Projects

Impact	Impact Conclusions	Proposed Mitigation
AESTHETICS		
Impact AES-a: Have a substantial adverse effect on a scenic vista **Impact AES-b:** Substantially damage scenic resources, including, but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway **Impact AES-c:** Substantially degrade the existing visual character or quality of the site and its surroundings **Impact AES-d:** Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area	**Potentially Significant** ***Common Construction*** [a] Construction may physically damage scenic resources, introduce large construction equipment, remove vegetation, stockpile materials, create dust, or add new sources of lighting and glare Permanent installation of artificial elements (e.g., riprap), solar panels, and/or security and safety lighting	**7.21 MM-AES-a–d: Mitigate impacts on visual resources** **A. Construction AES Mitigation Measures (CMM-AES-a–d)** 1. Project Siting and Design 2. Screen Construction Areas 3. Spoil Disposal Areas 4. Dust Control Measures (CMM-AQ-a–e: 3) 5. Waste Management and Material Control Measures (CMM-WQ-a–j: 4) 6. Light and Glare Minimization 7. Construction BIO Mitigation Measures: Avoid Vegetation Disturbance (CMM-BIO-a–f: 9), Revegetation Plan (CMM-BIO-a–f: 11) and Revegetation Monitoring and Reporting (CMM-BIO-a–f: 12)
	Physical Habitat Restoration Long-term changes to the quality of visual resources from the addition of hardscape elements (e.g., fence, bench, erosion control structures), additional or modified water infrastructure (e.g., water storage structures and associated delivery lines), or gravel augmentation	**B. Physical Habitat Restoration AES Mitigation Measures** 1. Project Design 2. Physical Habitat Restoration BIO Mitigation Measures (7.21 MM-BIO-a–f: C)
	Fish Passage Improvements Changes in a scenic vista from dam removal Large areas of bare sediment and rock could be exposed in previously inundated areas after reservoir drawdown and removal	**C. Dam Removal AES Mitigation Measures** 1. Project Planning 2. Dam Removal BIO Mitigation Measures (7.21 MM-BIO-a–f: E) 3. Revegetation Plan

Impact	Impact Conclusions	Proposed Mitigation
	Less than Significant/No Impact	
	Invasive Aquatic Vegetation Control	—
	Temporary and short duration use of mechanical harvester equipment and areas of vegetation decay after herbicide use	
	Minimal increase of glare from removal of vegetation and return of open water	
	Beneficial	
	Physical habitat restoration could enhance the visual character or quality of an area and improve views from a scenic vista by returning disturbed areas to a more natural state	—
	Invasive aquatic vegetation control could improve the visual character and quality of surface waters and improve views from a scenic vista by returning clogged waterways to open water	
AGRICULTURE AND FOREST RESOURCES		
Impact AG-a: Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use **Impact AG-b:** Conflict with existing zoning for agricultural use or conflict with a Williamson Act contract **Impact AG-c:** Conflict with existing zoning for, or cause rezoning of forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g)) **Impact AG-d:** Result in the loss of forest land or	**Potentially Significant** ***Common Construction*** [a] Construction activities could remove vegetation and/or topsoil; introduce invasive weeds; restrict access to or interfere with use of agricultural land; disturb utilities and infrastructure serving agriculture; and disturb soil in development footprints, borrow/spoils areas or staging areas (e.g., soil compaction resulting from heavy equipment storage or soil stockpiling)	**7.21 MM-AG-a–e: Mitigate impacts on agriculture and forest resources** **A. Construction AG Mitigation Measures (CMM-AG-a–e)** 1. Project Siting and Design 2. Invasive Species Control Measures 3. Postconstruction Best Management Practices 4. Protect Agricultural Soils 5. Agricultural Mitigation Consistent with County and Local Jurisdiction Requirements 6. Avoid or Minimize Impacts on Forest and Timberland

Impact	Impact Conclusions	Proposed Mitigation
conversion of forest land to non-forest use **Impact AG-e:** Involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland to non-agricultural use or conversion of forest land to non-forest use	***Physical Habitat Restoration*** Long-term or permanent changes to agriculture resources due to project siting (i.e., convert the land to nonagricultural uses or conflict with existing zoning or with Williamson Act contracts) Incidental impacts on adjacent agricultural lands (e.g., seepage issues on adjacent land, herbicide use on invasive plant species)	**B. Physical Habitat Restoration AG Mitigation Measures** 1. Project Siting and Design 2. Agricultural Land Easements 3. Compatible Agricultural Practices 4. Monitor for Seepage 5. Consistency with Local and Regional Land Use Plans 6. Invasive Aquatic Vegetation Control BIO Mitigation Measures (7.21 MM-BIO-a–f: G2)
	Fish Passage Improvements Reduced or altered availability of water supplies for crop irrigation from dam removal Agricultural diversion headworks downstream of a dam could experience siltation or otherwise be affected during reservoir drawdown Reservoir removal could affect legal users of water if a diverter is dependent on the reservoir or reservoir infrastructure	**C. Dam Removal AG Mitigation Measure** 1. Dam Removal WQ Mitigation Measures (7.21 MM-WQ-a–j: G)
	Invasive Aquatic Vegetation Control Incidental impacts on adjacent agricultural lands from herbicide use	**D. Invasive Aquatic Vegetation Control AG Mitigation Measures** 1. Invasive Aquatic Vegetation Control BIO Mitigation Measures (7.21 MM-BIO-a–f: G2)
	Beneficial Restoration projects could benefit agriculture by reducing soil erosion, recharging groundwater, providing natural pest control and water quality buffers Reservoir drawdown and dam removal could increase agricultural opportunities on currently inundated lands Increase in forest land following dam	—

Impact	Impact Conclusions	Proposed Mitigation
	removal due to revegetation of previously inundated lands with woody species Clearing invasive aquatic vegetation could benefit agricultural resources because these plants can interfere with irrigation intakes	
AIR QUALITY		
Impact AQ-a: Conflict with or obstruct implementation of the applicable air quality plan **Impact AQ-b:** Violate any air quality standard or contribute substantially to an existing or projected air quality violation **Impact AQ-c:** Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors) **Impact AQ-d:** Expose sensitive receptors to substantial pollutant concentrations **Impact AQ-e:** Create objectionable odors affecting a substantial number of people	**Potentially Significant** ***Common Construction*** [a] Construction activities could generate fugitive dust and emissions from fuel combustion in heavy construction equipment and vehicles Inadvertent dispersal of *Coccidioides* spores (responsible for Valley fever) and asbestos into the environment	**7.21 MM-AQ-a–e: Mitigate impacts on air quality** **A. Construction AQ Mitigation Measures (CMM-AQ-a–e)** 1. Regulatory Compliance 2. Emission Reduction Measures 3. Dust Control Measures 4. Valley Fever Control Measures 5. Asbestos Control Measures 6. Health Risk Assessment 7. Minimize Construction-Related Traffic and Equipment Use 8. Blasting Operations and Safety Plan (CMM-GEO-a–e: 7) for fugitive dust control
	Physical Habitat Restoration Objectionable odors sometimes associated with wetlands could affect nearby land uses, such as the closest recreational facilities and residential uses	**B. Odor Control Measures**
	Fish Passage Improvements Earthy or hydrogen sulfide odors may be evident during or immediately following reservoir drawdown for dam removal Substantial particulate emissions due to fugitive dust generated from blasting and	**B. Odor Control Measures** **C. Dam Removal AQ Mitigation Measures** 1. Site-Specific Dust Control Plan 2. Revegetation Plan (7.21 MM-BIO-a–f: E3) 3. Odor Control Measures (7.21 MM-AQ-a–e: B)

Impact	Impact Conclusions	Proposed Mitigation
	cut-and-fill activities for dam removal Windblown dust from exposure of sediment deposits remaining in the reservoir footprint after dam removal	
	Less than Significant	
	Fish Passage Improvements TCDs could result in short-term objectionable odors, such as from hydrogen sulfide, from an increase in the quantity of cool water pulled from deeper areas of a reservoir Dam removal could reduce power production if hydropower facilities are dismantled, resulting in increased criteria pollutant emissions at other power facilities or requiring construction and operation of a new powerhouse	—
	Invasive Aquatic Vegetation Control Emissions associated with chemical trucks, mechanical harvesters, haul trucks, and/or boats Temporary odors associated with herbicide spraying	—
	Beneficial	
	Physical Habitat Restoration Physical habitat restoration projects on agricultural lands could benefit air quality by reducing emissions associated with active agricultural operations	—
BIOLOGICAL RESOURCES		
Impact BIO-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California	**Potentially Significant** ***Common Construction*** [a] Construction projects could be located in a sensitive natural community, habitat for special-status species, wetlands, wildlife	**7.21 MM-BIO-a–f: Mitigate impacts on biological resources** **A. Construction BIO Mitigation Measures (CMM-BIO a–f)**

Impact	Impact Conclusions	Proposed Mitigation
Department of Fish and Game or U.S. Fish and Wildlife Service **Impact BIO-b:** Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service **Impact BIO-c:** Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marshes, vernal pools, coastal wetlands, etc.) through direct removal, filling, hydrolgical interruption, or other means **Impact BIO-d:** Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites **Impact BIO-e:** Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance **Impact BIO-f:** Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan	corridors, or waterways Direct or indirect harm (including mortality) to special-status species and associated habitat from movement of heavy machinery where such species occur Disturbance of special-status species through construction noise, physical vibration, and direct removal of structures that provide habitat Introduction or spread of invasive vegetative species through the movement of topsoil, fill, gravel, and construction equipment Removal of riparian vegetation and disturbance to wetlands to facilitate heavy equipment movement and other construction activities Release of sediment and possibly hazardous materials (e.g., oil or gas from construction equipment) into waterbodies from construction on or near waterways Creation of noise and vibration that could harm fish from activities such as pile driving, blasting, or use of other construction equipment Release of concrete particles from blasting to surface waters could disturb terrestrial wildlife and harm fish Take of special-status fish species could result from construction and installation of cofferdams (resulting in fish stranding) or fish rescue in a dewatered area (seining, electrofishing) Some construction projects may conflict with adopted habitat conservation plans (HCPs) or natural community conservation plans (NCCPs)	1. Regulatory Compliance 2. Preconstruction Surveys 3. Avoid, Minimize, or Compensate for Impacts on Sensitive Natural Communities 4. Avoid, Minimize, or Compensate for Impacts on Special-Status Species 5. Environmental Awareness Training 6. Incorporate Protection Measures for In-Water Construction 7. Avoid or Minimize Impeding Access to Established Native Resident or Migratory Wildlife Corridors or Native Wildlife Nurseries for Fish or Wildlife Species during Construction 8. Invasive Species Control Measures 9. Avoid Vegetation Disturbance 10. Staging Areas 11. Revegetation Plan 12. Revegetation Monitoring and Reporting 13. Compliance with HCPs and NCCPs 14. Construction WQ Mitigation Measures (CMM-WQ-a–j) 15. Avoid or Minimize Lighting and Glare Effects 16. Dust Control Measures (CMM-AQ-a–e: 3) 17. Construction NOI Mitigation Measures: Noise-Reduction Measures (CMM-NOI-a,b,d–f: 2) and Vibration-Reduction Measures (CMM-NOI- a,b,d–f: 3) 18. Blasting Operations and Safety Plan (CMM-GEO-a–e: 7)

Impact	Impact Conclusions	Proposed Mitigation
	Physical Habitat Restoration Loss of riparian habitat and large trees Adversely affect species by changing habitat types from some habitat restoration projects (e.g., non-tidal aquatic habitats to tidal aquatic habitats, conversion of agriculture land to native riparian habitat) Creation of barriers such as shallow puddles leading to fish stranding from floodplain drainage Facilitation of methylmercury production and subsequent bioaccumulation in fish and other wildlife species from the creation of freshwater wetlands and floodplains Increased predation on sensitive fish species that use shallow-water floodplain habitats from floodplain restoration Application of toxic herbicides and pesticides from increased invasive plant species and creation of mosquito habitat could adversely affect aquatic and terrestrial species Effects on fish spawning from addition of course sediment and various in-channel activities of gravel augmentation projects Mortality of salmon and steelhead embryos and alevins due to gravel placement Effects on salmon and salmon redds due to increased turbidity and sedimentation due to gravel placement ***Fish Passage Improvements*** Improperly designed fish passage projects can obstruct and injure fish species (e.g., incorrect velocities of fish screens can impinge fish) Increase depth of warm epilimnion in	**B. Approval by State and Federal Fisheries Agencies** • NMFS' programmatic restoration biological opinion to facilitate implementation of restoration projects in the Central Valley • CDFW's California Salmonid Stream Habitat Restoration Manual • NMFS' Guidelines for Salmonid Passage at Stream Crossings • NMFS' Fish Screening Criteria for Anadromous Salmonids • NMFS' Science Base and Tools for Evaluating Stream Engineering, Management, and Restoration Proposals **C. Physical Habitat Restoration BIO Mitigation Measures** 1. Restoration Strategy 2. Adaptive Management 3. Biological Goals 4. Avoid Fish Stranding 5. Vegetation Management 6. Physical Habitat Restoration WQ Mitigation Measures (7.21 MM-WQ-a–j: E) 7. Invasive Species Control 8. Gravel Augmentation BIO Mitigation Measures 9. Approval by State and Federal Fisheries Agencies (7.21 MM-BIO-a-f: B) **D. Fish Passage BIO Mitigation Measures** 1. Consultation with Fish and Wildlife Agencies 2. TCD Design 3. Approval by State and Federal Fisheries Agencies (7.21 MM-BIO-a-f: B)

Impact	Impact Conclusions	Proposed Mitigation
	reservoir by drawing down the depth of the thermocline from operation of TCDs Introduction of special-status species to inhospitable habitat and/or creation of conditions to allow previously blocked invasive species upstream from fishways and dam removal projects Elevated suspended sediment concentrations resulting from the release of sediment stored behind a dam can adversely affect or cause mortality of sensitive life stages of special-status fish, amphibians and reptiles, as well benthic macroinvertebrates occurring downstream of dam removal sites.; subsequent sedimentation could adversely affect salmonid spawning areas Sediments from dam removal can contain toxic pollutants (e.g., metals or bioaccumulative compounds including legacy pesticides and methylmercury) Sediment may temporarily deposit in pools and other slack water areas (e.g., eddies), at tributary confluences, and potentially along channel margins High levels of sediment and turbidity can adversely affect aquatic ecosystems by reducing photosynthetic activity, reducing food availability, burying habitat, and directly harming organisms Supersaturation of nitrogen gas (water containing more dissolved gas than normal) can occur when a reservoir is drawn down too quickly Dam removal would change reservoir to riverine habitat, which could alter habitat	**E. Dam Removal BIO Mitigation Measures** 1. Project Planning 2. Regulatory Compliance 3. Revegetation Plan 4. Dam Removal WQ Mitigation Measures (7.21 MM-WQ-a–j: G)

Impact	Impact Conclusions	Proposed Mitigation
	availability for some aquatic and terrestrial species	
	Predatory Fish Control	**F. Predatory Fish Control BIO Mitigation Measures**
	Cause turbidity and startling of native fish from direct methods of predatory fish control (e.g., electrofishing, hook-and-line fishing, passive trapping) and active capture methods (e.g., trawls, beach seines)	1. Regulatory Compliance 2. BMPs for Hook-and-Line Sampling 3. Selective Capture 4. Fish Handling
	Inadvertant capture of and harm to native fish from capture methods (e.g., hook-and-line, traps, and electrofishing)	
	Invasive Aquatic Vegetation Control	**G. Invasive Aquatic Vegetation Control BIO Mitigation Measures**
	Harm from direct contact with workers and equipment or if plant fragments are left to propagate	1. Physical-Control Methods 2. Chemical-Control Methods
	Harm to sensitive habitats, plants, and wildlife species from use of herbicides	
	Beneficial	
	Physical Habitat Restoration	—
	Physical habitat restoration projects that complement flow actions (e.g., creation of floodplain and tidal shallow-water habitat) would generally be expected to improve habitat conditions for native species such as Chinook salmon and steelhead	
	Change in some habitat types from some habitat restoration projects to benefit some plant and animal species (e.g., non-tidal aquatic habitats to tidal aquatic habitats, conversion of agriculture land to native riparian habitat)	
	Improve the quality and extent of riparian habitat and wildlife access to habitat by removing invasive vegetation and substantially increasing the total riparian area	

Impact	Impact Conclusions	Proposed Mitigation
	Restoration of long stretches of riparian habitat would restore and enhance habitat for native and migratory corridor species	
	Fish Passage Improvements	—
	New or improved fish screens would reduce impingement and entrainment at diversions	
	New or improved fishways would improve passage conditions for adult Chinook salmon and steelhead and provide greater access to upstream habitat	
	TCDs would be expected to support cooler temperatures downstream of dams and thereby create migration, spawning, and rearing conditions beneficial for Chinook salmon and steelhead and other native cold water species	
	Dam removal projects would be expected to benefit anadromous salmonids by restoring access to historical habitat that is currently blocked by impassible dams	
	Predatory Fish Control	—
	Removal or modification of human-made structures may allow fish to access more and better habitat and decrease predation	
	Invasive Aquatic Vegetation Control	—
	Improved habitat for native aquatic species by allowing regrowth of native plant species and improving water quality (e.g., increasing dissolved oxygen levels)	
CULTURAL RESOURCES		
Impact CUL-a: Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5 **Impact CUL-b:** Cause a substantial adverse change in the significance of an archaeological resource	**Potentially Significant** ***Common Construction*** [a] Ground-disturbing activities, including deep excavation, could damage archaeological sites or historic built	**7.21 MM-CUL-a–d: Mitigate impacts on cultural resources** **A. Construction CUL Mitigation Measures**

Impact	Impact Conclusions	Proposed Mitigation
pursuant to § 15064.5 **Impact CUL-c:** Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature I**mpact CUL-d:** Disturb any human remains, including those interred outside of formal cemeteries	environment resources or degrade unknown buried or near-surface cultural resources Changes in topography, hydrologic patterns, and soil movement could degrade or otherwise affect near-surface archaeological or built environment resources Construction activities could alter the appearance of a historic resource from dust interacting with an object's surface, which could cause damage or chemical alteration Temporary or permanent visual obstructions from the presence of large-scale equipment, machinery, and vehicles could diminish the integrity of cultural resources Unauthorized removal or vandalism of cultural resources could occur if construction enables access to cultural sites that were not previously known or accessible Access to cultural resources during construction could be reduced and thereby prevent or impair visits to cultural resources by people with a religious or cultural connection to the resource Vegetation clearing, generation of dust, and visual obstructions from the presence of large-scale equipment, machinery, and vehicles could result in impacts on cultural resources that have an associated landscape or other visual component that contributes to their significance, such as a sacred landscape or historic trail Pile driving could cause vibration that could physically damage or alter nearby	**(CMM-CUL-a–d)** 1. Regulatory Compliance 2. Preconstruction Surveys for Historical, Archaeological, and Paleontological Resources, Cultural Landscapes, and Traditional Cultural Properties 3. Cultural Resources Management Plan 4. Unanticipated Discovery Measures 5. Oversight and Monitoring of Construction Activities 6. Worker Cultural Resources Sensitivity Training 7. Dust Control Measures (CMM-AQ-a–e: 3) 8. Construction NOI Mitigation Measures: Noise-Reduction Measures (CMM-NOI-a,b,d–f: 2) and Vibration-Reduction Measures (CMM-NOI-a,b,d–f: 3) 9. Construction Site Security Measures (CMM-HAZ-a–h: 7) 10. Construction AES Mitigation Measures: Project Siting and Design (CMM-AES-a–d: 1) and Screen Construction Areas (CMM-AES-a–d: 2)

Impact	Impact Conclusions	Proposed Mitigation
	historic built environment resources or linear features	
	Fish Passage Improvements Older structures that would be removed or modified from TCD and dam removal projects could be eligible for listing in the National Register of Historic Places or California Register of Historic Places Reservoir drawdown prior to dam removal could result in shifting, erosion, and exposure of known or as-yet-unrecorded previously submerged cultural resources or human remains **Less than Significant**	**B. Fish Passage CUL Mitigation Measures** 1. Historic Dams and Structures 2. Project Planning 3. Cultural Resources Management Plan 4. Coordination with General or Resource Management Plan 5. Human Remains
	Physical Habitat Restoration Operation of restoration areas would have a very low potential to affect cultural resources because operations would be along the riverbank and channels	—
	Invasive Aquatic Vegetation Control Operations would involve limited ground-disturbing activities and therefore would have a low potential for disturbing any known or as-yet-unrecorded cultural resources	—
ENERGY AND GREENHOUSE GAS EMISSIONS		
Impact EN-a: Adversely affect the reliability of California's electric grid **Impact EN-b:** Result in inefficient, wasteful, and unnecessary energy consumption **Impact GHG-a:** Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment	**Potentially Significant** ***Common Construction*** [a] Temporary increase in energy demand from heavy construction equipment (e.g., trucks or barges, earthmoving equipment, and power tools) for actions such as excavating, grading, transporting materials, and transporting construction workers to and from the work sites	**7.21 MM-EN-a,b/GHG-a,b: Mitigate energy and GHG emissions impacts** **A. EN/GHG Mitigation Measures (CMM-EN-b/GHG-a,b)** 1. Regulatory Compliance 2. GHG Emission Reduction Measures 3. Construction AQ Mitigation Measures: Regulatory Compliance (CMM-AQ-a–e: 1),

Impact	Impact Conclusions	Proposed Mitigation
Impact GHG-b: Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases	Generation of GHG emissions from heavy construction equipment, haul trucks, and worker vehicles Construction activities could remove vegetation that acts to sequester GHGs (e.g., trees) GHG emissions from construction could conflict with an applicable GHG plan, policy, or regulation	Emission Reduction Measures (CMM-AQ-a–e: 2), and Minimize Construction-Related Traffic and Equipment Use (CMM-AQ-a–e: 7)
	Fish Passage Improvements Removing a hydropower dam could result in increased GHG emissions from replacing the renewable source of power with a non-renewable alternate source (including GHG-emitting fossil fuels) **Less than Significant**	**B. Dam Removal EN/GHG Measures** 1. Feasibility Studies 2. Renewable Energy 3. Increase Power Generation
	Physical Habitat Restoration Periodic use of heavy equipment to replenish gravel at gravel augmentation sites	—
	Invasive Aquatic Vegetation Control Use of vehicles (e.g., chemical trucks, haul trucks, boats, and/or worker vehicles) and mechanical harvester equipment during vegetation control activities	—
	Beneficial Operation of physical habitat restoration projects could reduce net GHG emissions by establishing, restoring, and enhancing tidal and freshwater wetlands, which provide more trees and plants that sequester carbon	—

Impact	Impact Conclusions	Proposed Mitigation
GEOLOGY AND SOILS		
Impact GEO-a: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure including liquefaction, or landslides **Impact GEO-b:** Result in substantial soil erosion or the loss of topsoil **Impact GEO-c:** Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse I**mpact GEO-d:** Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property **Impact GEO-e:** Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of waste water	**Potentially Significant** Construction activities could occur in areas known to have seismic activity or experience landslides, or could be located on expansive soil or on a geologic unit or soil that is unstable or would become unstable due to construction Construction activities could occur in areas underlain by soft or loose soils, where high groundwater or seepage may be present, and on sloping grounds Ground disturbance could expose geologic materials or soil, destabilize the material, and cause soil erosion or loss of topsoil Construction activity that involves blasting could trigger landslides on unstable slopes and expose construction workers or members of the public to the risk of injury or death ***Physical Habitat Restoration*** Intended levee breaching could result in loss of topsoil and soil erosion ***Fish Passage Improvements*** Large dam removal projects could result in hillslope instability in reservoir rim areas and erosion of slope sediments during reservoir drawdown The rate of reservoir drawdown could induce potential landslides along the reservoir margins or a slope failure of an embankment dam and cause additional erosion and sedimentation downstream **Beneficial**	**7.21 MM-GEO-a–e: Mitigate geology and soils impacts** **A. Construction GEO Mitigation Measures (CMM-GEO-a–e)** 1. Regulatory Compliance 2. Project Siting and Design 3. Assurance of No Fault Traces 4. Geology and Soils Management Measures 5. Construction WQ Mitigation Measures: Regulatory Compliance (CMM-WQ-a–j: 1) and Erosion Control, Sedimentation Control, and Soil Stabilization Measures (CMM-WQ-a–j: 3) 6. Septic System Management Measures 7. Blasting Operations and Safety Plan 8. Protect Agricultural Soils (CMM-AG-a–e: 4) **B. Physical Habitat Restoration GEO Mitigation Measure** **C. Dam Removal GEO Mitigation Measures** 1. Feasibility Studies 2. Sediment Management and Monitoring Plan

Impact	Impact Conclusions	Proposed Mitigation
	Physical Habitat Restoration and Other Ecosystem Projects Planting and growth of native vegetation from habitat restoration activities and returning areas to a more natural state would decrease erosion and stabilize soils Enhanced in-channel projects designed to restore degraded rivers include bank stabilization measures that could reduce erosion	—
HAZARDS AND HAZARDOUS MATERIALS		
Impact HAZ-a: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials **Impact HAZ-b:** Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment **Impact HAZ-c:** Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school **Impact HAZ-d:** Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment **Impact HAZ-e:** For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area **Impact HAZ-f:** For a project within the vicinity of a private airstrip, would the project result in a safety	**Potentially Significant** ***Common Construction*** [a] Accidental release of hazardous materials from construction activities requiring the transport, use, or disposal of hazardous materials (e.g., fuel, motor oil, hydraulic fluid, solvents, cleaners, sealants, welding flux, paint, paint thinner) Safety hazards could occur from rock thrown and scattered from use of explosives Exposure to or the spread of toxic chemicals from excavation during construction that disturb areas with existing soil or groundwater contamination (i.e., asbestos or lead-based paint from existing building materials or stored liquid paints, solvents, and household or industrial-strength maintenance chemicals and cleaners) Underground infrastructure (e.g., natural gas pipelines, utility lines) within a project area could be encountered during excavation and could result in hazards to the public or environment if damaged	**7.21 MM-HAZ-a–h: Mitigate hazards and hazardous materials impacts** **A. Construction HAZ Mitigation Measures (CMM-HAZ-a–h)** 1. Measures for Transport, Use, or Disposal of Hazardous Materials 2. Project Siting 3. Demolition Measures 4. Herbicide and Pesticide Use 5. Hazardous Materials and Work Site Safety Training 6. Emergency Response Plan 7. Construction Site Security 8. Construction near Airports 9. Fire Prevention and Management Plan 10. Asbestos Control Measures (CMM-AQ-a–e: 5) 11. Valley Fever Control Measures (CMM-AQ-a–e: 4) 12. Blasting Operations and Safety Plan (CMM-GEO-a–e: 7) 13. Septic System Management Measures (CMM-

Impact	Impact Conclusions	Proposed Mitigation
hazard for people residing or working in the project area **Impact HAZ-g:** Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan **Impact HAZ-h:** Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands	Disturbance of soils containing *Coccidioides* spores may expose workers and people adjacent to construction sites to these fungal spores in fugitive dust Accidental hazardous materials spills from airborne materials (e.g., gases, asbestos particles) or through ignition of flammable liquids or vapors during construction activities could occur within 0.25 mile of a school Impairment of emergency response services' access or interfering with emergency evacuation by rerouting traffic during construction and increased need for emergency service providers during construction due to accidental releases of hazardous materials, work site fires, and vehicular accidents due to construction-related changes in traffic Wildfire risk from the use of electrical or gas-powered equipment, flammable materials (e.g., fuels, solvents), and/or explosives during construction Safety hazards from project components, such as buildings or construction equipment, that encroach on airspace of airport runways Stagnant water present in construction areas during the wet season could create new disease vector habitat (i.e., mosquito habitat) that require application of pesticides Faulty installation or inadequate operation and maintenance of underground or aboveground storage tanks for bulk fuel storage may result in surface water and groundwater contamination, the potential	GEO-a–e: 6) 14. Mosquito Control Measures 15. Installation and Operation of Underground and Aboveground Storage Tanks 16. Installation and Maintenance of Plumbing in Public Restrooms

Impact	Impact Conclusions	Proposed Mitigation
	for fire and explosion, exposure of the public to raw sewage, and daylighting of wastewater at the ground surface	
	Physical Habitat Restoration	**B. Physical Habitat Restoration HAZ Mitigation Measures**
	Exposure of application crews and the public to toxic chemicals from accidental release or improper use or storage of herbicides	1. Herbicide Application Control Measures 2. Mosquito Abatement Control Measures
	Increase in transmission of mosquito-borne diseases (e.g., West Nile virus) and application of pesticides from creating favorable conditions to mosquitos	3. Mitigate Potential Impacts on Air Traffic Safety 4. Wildfire Prevention Plan
	Restoration of floodplain, riparian, and tidal habitat in proximity to existing airport flight zones could increase bird-aircraft strikes	5. Roadway Detour Plan (7.21 MM-TRA-a,b,d–f: B1) 6. Physical Habitat Restoration WQ Mitigation Measures (7.21 MM-WQ-a–j: E)
	Increase in vegetation could cause an increase in the risk of wildland fire by increasing the fuel load	
	Wildfire risk could increase due to an increased number of cars and people visiting larger habitat restoration projects	
	Fish Passage Improvements	**C. Fish Passage Improvements HAZ Mitigation Measure**
	Thermal curtains and associated structures could pose a physical safety hazard (e.g., collision) to recreationists in the vicinity of TCDs	1. Signage and Buoys for Temperature Control Curtains
	Remaining portions of a dam after dam removal could represent hazards to the public	**D. Dam Removal HAZ Mitigation Measures** 1. Project Planning 2. Hazardous Materials Management Plan
	Construction-related traffic could cause hazards on existing transportation infrastructure (e.g., roadways, bridges, and culverts) en route to a dam removal site	3. Dam Removal WQ Mitigation Measures (7.21 MM-WQ-a–j: G) 4. Fire Management Plan
	Demolition and disposal of structures containing hazardous materials such as	

Impact	Impact Conclusions	Proposed Mitigation
	lead, asbestos, treated wood, coating contaminants (e.g., lead-based paint), batteries, chemicals, petroleum products, PCBs, and mercury could result in hazards to the public or the environment through accidental release Dust from drilling and cutting into large quantities of concrete during construction activities could pose a hazard to the public or the environment Additional traffic from commuting workers, hauling of large equipment, and disposal of wastes during construction could temporarily result in interference with an adopted emergency response plan or emergency evacuation Removal of reservoirs could increase the public's risk of loss, injury, or death associated with wildfires if other sources of water or means of fire suppression are not readily available; and increase a source of wildfire fuel in the form of dead trees and other vegetation around the former reservoir shoreline	
	Predatory Fish Control Electrofishing operations, if not implemented safely, could result in electrocution of nearby swimmers	**E. Predatory Fish Control HAZ Mitigation Measure** 1. Electrofishing Safety Best Management Practices
	Invasive Aquatic Vegetation Control Exposure of application crews and the public to toxic chemicals from accidental release or improper use of herbicides	**F. Invasive Aquatic Vegetation Control BIO Mitigation Measures** for chemical control (7.21 MM-BIO-a–f: G2)
HYDROLOGY & WATER QUALITY—SURFACE WATER AND GROUNDWATER		
Impact WQ-a: Violate any water quality standards or waste discharge requirements **Impact WQ-b:** Substantially deplete groundwater	**Potentially Significant** ***Common Construction*** [a] Construction could contribute polluted	**7.21 MM-WQ-a–j: Mitigate impacts on hydrology and water quality**

Impact	Impact Conclusions	Proposed Mitigation
supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted) **Impact WQ-c:** Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site **Impact WQ-d:** Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site **Impact WQ-e:** Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff **Impact WQ-f:** Otherwise substantially degrade water quality **Impact WQ-g:** Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map **Impact WQ-h:** Place within a 100-year flood hazard area structures which would impede or redirect flood flows **Impact WQ-i:** Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam **Impact WQ-j:** Inundation by seiche, tsunami, or	runoff and sediment to nearby water bodies In-water construction can cause temporary sediment disturbance and resuspension, which may cause increased turbidity, siltation, and bioavailability of sediment-associated pollutants Accidental release of pollutants that could enter storm drains or streams; pollutants include petroleum products (e.g., fuel, oil, grease from vehicles and equipment), paving materials (e.g., concrete and asphalt), other materials used or stored on site (e.g., paint, adhesives, and solvents), and project waste (e.g., litter, debris, hazardous and liquid waste) Use of herbicides to control invasive plant species could affect water quality and violate water quality standards if improperly applied or stored Faulty installation or inadequate operation and maintenance of underground or aboveground storage tanks for bulk fuel storage may result in surface water and groundwater contamination and release of raw sewage, which could affect groundwater and surface water quality Improper siting of septic systems could result in adverse water quality effects Localized degradation of groundwater quality could result from temporary, short-term constructions activities Blasting, saw-cutting, and hydraulic hammering could release concrete and other particles into surface waters, which could violate water quality standards and/or affect aquatic resources	**A. Construction WQ Mitigation Measures (CMM-WQ-a–j)** 1. Regulatory Compliance 2. Project Siting and Design 3. Erosion Control, Sedimentation Control, and Soil Stabilization Measures 4. Waste Management and Material Control Measures 5. In-Water Placement of Materials, Structures, and Operation of Equipment 6. Stream-Crossing, Culvert, and Bridge Projects 7. Groundwater Protection Measures 8. Drainage and Flood Protection Measures 9. Construction GEO Mitigation Measures: Blasting Operations and Safety Plan (CMM-GEO-a–e: 7) and Septic System Management Measures (CMM-GEO-a–e: 6) 10. Construction BIO Mitigation Measures (CMM-BIO-a–f) 11. Construction HAZ Mitigation Measures: Herbicide and Pesticide Use (CMM-HAZ-a–h: 4), Installation and Operation of Underground and Aboveground Storage Tanks (CMM-HAZ-a–h: 15), and Installation and Maintenance of Plumbing in Public Restrooms (CMM-HAZ-a–h: 16) **B. Approval by State and Federal Fisheries, Flood-Control, and Water Resources Agencies** **C. Project Siting and Design of Habitat Restoration and Other Ecosystem Projects** **D. Waste Discharge Requirements**

Impact	Impact Conclusions	Proposed Mitigation
mudflow	Construction activities may lower local groundwater through dewatering; dewatered groundwater of poor quality could increase turbidity, dissolved solids, nutrients, metals, or other constituents if discharged to a surface waterway Construction could substantially alter drainage patterns of a project site and thereby cause erosion, siltation, or flooding on site or off site Construction activities could change the on-site land slopes across which drainage flows, which could alter the flow rates, directions, water surface elevations, or velocities of runoff that enters or originates on the construction site Activities such as grading, vegetation removal, soil compacting, and paving could increase land surface imperviousness and affect water quality by creating surfaces where pollutants (e.g., petroleum products from vehicles) can accumulate and later be washed into waterways Project sites may be located within a 100-year flood hazard area or in areas subject to inundation by seiche, tsunami, or mudflow	
	Physical Habitat Restoration Geomorphic changes from habitat restoration could increase long-term rates of erosion or sedimentation Placement of fill and gravel has the potential to release turbidity and existing contaminants from in-channel sediment into the water column Increased turbidity and release of contaminants from gravel mining in or near streams	**E. Physical Habitat Restoration WQ Mitigation Measures** 1. Restoration Strategy 2. Adaptive Management 3. Levee Protection 4. Dredging Plan 5. Minimize Impacts on Infrastructure 6. Contaminant Evaluation 7. Monitor Groundwater Levels

Impact	Impact Conclusions	Proposed Mitigation
	Habitat restoration projects could alter the existing drainage pattern of the site or area and, if improperly designed, alter hydrology and/or increase erosion and sedimentation Possible exceedance of sediment and turbidity objectives from large-scale restoration projects Operation of habitat restoration projects (i.e., tidal, floodplain, riparian) could direct water through restoration areas with contaminated soils and organic material Altered salinity from tidal restoration Formation of harmful algal blooms from algae produced at restoration project sites Mobilized potentially contaminated sediment from dredging activities Potential to increase methylmercury formation or temperature effects from increased floodplain inundation	8. Gravel Augmentation WQ Mitigation Measures 9. Harmful Algal Bloom Mitigation 10. Approval by State and Federal Fisheries, Flood-Control, and Water Resources Agencies (7.21 MM-WQ-a–j: B) 11. Project Siting and Design of Habitat Restoration and Other Ecosystem Projects (7.21 MM-WQ-a–j: C) 12. Waste Discharge Requirements (7.21 MM-WQ-a–j: D)
	Fish Passage Improvements Fishways aligned in a straight line without bends have high velocities down the center at moderate to high flows, which can cause erosion downstream of the fishway if the channel is narrow or if the fishway is aligned toward a bank TCDs could change the distribution of water temperature in reservoirs and dissolved oxygen concentration of water discharged downstream Increased sediment, contaminants (e.g., PCBs, chlorinated pesticides, mercury), erosion, turbidity, and reduction in dissolved oxygen levels downstream from dam removal Decrease of groundwater levels and a corresponding decrease in production rates	**F. Fish Passage WQ Mitigation Measures** 1. Consultation with Fish and Wildlife Agencies 2. Fish Passage BIO Mitigation Measures (7.21 MM-BIO-a–f: D) 3. Approval by State and Federal Fisheries, Flood-Control, and Water Resources Agencies (7.21 MM-WQ-a–j: B) 4. Project Siting and Design of Habitat Restoration and other Ecosystem Projects (7.21 MM-WQ-a–j: C) 5. Waste Discharge Requirements (7.21 MM-WQ-a–j: D) **G. Dam Removal WQ Mitigation Measures** 1. Project Planning 2. Regulatory Compliance

Impact	Impact Conclusions	Proposed Mitigation
	in some existing wells from dam removal Changes to the downstream channel geometry, reduction of conveyance capacity, or destabilized infrastructure after increase in deposition and erosion from dam removal Substantial increase in flood flows and release of sediments from dam removal Short-term increase flooding from reservoir drawdown and dam removal Long-term changes in water quality from removal of a barrier An increase in the 100-year floodplain from removal of a large dam or reservoir	3. Sediment Management and Monitoring Plan 4. Revegetation Plan 5. Dam Removal BIO Mitigation Measures (7.21 MM-BIO-a–f: E) 6. Dam Removal HAZ Mitigation Measures (7.21 MM-HAZ-a–h: D) 7. Dam Removal GEO Mitigation Measures (7.21 MM-GEO-a–e: C) 8. Control Concrete Dust (7.21 MM-AQ-a–e: C1) 9. Flood Control Measures 10. Performance Monitoring and Adaptive Management 11. Approval by State and Federal Fisheries, Flood-Control, and Water Resources Agencies (7.21 MM-WQ-a–j: B) 12. Project Siting and Design of Habitat Restoration and other Ecosystem Projects (7.21 MM-WQ-a–j: C) 13. Waste Discharge Requirements (7.21 MM-WQ-a–j: D)
	Invasive Aquatic Vegetation Control Disturbance of channel substrate, increase in surface water turbidity, and low dissolved oxygen from mechanical plant removal Direct water quality effects from use of herbicides **Less than Significant**	**H. Invasive Aquatic Vegetation Control WQ Mitigation Measures** 1. Reduce Dead Vegetation in Channel 2. Limit Herbicide Use in Water
	Predatory Fish Control Substrate disturbance from direct predatory fish removal methods (e.g., setting up/retrieving nets or traps)	—

Impact	Impact Conclusions	Proposed Mitigation
	Beneficial	
	Physical Habitat Restoration	—
	Physical habitat restoration projects would provide increased quality and availability of native habitat (e.g., floodplain habitat) that, in combination with a more natural flow regime, would be expected to benefit native species and ecosystems	
	Riparian and floodplain restoration projects could increase groundwater recharge	
	Restoration projects that support native vegetation benefits water quality by filtering and retaining sediment, nutrients, and some pollutants	
	Increased riparian vegetation, particularly riparian trees, provide shade that can reduce water temperature	
	Large restoration projects could provide additional flood storage space and reduce flood stage in the main waterway	
	Fish Passage Improvements	
	New or improved fish screens would reduce impingement and entrainment at diversions	
	Fishways would improve passage conditions for adult Chinook salmon and steelhead and provide greater access to upstream habitat	
	TCDs would be expected to support cooler temperatures downstream of dams and thereby create migration, spawning, and rearing conditions beneficial for Chinook salmon and steelhead and other native cold water species	

Impact	Impact Conclusions	Proposed Mitigation
	Dam removal projects would be expected to benefit anadromous salmonids by restoring access to historical habitat that is currently blocked by impassible dams ***Invasive Aquatic Vegetation Control*** Invasive aquatic vegetation control efforts can benefit water quality by removing hyacinth and Brazilian waterweed, which clog waterways, increase sedimentation, reduce turbidity, and create low dissolved oxygen conditions	
LAND USE AND PLANNING		
Impact LU-a: Physically divide an established community **Impact LU-b:** Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect **Impact LU-c:** Conflict with any applicable habitat conservation plan or natural community conservation plan	**Potentially Significant** ***Common Construction*** [a] Temporary effects on existing land uses from activities such as ground clearing, increased traffic, noise, dust, and human activity, as well as by changes in the visual landscape Construction may temporarily physically divide an established community primarily by cutting off access to roadways or bridges Siting permanent facilities within an established community (e.g., distribution pipelines and other infrastructure) could create physical barriers that could divide the community Siting and construction could result in a permanent change in land use that could conflict with land use plans, policies, or regulations, depending on the location, configuration, and magnitude of the project ***Physical Habitat Restoration*** Projects could include actions, such as levee breaching and road removal, that could isolate communities from services and	**7.21 MM-LU-a,b: Mitigate land use impacts** **A. Construction LU Mitigation Measures (CMM-LU-a–c)** 1. Regulatory Compliance 2. Project Siting and Design 3. Traffic Management Plan (CMM-TRA-a,b,d–f: 3) **B. Physical Habitat Restoration LU Mitigation Measures** 1. Project Siting and Design

Impact	Impact Conclusions	Proposed Mitigation
	markets or cut off access to properties Some habitat restoration projects could be incompatible with land use designations, such as plans with exclusive agricultural designations	2. Develop New Habitat on Public Lands 3. Compensate for Loss or Reduction in Environmental Value
	Fish Passage Improvements Removal of dams could physically divide communities; new land use and zoning designations may need to be determined for areas previously inundated by the reservoirs	**C. Dam Removal LU Mitigation Measures** 1. Feasibility Study 2. Minimize Community Disruption Due to Hauling/Disposing of Construction Waste 3. Dam Removal TRA Mitigation Measures (7.21 MM-TRA-a,b,d–f: C) 4. Dam Removal REC Mitigation Measures (7.21 MM-REC-a,b: C)
MINERAL RESOURCES		
Impact MIN-a: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state **Impact MIN-b:** Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan	**Potentially Significant** ***Common Construction*** [a] Construction activities could occur in areas with active natural gas, oil, or aggregate production or with the potential to contain untapped reserves of those resources and restrict access Construction demand for aggregate and/or cement for construction projects could exceed local supplies	**7.21 MM-MIN-a,b: Mitigate impacts on mineral resources** **A. Construction MIN Mitigation Measures (CMM-MIN-a,b)** 1. Project Siting and Design 2. Aggregate Use 3. Access to Extraction Sites 4. Implement the California Department of Conservation's Geologic Energy Management Division's (CalGEM) Recommendations
	Less than Significant ***Physical Habitat Restoration*** Depletion of mineral resources (specifically aggregate) from gravel augmentation would not be substantial	—

Impact	Impact Conclusions	Proposed Mitigation
NOISE		
Impact NOI-a: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies **Impact NOI-b:** Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels **Impact NOI-d:** A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project **Impact NOI-e:** For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels **Impact NOI-f:** For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels	**Potentially Significant** ***Common Construction*** [a] Construction would result in temporary noise and groundborne vibration from the use of heavy construction equipment (e.g., excavators, bulldozers, pile drivers, jackhammers), drilling, and blasting Noise-sensitive receptors may be exposed to noise levels in excess of established standards or to a substantial increase in ambient noise Project sites may be located near a public or private airport or airstrip and temporarily expose construction crew to excessive noise levels	**7.21 MM-NOI-a,b,d–f: Mitigate noise and vibration impacts** **A. Construction NOI Mitigation Measures (CMM-NOI-a,b,d–f)** 1. Regulatory Compliance 2. Noise-Reduction Measures 3. Vibration-Reduction Measures 4. Blasting Operations and Safety Plan (CMM-GEO-a–e: 7) 5. Construction near Airports (CMM-HAZ-a-h: 8)
	Less than Significant ***Predatory Fish Control*** Nets or other entrapment devices set up or use of boats for capture by fish trawl nets	—
	Invasive Aquatic Vegetation Control Mechanical harvester or herbicide application by aircraft would be intermittent and of short duration	—
Impact NOI-c: A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project	**Less than Significant** ***Physical Habitat Restoration and Other Ecosystem Projects*** Long-term operation and maintenance may include occasional repair activities and vehicular trips for periodic inspections, monitoring, and evaluation, which would not create or expose people to an excessive or substantial permanent increase in noise or vibration	—

Impact	Impact Conclusions	Proposed Mitigation
POPULATION AND HOUSING		
Impact POP-a: Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure) **Impact POP-b:** Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere **Impact POP-c:** Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere	**No Impact** ***Physical Habitat Restoration and Other Ecosystem Projects*** Habitat restoration and other ecosystem projects would not involve construction of new homes or businesses, extension of roads, other infrastructure, or other actions that may directly or indirectly induce substantial population growth in an area	—
PUBLIC SERVICES		
Impact PS-a: Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services: fire protection, police protection, schools, parks, or other public facilities	**Less than Significant** Physical habitat restoration and other ecosystem projects facilities would not result in increases in housing or in population and therefore would not create a need for additional schools, parks, or other public facilities Construction activities could result in temporary, short-term increased response times for fire, police, and other emergency responders due to increased construction traffic and potential road closures and detours Construction activities could result in temporary increases in the number of fire, police, or emergency medical provider service calls in the vicinity of work sites related to emergencies related to construction; but calls are not expected to be large enough or frequent enough to affect response times beyond the regular variation experienced by providers of emergency services	—

Impact	Impact Conclusions	Proposed Mitigation
RECREATION		
Impact REC-a: Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated **Impact REC-b:** Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment	**Potentially Significant** ***Common Construction*** [a] Recreationists could be affected by construction-related traffic, visual impacts, water quality effects, noise, fugitive dust, and exhaust emissions from heavy equipment; restricted access to recreational facilities could result in physical deterioration of alternative locations and facilities	**7.21 MM-REC-a,b: Mitigate impacts on recreation** **A. Construction REC Mitigation Measures (CMM-REC-a,b)** 1. Project Siting and Design 2. Maintain Access to Existing Recreational Facilities during Construction 3. Coordinate with Public and Private Recreation Providers 4. Rehabilitate or Restore Degraded Recreational Facilities or Provide Replacement Recreational Facilities 5. Construction AES Mitigation Measures (CMM-AES-a-d) 6. Construction AQ Mitigation Measures (CMM-AQ-a-e) 7. Construction WQ Mitigation Measures (CMM-WQ-a-j) 8. Construction NOI Mitigation Measures (CMM-NOI-a,b,d-f) 9. Construction TRA Mitigation Measures (CMM-TRA-a,b,d-f)
	Physical Habitat Restoration Habitat restoration projects that require levee breaching, construction of setback levees, and floodplain expansion could adversely affect marinas and other land-based recreational facilities and infrastructure Permanent removal of marinas and other recreation facilities and infrastructure could displace recreationists to other	**B. Physical Habitat Restoration REC Mitigation Measures** 1. Project Siting and Design 2. Compensation for Unavoidable Long-Term Impacts

Impact	Impact Conclusions	Proposed Mitigation
	locations	
	Fish Passage Improvements	**C. Dam Removal REC Mitigation Measures**
	Dam removal projects could result in the long-term loss of existing opportunities for reservoir-based recreation activities and could affect flow-dependent activities such as whitewater rafting in river reaches downstream of a reservoir's removal location	1. Project Planning 2. Coordination with Public Recreation Providers 3. Compensate for Impacts on Recreational Facilities
	Dam removal projects could displace recreationists to other locations	
	Less than Significant	
	Fish Passage Improvements	—
	Increases in turbidity during reservoir drawdown and sediment flushing periods could temporarily reduce visibility for boaters, swimmers, and fisherpersons	
	The placement of certain types of TCDs (e.g., a thermal curtain) in a reservoir could result in a reduction in reservoir area that would otherwise be available for recreational users	
	Predatory Fish Control	—
	Removal of recreational and sport fish from rivers could result in a reduction in recreational and sport fishing opportunities	
	Removal or modification of structures that provide types of recreational opportunities, such as a small, abandoned dam that creates a swimming hole, could displace recreationists to other areas suitable for swimming	

Impact	Impact Conclusions	Proposed Mitigation
	Beneficial	
	Physical Habitat Restoration	—
	Habitat restoration projects would generally be expected to improve conditions for native fish, resulting in improved fishing opportunities for native species	
	Floodplain restoration projects could provide improved habitat for both wetland and upland game species, which would provide improved hunting and birdwatching opportunities for recreationists	
	Riparian restoration and enhanced in-channel complexity projects could provide improved canoeing and kayaking opportunities by creating a more natural, varied, and dynamic riverine setting in some locations. Large restoration projects could include interpretive facilities or signage related to the ecological history and restoration of the site, which would enhance the recreational experience in the long term	
	Removal of thick aquatic vegetation may allow increased boat access to areas that previously were not accessible	
TRANSPORTATION AND TRAFFIC		
Impact TRA-a: Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to intersections, streets, highways and freeways,	**Potentially Significant**	
	Common Construction [a]	**7.21 MM-TRA-a,b,d–f: Mitigate transportation impacts**
	Construction activities could result in temporary and short-term increases in traffic due to additional vehicles (e.g., construction vehicles, construction workers' personal vehicles) on roads near project sites and relocating roads, which	**A. Construction TRA Mitigation Measures (CMM-TRA-a,b,d–f)** 1. Regulatory Compliance 2. Avoid and Minimize Interference with

Impact	Impact Conclusions	Proposed Mitigation
pedestrian and bicycle paths, and mass transit **Impact TRA-b:** Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways **Impact TRA-d:** Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment) **Impact TRA-e:** Result in inadequate emergency access **Impact TRA-f:** Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities	would cause new rerouted traffic at an intersection not designed to accommodate additional traffic Construction activities may result in degradation of roads from haul trucks or trips required for fill transport Temporary relocation, closure, or complete removal of existing bicycle and pedestrian paths and trails could occur during construction Projects requiring in-channel construction activities could temporarily obstruct boat navigation and cause boat traffic delays; construction equipment, such as dredges and cofferdams, could temporarily obstruct boat traffic Construction projects may result in roads being temporary blocked, rerouted, or altered, which could affect emergency access Permanent relocation of road segments could require changes that could increase or introduce a hazard to vehicles traveling on that segment	Transportation Networks 3. Traffic Management Plan 4. Restore Damaged Transportation Facilities 5. Waterway Traffic Control Plan 6. Road and Bridge Design
	Physical Habitat Restoration Larger habitat restoration projects, including floodplain restoration, could result in inundation of roads that could impede use and cause traffic congestion at intersections or on certain roadway segments	**B. Physical Habitat Restoration TRA Mitigation Measures** 1. Roadway Detour Plan 2. Protection of Rail Lines
	Fish Passage Improvements Construction-related traffic from dam removal projects may affect local residential and recreational traffic; existing transportation infrastructure (e.g., roadways, bridges, culverts) en route to the	**C. Dam Removal TRA Mitigation Measures** 1. Project Planning 2. Road Design 3. Dam Removal WQ Mitigation Measures, including incorporation of any special

Impact	Impact Conclusions	Proposed Mitigation
	dam sites may require improvements over their current conditions Removal of dams that provide river crossings may require construction of a new bridge to meet local traffic demands upon its removal	accommodations for road infrastructure into engineering designs (7.21 MM-WQ-a–j: G1) 4. Dam Removal LU Mitigation Measures, including the consideration of transportation in feasibility studies on existing and future land use designations once the dam is removed (7.21 MM-LU-a,b: C1) 5. Dam Removal REC Mitigation Measures, including the consideration of transportation impacts and needs associated with recreation facilities (7.21 MM-REC-a,b: C)
	Less than Significant	
	Invasive Aquatic Vegetation Control Invasive aquatic vegetation would result in a few limited additional vehicle trips associated with a relatively small number of workers commuting to sites Neither chemical nor mechanical invasive aquatic vegetation control would substantially increase transportation hazards or result in inadequate emergency access	—
Impact TRA-c: Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks	**No Impact**	
	Physical Habitat Restoration and Other Ecosystem Projects Habitat restoration and other ecosystem projects would not result in a change in air traffic patterns because no airport facilities are proposed, and there would be no increase in demand for air travel as a result of implementing these types of projects	—

Impact	Impact Conclusions	Proposed Mitigation
UTILITIES AND SERVICE SYSTEMS		
Impact UT-a: Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board **Impact UT-f:** Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs **Impact UT-g:** Comply with federal, state, and local statutes and regulations related to solid waste	**Potentially Significant** ***Common Construction*** [a] Construction sites could generate stormwater runoff that discharges sediment and other pollutants Wastewater from construction could include wastewater from sanitation facilities used by construction crews or wastewater generated directly from construction-related activities Construction activities require water supply for construction workers on site, manufacture and curing of concrete and mortar, testing for waterproofing, cleaning, dust control, and other activities Construction of facilities could temporarily increase the volume of solid waste (e.g., soil, vegetative material, construction debris) disposed of at landfills Construction activities could temporarily disrupt existing electric and natural gas utilities and telecommunication lines and damage utility poles or snag suspended utility lines ***Fish Passage Improvements*** Dam removal projects could affect public utilities if water pipelines or electrical transmission lines cross the dam or reservoir or by the loss of a source of hydroelectric power Dam removal would generate substantial volumes of solid waste, including excavated material and demolition debris (e.g., concrete, treated wood, other waste), that would require landfill disposal	**7.21 MM-UT-a,f,g: Mitigate impacts on utilities and service systems** **A. Construction UT Mitigation Measures (CMM-UT-a,f,g)** 1. Wastewater Control Measures 2. Water Supply 3. Nonhazardous Solid Waste Disposal 4. Utility Services **B. Dam Removal UT Mitigation Measures** 1. Feasibility Study 2. Dam Removal WQ Mitigation Measures (7.21 MM-WQ-a–j: G) 3. Solid Waste Disposal

Impact	Impact Conclusions	Proposed Mitigation
Impact UT-b: Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects **Impact UT-c:** Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects **Impact UT-d:** Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed **Impact UT-e:** Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments	**Less than Significant** ***Physical Habitat Restoration and Other Ecosystem Projects*** Physical habitat restoration and other ecosystem projects would not require the construction of new or expanded wastewater treatment facilities or result in the determination of a wastewater treatment provider that there is inadequate capacity to serve the projects because these projects would not discharge wastewater Physical habitat restoration and other ecosystem projects would not require construction of new storm water drainage facilities or expansion of existing facilities Some habitat restoration projects could initially require a water supply for newly planted vegetation once construction is completed or for temporary irrigation needs in dry years until vegetation is sufficiently established	—

[a] Predatory fish control using capture methods and invasive aquatic vegetation control do not involve construction and therefore would not result in potentially significant impacts from construction.

BMP = best management practices; CALGEM = California Department of Conservation's Geologic Energy Management Division; CDFW = California Department of Fish and Wildlife; GHG = greenhouse gas; HCP = habitat conservation plan; NCCP = natural community conservation plan; NMFS = National Marine Fisheries Service; PCBs = polychlorinated biphenyls; TCD = temperature control device.

Table 13.7.22-3. Impact and Mitigation Measure Summary— New or Modified Facilities

Impact	Impact Conclusions	Proposed Mitigation
AESTHETICS		
Impact AES-a: Have a substantial adverse effect on a scenic vista **Impact AES-b:** Substantially damage scenic resources, including, but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway **Impact AES-c:** Substantially degrade the existing visual character or quality of the site and its surroundings **Impact AES-d:** Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area	**Potentially Significant** ***Common Construction*** Construction may physically damage scenic resources, introduce large construction equipment, remove vegetation, stockpile materials, create dust, or add new sources of lighting and glare Permanent installation of artificial elements (e.g., riprap), solar panels, and/or security and safety lighting	**7.22 MM-AES-a–d: Mitigate impacts on visual resources** **A. Construction AES Mitigation Measures (CMM-AES-a–d):** 1. Project Siting and Design 2. Screen Construction Areas 3. Spoil Disposal Areas 4. Dust Control Measures (CMM-AQ-a–e: 3) 5. Waste Management and Material Control Measures (CMM-WQ-a–j: 4) 6. Light and Glare Minimization 7. Construction BIO Mitigation Measures: Avoid Vegetation Disturbance (CMM-BIO-a–f: 9), Revegetation Plan (CMM-BIO-a–f: 11) and Revegetation Monitoring and Reporting (CMM-BIO-a–f: 12)
	Reservoirs and Points of Diversion On-stream reservoirs could flood land and convert natural river canyon scenery to lacustrine scenery affecting a scenic vista, damaging scenic resources, or degrading the visual character or quality of the site Flooding farmland or other land cover types could affect a scenic vista, damage scenic resources, or degrade the visual character or quality of the site Introducing new permanent facilities (e.g., pump houses, spillways, power generation facilities), installation of artificial elements (e.g., riprap), buildings and other structures	**B. Reservoirs and Points of Diversion AES Mitigation Measures** 1. Project Planning 2. Project Siting 3. Project Design

Impact	Impact Conclusions	Proposed Mitigation
	(e.g., transmission lines), and roads could affect scenic and visual quality	
	Groundwater Wells and Groundwater Storage and Recovery	**A. Construction AES Mitigation Measures (CMM-AES-a–d)**
	Well siting could change the visual quality or character of an urban or suburban area and introduce new sources of light or glare	**C. Water Treatment Facilities AES Mitigation Measures** 1. Project Siting (7.22 MM-AES-a–d: C2) 2. Project Design (7.22 MM-AES-a–d: C3)
	Water Treatment Facilities	**C. Water Treatment Facilities AES Mitigation Measures**
	Introducing new or expanded built facilities (e.g., large buildings, water conveyance infrastructure) to an area could affect the existing visual character and quality	1. Project Planning 2. Project Siting 3. Project Design
	Other Construction Projects	**A. Construction AES Mitigation Measures (CMM-AES-a–d)**
	Canal lining or encasement projects could result in permanent landscape-level changes to the visual environment	
	Less than Significant	
	Water Treatment Facilities	—
	Modified water treatment facilities, including water recycling treatment plants, would be less likely to have long-term impacts on the visual character or quality of an area because these facilities would be located adjacent to existing infrastructure and/or within or adjacent to existing facilities	
AGRICULTURE AND FOREST RESOURCES		
Impact AG-a: Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring	**Potentially Significant**	
	Common Construction	**7.22 MM-AG-a–e: Mitigate impacts related to agriculture and forest resources**
	Construction activities could remove vegetation and/or topsoil; introduce	**A. Construction AG Mitigation Measures**

Impact	Impact Conclusions	Proposed Mitigation
Program of the California Resources Agency, to nonagricultural use **Impact AG-b:** Conflict with existing zoning for agricultural use or conflict with a Williamson Act contract **Impact AG-c:** Conflict with existing zoning for, or cause rezoning of forest land (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g)) **Impact AG-d:** Result in the loss of forest land or conversion of forest land to non-forest use **Impact AG-e:** Involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland to non-agricultural use or conversion of forest land to non-forest use	invasive weeds; restrict access to or interfere with use of agricultural land; disturb utilities and infrastructure serving agriculture; and disturb soil in development footprints, borrow/spoils areas, or staging areas (e.g., soil compaction resulting from heavy equipment storage or soil stockpiling) Agricultural or forested areas cleared for buildings and other facilities (e.g., power supply facilities), roads, and other project features could result in direct permanent conversion of important farmland, conflict with agricultural zoning or Williamson Act-contracted land, result in loss or conversion of forest land, or conflict with existing zoning for forest land or timberland	**(CMM-AG-a–e)** 1. Project Siting and Design 2. Invasive Species Control Measures 3. Post-Construction Best Management Practices 4. Protect Agricultural Soils 5. Agricultural Mitigation Consistent with County and Local Jurisdiction Requirements 6. Avoid or Minimize Impacts on Forest and Timberland
	Reservoirs and Points of Diversion Filling a new reservoir or expanding an existing reservoir footprint could permanently convert important farmland or forest land, conflict with agricultural zoning or Williamson Act-contracted land, or conflict with existing zoning for forest land or timberland land if the reservoir was sited in whole or part on these land types	**A. Construction AG Mitigation Measures (CMM-AG-a–e)**
	Beneficial ***New or Modified Facilities*** Reservoirs and points of diversion, groundwater wells, groundwater storage and recovery projects, and water treatment facilities could support the continued use of agricultural land by supplying irrigation water, and to make water delivery more accessible and efficient	—

Impact	Impact Conclusions	Proposed Mitigation
AIR QUALITY		
Impact AQ-a: Conflict with or obstruct implementation of the applicable air quality plan **Impact AQ-b:** Violate any air quality standard or contribute substantially to an existing or projected air quality violation **Impact AQ-c:** Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors) **Impact AQ-d**: Expose sensitive receptors to substantial pollutant concentrations **Impact AQ-e:** Create objectionable odors affecting a substantial number of people	**Potentially Significant** ***Common Construction*** Construction activities could generate fugitive dust and emissions from fuel combustion of heavy construction equipment and vehicles Inadvertent dispersal of *Coccidioides* spores (responsible for Valley Fever) and asbestos into the environment	**7.22 MM-AQ-a–e: Mitigate impacts on air quality** **A. Construction AQ Mitigation Measures (CMM-AQ- a–e)** 1. Regulatory Compliance 2. Emissions Reductions Measures 3. Dust Control Measures 4. Valley Fever Control Measures 5. Asbestos Control Measures 6. Health Risk Assessment 7. Minimize Construction-Related Traffic and Equipment Use 8. Blasting Operations and Safety Plan (CMM-GEO-a–e: 7) for fugitive dust control
	Reservoirs and Points of Diversion Substantial particulate emissions from use of heavy construction equipment and vehicles, blasting activities, and from removal of soil spoils Operation of recreational facilities associated with the new reservoir could result in generation of emissions from vehicle trips and motorized recreational vehicles (e.g., boats and jet skis)	**B. Reservoirs and Points of Diversion AQ Mitigation Measures** 1. Site-Specific Dust Control Plan 2. Recreational Boat Emissions Minimization Plan 3. Offset Criteria Pollutant Emissions Generated from Recreational Boating
	Water Treatment Facilities Operation of new wastewater treatment plants could result in new source of odors	**C. Water Treatment Facilities AQ Mitigation Measures** 1. Regulatory Compliance (7.22 MM-WQ-a–j: D1) 2. Odor Management Plan

Impact	Impact Conclusions	Proposed Mitigation
	Less than Significant	
	Reservoirs and Points of Diversion	—
	Odors produced by harmful algal blooms (HABs) in new reservoirs	
	Water Treatment Facilities	—
	Operation of desalination facilities would likely be powered by energy efficient and low-cost power sources and not generate significant power-generation emissions	
BIOLOGICAL RESOURCES		
Impact BIO-a: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service **Impact BIO-b:** Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service **Impact BIO-c:** Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marshes, vernal pools, coastal wetlands, etc.) through direct removal, filling, hydrolgical interruption, or other means **Impact BIO-d:** Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites	**Potentially Significant** ***Common Construction*** Construction projects could be located in a sensitive natural community, habitat for special-status species, wetlands, wildlife corridors, or waterways Direct or indirect harm (including mortality) to special-status species and associated habitat from movement of heavy machinery where such species occur Disturbance of special-status species through construction noise, physical vibration, and direct removal of structures that provide habitat Introduction or spread of invasive vegetative species through the movement of topsoil, fill, gravel, and construction equipment Removal of riparian vegetation and disturbance to wetlands to facilitate heavy equipment movement and other construction activities Release of sediment and possibly hazardous materials (e.g., oil or gas from	**7.22 MM-BIO a–f: Mitigate impacts on biological resources** **A. Construction BIO Mitigation Measures (CMM-BIO-a–f)** 1. Regulatory Compliance 2. Preconstruction Surveys 3. Avoid, Minimize, or Compensate for Impacts on Sensitive Natural Communities 4. Avoid, Minimize, or Compensate for Impacts on Special-Status Species 5. Environmental Awareness Training 6. Incorporate Protection Measures for In-Water Construction 7. Avoid or Minimize Impeding Access to Established Native Resident or Migratory Wildlife Corridors or Native Wildlife Nurseries for Fish or Wildlife Species during Construction 8. Invasive Species Control Measures 9. Avoid Vegetation Disturbance 10. Staging Areas

Impact	Impact Conclusions	Proposed Mitigation
Impact BIO-e: Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance **Impact BIO-f:** Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan	construction equipment) into waterbodies from construction on or near waterways Creation of noise and vibration that could harm fish from activities such as pile driving, blasting, or use of other construction equipment Release of concrete particles from blasting to surface waters could disturb terrestrial wildlife and harm fish Take of special-status fish species could result from construction and installation of cofferdams (resulting in fish stranding) or fish rescue in a dewatered area (seining, electrofishing) Some construction projects may conflict with adopted habitat conservation plans (HCPs) or natural community conservation plans (NCCPs)	11. Revegetation Plan 12. Revegetation Monitoring and Reporting 13. Compliance with HCPs and NCCPs 14. Construction WQ Mitigation Measures (CMM-WQ-a–j) 15. Avoid or Minimize Lighting and Glare Effects 16. Dust Control Measures (CMM-AQ-a–e: 3) 17. Construction NOI Mitigation Measures: Noise Reduction Measures (CMM-NOI-a,b,d-f: 2) and Vibration-Reduction Measures (CMM-NOI-a,b,d-f: 3) 18. Blasting Operations and Safety Plan (CMM-GEO-a–e: 7)
	Reservoirs and Points of Diversion Operation of reservoirs and points of diversion could affect biological resources depending on the source of the water and how much flow is diverted from the stream system Reservoir footprint inundation of a large new reservoir could result in permanent loss of thousands of acres of wildlife habitat, including sensitive natural communities New on-stream reservoirs would replace existing riverine habitats with aquatic lake habitat through flooding Loss of riparian trees and related habitat could affect multiple candidate, sensitive, and special-status species	**B. Reservoirs and Points of Diversion BIO Mitigation Measures** 1. Regulatory Compliance 2. Project Planning and Design 3. Reservoirs and Points of Diversion WQ Mitigation Measures (7.22 MM-WQ-a-j: B) 4. Avoid or Minimize Impeding Access to Established Native Resident or Migratory Wildlife Corridors or Native Wildlife Nurseries for Fish or Wildlife Species 5. Dredging Plan 6. Minimize Intake Impacts on Fish 7. Compensate for Impacts on Special-Status Species and Habitat 8. Recreation Management Plan 9. Environmental Awareness Training

Impact	Impact Conclusions	Proposed Mitigation
	Reservoir and points of diversion projects could negatively affect biological resources by altering the timing and magnitude of flows and downstream water temperature Reservoir and points of diversion projects could eliminate important geomorphic processes and floodplain inundation, decrease habitat connectivity, alter hydrodynamics, and alter scour and deposition Flow changes to the Delta could alter temperature and salinity gradients in the Delta Dredging could result in direct physical injury to aquatic species, including special-status species if present, and could temporarily disrupt the movement of local and migratory fish species through increased turbidity Candidate, sensitive, and special-status species; their habitat; and sensitive natural communities could be affected in areas where dredged material is deposited Projects could interfere with movement of native resident or migratory fish Impingement and entrainment could occur at surface water diversions Invasive aquatic species could be established and spread; and habitat for species that prey on, compete with, or displace special-status species could be inadvertently created Recreation activities associated with reservoirs could disrupt wildlife movement patterns Power transmission lines could adversely	10. Reduce Bird Collisions with Overhead Power Lines 11. Maintenance Activities: Construction BIO Mitigation Measures (CMM-BIO-a–f) and Herbicide and Pesticide Use (CMM-HAZ-a–h: 4)

Impact	Impact Conclusions	Proposed Mitigation
	affect migratory and non-migratory birds Temporary in-water activities that may be required for facility repairs or maintenance, although limited in duration, could result in injury or mortality of special-status fish and wildlife species and habitat disturbance	
	Water Treatment Facilities Operation of surface water treatment facilities could affect biological resources depending on the source of the water and how much is used Operation of intakes for surface water treatment facilities may result in impingement or entrainment of special-status fish and aquatic species and may create conditions conducive to predation Desalination plant discharge-related effects on aquatic species could occur from exposure to toxic concentrations of brine Brine waste discharge may result in marine life mortality as a result of creating hypoxic or anoxic conditions or shearing stress from turbulent mixing Seawater desalination would remove benthic ecosystems on the ocean floor during excavation Power transmission lines could adversely affect migratory and non-migratory birds	**C. Water Treatment Facilities BIO Mitigation Measures** 1. Reservoirs and Points of Diversion BIO Mitigation Measures (7.22 MM-BIO-a-f: B) 2. Water Treatment Facilities WQ Mitigation Measures (7.22 MM-WQ-a–j: D) 3. Desalination Facilities BIO Mitigation Measures 4. Groundwater Wells and Groundwater Storage and Recovery WQ Mitigation Measures (7.22 MM-WQ-a-j: C) 5. Reduce Bird Collisions with Overhead Power Lines (7.22 MM-BIO-a–f: B10) 6. Maintenance Activities: Construction BIO Mitigation Measures (CMM-BIO-a–f) and Herbicide and Pesticide Use (CMM-HAZ-a–h: 4)
	Other Construction Projects Create drowning risk to wildlife by lining a canal, which would result in a steeper sideslope and faster flow velocity Conversion of a canal to an aboveground pipeline could interfere with an existing	**D. Other Construction Project BIO Mitigation Measures** 1. Wildlife Escape Measures 2. Wildlife Passage at Aboveground Pipelines 3. Avoid, Minimize, or Compensate for Impacts on Sensitive Natural Communities (CMM-

Impact	Impact Conclusions	Proposed Mitigation
	terrestrial migratory corridor	BIO-a–f: 3)
	Canal lining and encasement could substantially reduce or eliminate water seepage from unlined canals that support riparian and other adjacent sensitive natural communities or wetland vegetation	
	Less than Significant	
	Reservoirs and Points of Diversion	—
	New reservoirs could create mosquito habitat and thus require the use of pesticides	
	Water Treatment Facilities	—
	Use of recycled water could increase incidental irrigation runoff, soil salinity, and saturate soils that may affect adjacent natural habitat and potentially sensitive species and plants	
	Other Construction Projects	—
	Modifying an open irrigation canal to an underground pipeline could result in loss of a drinking water source to wildlife	
	Beneficial	
	Other Construction Projects	—
	Modifying an open irrigation canal to an underground pipeline could remove barriers to wildlife	
CULTURAL RESOURCES		
Impact CUL-a: Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5 **Impact CUL-b:** Cause a substantial adverse change in the significance of an archaeological resource as defined in Section 15064.5 **Impact CUL-c:** Directly or indirectly destroy a	**Potentially Significant** ***Common Construction*** Ground-disturbing activities, including deep excavation, could damage archaeological sites or historic built environment resources or degrade unknown buried or near-surface cultural	**7.22 MM-CUL-a–d: Mitigate impacts on cultural resources** **A. Construction CUL Mitigation Measures (CMM-CUL-a–d)** 1. Regulatory Compliance

Impact	Impact Conclusions	Proposed Mitigation
unique paleontological resource or site or unique geologic feature **Impact CUL-d:** Disturb any human remains, including those interred outside of dedicated cemeteries	resources Changes in topography, hydrologic patterns, and soil movement could degrade or otherwise affect near-surface archaeological or built environment resources Construction activities could alter the appearance of a historic resource from dust interacting with an object's surface, which could cause damage or chemical alteration Temporary or permanent visual obstructions from the presence of large-scale equipment, machinery, and vehicles could diminish the integrity of cultural resources Unauthorized removal or vandalism of cultural resources could occur if construction enables access to cultural sites that were not previously known or accessible Access to cultural resources during construction could be reduced and thereby prevent or impair visits to cultural resources by people with a religious or cultural connection to the resource Vegetation clearing, generation of dust, and visual obstructions from the presence of large-scale equipment, machinery, and vehicles could result in impacts on cultural resources that have an associated landscape or other visual component that contributes to their significance, such as a sacred landscape or historic trail Pile driving could cause vibration that could physically damage or alter nearby historic built environment resources or	2. Preconstruction Surveys for Historical, Archaeological, and Paleontological Resources; Cultural Landscapes; and Traditional Cultural Properties 3. Cultural Resources Management Plan 4. Unanticipated Discovery Measures 5. Oversight and Monitoring of Construction Activities 6. Worker Cultural Resources Sensitivity Training 7. Dust Control Measures (CMM-AQ-a–e: 3) 8. Construction NOI Mitigation Measures: Noise-Reduction Measures (CMM-NOI- a,b,d-f: 2) and Vibration-Reduction Measures (CMM-NOI- a,b,d-f: 3) 9. Construction Site Security (CMM-HAZ-a–h: 7) 10. Construction AES Mitigation Measures: Project Siting and Design (CMM-AES-a–d: 1) and Screen Construction Areas (CMM-AES-a–d: 2)

Impact	Impact Conclusions	Proposed Mitigation
	linear features ***Reservoirs and Points of Diversion*** New and expanded reservoir projects could permanently flood areas with buried or surficial historical, archaeological, or paleontological resources; unique geologic features; or human remains Changing water levels could expose previously inundated cultural resources or buried human remains to increased wave action, erosion, and human activity (e.g., looting) A dam raise project could cause a substantial adverse change to a historical resource if the existing dam were recognized as such If archaeological and/or paleontological resources exist in native soils below accumulated sediment in an existing reservoir, dredging (as part of reservoir expansion) could directly adversely affect these cultural resources	**B. Reservoirs and Points of Diversion CUL Mitigation Measures** 1. Historic Dams and Structures 2. Project Planning 3. Coordination with General or Resource Management Plan 4. Monitoring of Dredging
ENERGY AND GREENHOUSE GAS EMISSIONS		
Impact EN-b: Result in inefficient, wasteful, and unnecessary energy consumption **Impact GHG-a:** Generate greenhouse gas emissions, either directly or indirectly **Impact GHG-b:** Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases	**Potentially Significant** ***Common Construction*** Temporary increase in energy demand from heavy construction equipment (e.g., trucks or barges, earthmoving equipment, and power tools) for actions such as excavating, grading, transporting materials, and transporting construction workers to and from the work sites Generation of GHG emissions from heavy construction equipment, haul trucks, and worker vehicles	**7.22 MM-EN-b/GHG-a,b: Mitigate energy and GHG emissions impacts** **A. Construction EN/GHG Mitigation Measures (CMM-EN-b/GHG-a,b)** 1. Regulatory Compliance 2. GHG Emission Reduction Measures 3. Construction AQ Mitigation Measures: Regulatory Compliance (CMM-AQ-a–e: 1), Emission Reduction Measures (CMM-AQ-a–e: 2), and Minimize Construction-Related

Impact	Impact Conclusions	Proposed Mitigation
	Construction activities could remove vegetation that acts to sequester GHGs (e.g., trees) GHG emissions from construction could conflict with an applicable GHG plan, policy, or regulation	Traffic and Equipment Use (CMM-AQ-a–e: 7) **B. Regulatory Compliance**
	Reservoirs and Points of Diversion Energy use and associated GHG emissions for water diversion and conveyance Vegetation decay, which produces carbon dioxide and methane gases, could occur if vegetation is present in newly inundated areas	**C. Reservoirs and Points of Diversion EN/GHG Mitigation Measures** 1. Regulatory Compliance (7.22 MM-EN-b/GHG-a,b: B) 2. Project Design 3. GHG Reduction Plan 4. Vegetation Removal (7.22 MM-WQ-a–j: B8ii)
	Water Treatment Facilities Energy use and associated generation of GHGs for water treatment GHG emissions from facility operation could conflict with an applicable GHG plan, policy, or regulation	**D. Water Treatment Facilities EN/GHG Mitigation Measures** 1. Regulatory Compliance (7.22 MM-EN-b/GHG-a,b: B) 2. GHG Reduction Plan (7.22 MM-EN-b/GHG-a,b: C3) 3. Project Siting and Design
	Less than Significant	
	Reservoirs and Points of Diversion Power for operating lighting, pumps, valves, gages, and other equipment is modest, and operation of reservoirs could result in generation of hydropower	—
	Water Treatment Facilties Operation of water treatment facilities would not result in inefficient, wasteful, or unnecessary consumption of energy because these facilities would provide reliable potable and nonpotable water to meet existing demand in affected areas	—

Impact	Impact Conclusions	Proposed Mitigation
Impact EN-a: Adversely affect the reliability of California's electric grid	**Less than Significant**	
	New or Modified Facilities	—
	Increased electrical load for new or modified facilities would be small compared to the existing local and statewide electrical demand and because much construction activity is powered directly by fossil fuel and, as such, does not require use of the electric grid	
GEOLOGY AND SOILS		
mpact GEO-a: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, including liquefaction, or landslides **Impact GEO-b:** Result in substantial soil erosion or the loss of topsoil **Impact GEO-c:** Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse **Impact GEO-e:** Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater I**mpact GEO-d:** Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property **Impact GEO-e:** Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where	**Potentially Significant** ***Common Construction*** Construction activities could occur in areas known to have seismic activity, or experience landslides or could be located on expansive soil or on a geologic unit or soil that is unstable or would become unstable due to construction Construction activities could occur in areas underlain by soft or loose soils, where high groundwater or seepage may be present, and on sloping grounds Ground disturbance could expose geologic materials or soil, destabilize the material, and cause soil erosion or loss of topsoil Construction activity that involves blasting could trigger landslides on unstable slopes and expose construction workers or members of the public to the risk of injury or death ***Reservoirs and Points of Diversion*** Dams, points of diversions, and other constructed facilities located near active faults could be damaged or fail due to seismic-related ground shaking, fault	**7.22 MM-GEO-a–e: Mitigate geology and soils impacts** **A. Construction GEO Mitigation Measures (CMM-GEO-a–e)** 1. Regulatory Compliance 2. Project Siting and Design 3. Assurance of No Fault Traces 4. Geology and Soils Management Measures 5. Construction WQ Mitigation Measures: Regulatory Compliance (CMM-WQ-a–j: 1) and Erosion Control, Sedimentation Control, and Soil Stabilization Measures (CMM-WQ-a–j: 3) 6. Septic System Management Measures 7. Blasting Operations and Safety Plan 8. Protect Agricultural Soils (CMM-AG-a-e: 4) **B. Reservoirs and Points of Diversion GEO Mitigation Measures** 1. Regulatory Compliance 2. Project Siting and Design for New or

Impact	Impact Conclusions	Proposed Mitigation
sewers are not available for the disposal of wastewater	movements, liquefaction, or lateral spreading Formation of surface springs and seeps in adjacent areas due to leakage from operation of a new reservoir could result in unstable soils, landslides, lateral spreading, subsidence, liquefaction, or collapse Points of diversion and other constructed facilities (e.g., water conveyance pipelines) located near active faults could be damaged or fail if exposed to surface fault rupture or strong seismic ground shaking Reservoirs can draw people to an area for recreation, thereby exposing them to any geologic hazards	Modified Reservoirs 3. Geotechnical Investigations for Dam Foundation and Reservoir Rim 4. Feasibility Studies 5. Sediment Management and Monitoring Plan
	Groundwater Wells and Groundwater Storage and Recovery New groundwater wells located in areas with high groundwater levels and cohesionless soils may be subject to effects from liquefaction in a seismic event New groundwater wells could create a shallow water table, making area prone to liquefaction in areas of poorly consolidated geologic materials Potential for substantial erosion and/or loss of top soil if recharge water is applied at too high of a rate or volume	**C. Groundwater Wells and Groundwater Storage and Recovery GEO Mitigation Measures** 1. Project Design for Passive Recharge 2. Regulatory Compliance (7.22 MM-WQ-a–j: C3) for groundwater wells
	Water Treatment Facilities Siting desalination facilities in a seismically active coastal area could expose people or structures to potential adverse geological effects	**D. Water Treatment Facilities GEO Mitigation Measure** 1. Coordination with the California Coastal Commission

Impact	Impact Conclusions	Proposed Mitigation
HAZARDS AND HAZARDOUS MATERIALS		
Impact HAZ-a: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials **Impact HAZ-b:** Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment **Impact HAZ-c:** Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school **Impact HAZ-d:** Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment **Impact HAZ-e:** For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area **Impact HAZ-f:** For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area **Impact HAZ-g:** Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan **Impact HAZ-h:** Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are	**Potentially Significant** ***Common Construction*** Accidental release of hazardous materials from construction activities requiring the transport, use, or disposal of hazardous materials (e.g., fuel, motor oil, hydraulic fluid, solvents, cleaners, sealants, welding flux, paint, paint thinner) Safety hazards could occur from rock thrown and scattered from use of explosives Exposure to or the spread of toxic chemicals from excavation during construction that disturb areas with existing soil or groundwater contamination (i.e., asbestos or lead-based paint from existing building materials or stored liquid paints, solvents, and household or industrial-strength maintenance chemicals and cleaners) Underground infrastructure (e.g., natural gas pipelines, utility lines) within a project area could be encountered during excavation and could result in hazards to the public or environment if damaged Disturbance of soils containing *Coccidioides* spores may expose workers and people adjacent to construction sites to these fungal spores in fugitive dust Accidental hazardous materials spills from airborne materials (e.g., gases, asbestos particles) or through ignition of flammable liquids or vapors during construction activities could occur within 0.25 mile of a	**7.22 MM-HAZ-a-h: Mitigate hazards and hazardous materials impacts** **A. Construction HAZ Mitigation Measures (CMM-HAZ-a–h)** 1. Measures for Transport, Use, or Disposal of Hazardous Materials 2. Project Siting 3. Demolition Measures 4. Herbicide and Pesticide Use 5. Hazardous Materials and Worksite Safety Training 6. Emergency Response Plan 7. Construction Site Security 8. Construction near Airports 9. Fire Prevention and Management Plan 10. Asbestos Control Measures (CMM-AQ-a–e: 5) 11. Valley Fever Control Measures (CMM-AQ-a–e: 4) 12. Blasting Operations and Safety Plan (CMM-GEO-a–e: 7) 13. Septic System Management Measures (CMM-GEO-a–e: 6) 14. Mosquito Control Measures 15. Installation and Operation of Underground and Aboveground Storage Tanks 16. Installation and Maintenance of Plumbing in Public Restrooms **B. Hazardous Materials Storage**

Impact	Impact Conclusions	Proposed Mitigation
adjacent to urbanized areas or where residences are intermixed with wildlands	school Impairment of emergency response services' access or interfering with emergency evacuation by rerouting traffic during construction and increased need for emergency service providers during construction due to accidental releases of hazardous materials, work site fires, and vehicular accidents due to construction-related changes in traffic Wildfire risk from the use of electrical or gas-powered equipment, flammable materials (e.g., fuels, solvents), and/or explosives during construction Safety hazards from project components, such as buildings or construction equipment, that encroach on airspace of airport runways Stagnant water present in construction areas during the wet season could create new disease vector habitat (i.e., mosquito habitat) that require application of pesticides Faulty installation or inadequate operation and maintenance of underground or aboveground storage tanks for bulk fuel storage may result in surface water and groundwater contamination, the potential for fire and explosion, exposure of the public to raw sewage, and daylighting of wastewater at the ground surface	**C. Hazardous Materials Accidental Spill Response Plan** **D. Hazardous Materials Training** **E. Wildfire Prevention Plan** 1. Signage 2. Parking Restriction 3. Vegetation Maintenance 4. Fire Fighting Equipment
	Reservoirs and Points of Diversion New or modified reservoir and diversion projects could result in prolonged construction-related impacts involving an increase in traffic on narrow rural roads	**F. Reservoirs and Points of Diversion HAZ Mitigation Measures** 1. Reservoirs and Points of Diversion WQ Mitigation Measures (7.22 MM-WQ-a-j: B) 2. Handling, Storage and Disposal of Dredged

Impact	Impact Conclusions	Proposed Mitigation
	from commuting workers, hauling of large equipment, and disposal of wastes Once constructed, some projects may require use of hazardous materials for operations and maintenance (e.g., use of petroleum-based lubricants for machinery, solvents and paints, herbicide control of invasive weeds as part of landscape maintenance, pesticide for control of mosquitoes); improper use or storage of herbicides could result in exposure of the application crews and general public (including children, for sites located within 0.25 mile of a school) to toxic chemicals Dredging could involve removal of contaminated sediment that could accidentally be released to areas and surface waters Release cyanotoxins from harmful algal blooms in new reservoirs Increase in surface water methylmercury due to operation of new reservoirs Reservoirs constructed close to an airport could potentially create a safety hazard for people (e.g., recreationists) by placing them in proximity to hazards associated with airport operations Create conditions favorable to mosquitos, which could lead to increased transmission of mosquito-borne diseases (e.g., West Nile virus) Wildfire risk from the use of vehicles, fire pits and grills, and electrical- or gas-powered maintenance equipment at new reservoirs Potential safety hazards (e.g., aircraft and	Material (CMM-WQ-a-j: 4vi) 3. Hazardous Material Storage (7.22 MM-HAZ-a-h: B) 4. Hazardous Materials Accidental Spill Response Plan (7.22 MM-HAZ-a-h: C) 5. Hazardous Materials Training (7.22 MM-HAZ-a–h: D) 6. Wildfire Prevention Plan (7.22 MM-HAZ-a-h: E) 7. Air Safety Mitigation 8. Mosquito Control 9. Blasting Operations and Safety Plan (CMM-GEO-a–e: 7)

Impact	Impact Conclusions	Proposed Mitigation
	waterfowl collisions) for air traffic would be associated with new reservoirs located close to an airport Increased potential for transmission of mosquito-borne diseases from the potential creation of mosquito habitat at new and expanded reservoirs and points of diversion	
	Groundwater Wells and Groundwater Storage and Recovery Accidental release of hazardous materials during transport and use could be associated with required chemical treatment of water at new groundwater wells Accidental release of hazardous material during transport and disposal of water treatment waste (e.g., used granular activated carbon filters) if water treatment occurs at new groundwater wells Accidental release of hazardous materials during transport and use could occur where diesel-powered pumps are used for groundwater wells Accidental release of hazardous materials during transport and use could occur where water treatment is implemented prior to injection for groundwater storage and recovery Increased potential for transmission of mosquito-borne diseases would result from the potential creation of mosquito habitat in groundwater recharge ponds or spreading basins	**G. Groundwater Wells and Groundwater Storage and Recovery HAZ Mitigation Measure** 1. Mosquito Control (7.22 MM-HAZ-a-h: F8)

Impact	Impact Conclusions	Proposed Mitigation
	Water Treatment Facilities Accidental release of hazardous materials could occur during transport, use, and storage for facility operation Accidental release of hazardous materials could occur during transport and disposal of hazardous waste (e.g., used granular activated carbon filters, biosolids) from water treatment Wildfire risk from the improper storage or use of flammable/ combustible or incompatible chemicals for facility operation and use of electrical or gas-powered equipment during maintenance activities Drinking water treatment plants that include groundwater wells could result in impacts described for new groundwater wells	**H. Water Treatment Facilities HAZ Mitigation Measures** 1. Hazardous Materials Business Plan 2. Design of On-Site Access and Service Roads 3. Measures for Transport, Use, or Disposal of Hazardous Materials (CMM-HAZ-a-h: 1) for operation and maintenance 4. Herbicide and Pesticide Use (CMM-HAZ-a-h: 4) for maintenance 5. Hazardous Materials Storage (7.22 MM-HAZ-a-h: B) 6. Hazardous Materials Accidental Spill Response Plan (7.22 MM-HAZ-a-h: C) 7. Hazardous Materials Training (7.22 MM-HAZ-a-h: D) 8. Wildfire Prevention Plan (7.22 MM-HAZ-a-h: E) 9. Water Treatment Facilities WQ Mitigation Measures (7.22 MM-WQ-a-j: D) 10. Groundwater Storage and Recovery HAZ Mitigation Measure (7.22 MM-HAZ-a–h: G)
	Other Construction Projects Wildfire risk could increase from the use of electrical or gas-powered equipment during maintenance activities and hot vehicle exhaust systems of maintenance vehicles, fuel-powered equipment, and grinding and welding activities, if required Operation of new or modified boat ramps adjacent to wildlands would attract recreationists and could expose them to wildland fires	**I. Other Construction Projects HAZ Mitigation Measure** 1. Wildfire Prevention Plan (7.22 MM-HAZ-a-h: E)

Impact	Impact Conclusions	Proposed Mitigation
	Less than Significant	
	Reservoirs and Point Diversion	—
	A new reservoir could flood a roadway designated in an emergency response plan or evacuation plan	
HYDROLOGY & WATER QUALITY		
Impact WQ-a: Violate any water quality standards or waste discharge requirements **Impact WQ-b:** Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted) **Impact WQ-c:** Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site **Impact WQ-d:** Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site **Impact WQ-e:** Create or combine runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff **Impact WQ-f:** Otherwise substantially degrade water quality	**Potentially Significant** ***Common Construction*** Construction could contribute polluted runoff and sediment to nearby waterbodies In-water construction can cause temporary sediment disturbance and resuspension, which may cause increased turbidity, siltation, and bioavailability of sediment-associated pollutants Accidental release of pollutants that could enter storm drains or streams; pollutants include petroleum products (e.g., fuel, oil, grease from vehicles and equipment), paving materials (e.g., concrete and asphalt), other materials used or stored on site (e.g., paint, adhesives, solvents), and project waste (e.g., litter, debris, hazardous and liquid waste) Use of herbicides to control invasive plant species could affect water quality and violate water quality standards if improperly applied or stored Faulty installation or inadequate operation and maintenance of underground or aboveground storage tanks for bulk fuel storage may result in surface water and groundwater contamination and release of raw sewage, which could affect	**7.22 MM-WQ-a–j: Mitigate impacts on hydrology and water quality** **A. Construction WQ Mitigation Measures (CMM-WQ-a–j)** 1. Regulatory Compliance 2. Project Siting and Design 3. Erosion Control, Sedimentation Control, and Soil Stabilization Measures: 4. Waste Management and Material Control Measures 5. In-Water Placement of Materials, Structures, and Operation of Equipment 6. Stream-Crossing, Culvert, and Bridge Projects 7. Groundwater Protection Measures 8. Drainage and Flood Protection Measures 9. Construction GEO Mitigation Measures: Blasting Operations and Safety Plan (CMM-GEO-a–e: 7) and Septic System Management Measures (CMM-GEO-a–e: 6) 10. Construction BIO Mitigation Measures (CMM-BIO-a-f) 11. Construction HAZ Mitigation Measures: Herbicide and Pesticide Use (CMM-HAZ-a-h: 4); Installation and Operation of

Impact	Impact Conclusions	Proposed Mitigation
Impact WQ-g: Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map **Impact WQ-h:** Place within a 100-year flood hazard area structures which would impede or redirect flood flows **Impact WQ-i:** Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam **Impact WQ-j:** Inundation by seiche, tsunami, or mudflow	groundwater and surface water quality Improper siting of septic systems could result in adverse water quality effects Localized degradation of groundwater quality could result from temporary, short-term constructions activities Blasting, saw-cutting, and hydraulic hammering could release concrete and other particles into surface waters, which could violate water quality standards and/or affect aquatic resources Construction activities may lower local groundwater through dewatering; dewatered groundwater of poor quality could increase turbidity, dissolved solids, nutrients, metals, or other constituents if discharged to a surface waterway Construction could substantially alter drainage patterns of a project site and thereby cause erosion, siltation or flooding, on site or off site Construction activities could change the on-site land slopes across which drainage flows, which could alter the flow rates, directions, water surface elevations, or velocities of runoff that enters or originates on the construction site Activities such as grading, vegetation removal, soil compacting, and paving could increase land surface imperviousness and affect water quality by creating surfaces where pollutants (e.g., petroleum products from vehicles) can accumulate and later be washed into waterways Project sites may be located within a 100-year flood hazard area or in areas subject to	Underground and Aboveground Storage Tanks (CMM-HAZ-a–h: 15); and Installation and Maintenance of Plumbing in Public Restrooms (CMM-HAZ-a–h: 16)

Impact	Impact Conclusions	Proposed Mitigation
	inundation by seiche, tsunami, or mudflow	
	Reservoirs and Points of Diversion	**B. Reservoirs and Points of Diversion WQ Mitigation Measures**
	Dams and points of diversion can alter flow regimes and reduce or eliminate important geomorphic processes and floodplain inundation, decrease habitat connectivity, alter temperatures to the detriment of cold water species, and alter salinity gradients and circulation patterns in the Delta	1. Project Planning 2. Feasibility Studies 3. Regulatory Compliance 4. Reservoir Operations and Management Plan 5. Prevent Impacts on Instream Flows 6. Develop Flood Control Rules 7. National Management Measures to Control Nonpoint Source Pollution from Hydromodification 8. Methylmercury Management for New Reservoirs 9. Harmful Algal Bloom Management for New Reservoirs 10. Construction Timing for a Dam Raise Project 11. Dredging Plan 12. Project Siting and Design for New or Modified Reservoirs (7.22 MM-GEO-a-e: B2) 13. Geotechnical Investigations for Dam Foundation and Reservoir Rim (7.22 MM-GEO-a-e: B3)
	Dams and points of diversion reduce stream flows, which could injure water right holders, alter water quality, affect surface water-groundwater interactions, and reduce groundwater recharge	
	Changes in streamflow could affect instream chemical constituent concentrations due to changes in instream dilution, potentially affecting the ability of a waste discharger or drinking water provider to comply with waste discharge requirements and/or water quality standards	
	Reservoirs create conditions conducive to harmful algal blooms, growth of invasive aquatic vegetation, and methylation of mercury	
	Reservoirs could affect channel erosion, sedimentation, and morphology as a result of long-term changes in the sediment balance	
	Sediment accumulation at the bottom of a reservoir may contribute to anoxic conditions and reduced water quality	
	Capture of sediment behind a dam can reduce the sediment supply to downstream waterways, affecting habitat and altering	

Impact	Impact Conclusions	Proposed Mitigation
	the balance between erosion and sedimentation Where reservoir expansion occurs through dredging, dredged sediments may contain contaminants (e.g., mercury and other metals, polychlorinated biphenyls, polyaromatic hydrocarbons) in concentrations that may violate water quality standards or otherwise degrade reservoir and downstream water quality if mobilized Dredging may result in the indirect, temporary, and short-term reduction of dissolved oxygen in the water column as a result of the suspension of anoxic organic matter in sediment Reservoir construction could result in temporary and permanent changes to drainages, erosion, or runoff due to grading or preparation of land as well as major excavation and blasting for dam foundation preparation Failure of new or modified dams would result in flooding, potentially exposing people or structures to a significant risk of loss, injury, or death Construction of facility pipelines associated with reservoirs and points of diversion through or under levees could compromise levee integrity and cause flooding Points of diversion could cause localized changes in sedimentation and bioavailability of pollutants	

Impact	Impact Conclusions	Proposed Mitigation
	Groundwater Wells and Groundwater Storage and Recovery Inappropriate siting, design, or construction of groundwater wells could result in groundwater contamination New groundwater wells located where multiple aquifer zones of varying water quality are cross-connected could cause a general degradation of groundwater quality Degradation of surface water and/or groundwater quality could occur from accidental release of water treatment chemicals used at groundwater wells Operation of new urban wells could degrade water quality by drawing in (inducing movement of) poorer-quality water	**C. Groundwater Wells and Groundwater Storage and Recovery WQ Mitigation Measures** 1. Well Siting 2. Groundwater Monitoring 3. Regulatory Compliance
	Water Treatment Facilities Water treatment facilities could violate standards or waste discharge requirements if discharges do not comply with all regulations pertaining to water quality standards and regulations to prevent degradation of water quality in receiving waters Degradation of surface water and/or groundwater quality could occur if treatment sludge is not properly contained Degradation of surface water quality could result from discharge of brine at desalination facilities Degradation of surface water and/or groundwater quality could occur from accidental release of water treatment chemicals during transport, storage, or use	**D. Water Treatment Facilities WQ Mitigation Measures** 1. Regulatory Compliance 2. Groundwater Wells and Groundwater Storage and Recovery WQ Mitigation Measures (7.22 MM-WQ-a–j: C) (i.e., well siting, groundwater monitoring, and regulatory compliance, if applicable) 3. Hazardous Materials Business Plan (7.22 MM-HAZ-a-h: H1), as applicable 4. Desalination Facilities WQ Mitigation Measures

Impact	Impact Conclusions	Proposed Mitigation
	Operation of subsurface or open water intakes at desalination facilities can result in significant intake and mortality of all forms of marine life from impingement and entrainment New drinking water treatment plants that include groundwater wells could result in impacts described for new groundwater wells (see *Groundwater Wells and Groundwater Storage and Recovery*) Maintenance of a water treatment facility would require storage and use of chemicals (e.g., coagulants, flocculants, chlorination agents, biocides) as part of the water treatment process; accidental release of these chemicals, which could be transported off site by stormwater to surface water, could adversely affect surface water quality as well as groundwater quality **Less than Significant**	
	Reservoirs and Points of Diversion Flood control rules would be developed for new or modified reservoirs to provide sufficient storage space to contain inflow during high runoff events and prevent use of emergency spillways Reservoir releases are generally limited to flows that can be contained by downstream levees; although, in some instances of very high inflows, required reservoir releases may exceed downstream levee capacities	—

Impact	Impact Conclusions	Proposed Mitigation
	Beneficial	
	Reservoirs and Points of Diversion	—
	Off-stream reservoirs would reduce flooding associated with local drainages in the reservoir footprint and could reduce flooding in the source-water stream by diverting water during high flows	
	Dams and points of diversion can reduce peak winter flow, which would reduce large-scale movement of substrate and potentially contaminated sediment	
	Dams and points of diversion could reduce floodplain inundation, potentially reducing formation of methylmercury	
	Some dams can prevent further expansion of invasive species	
LAND USE AND PLANNING		
Impact LU-a: Physically divide an established community **Impact LU-b:** Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect **Impact LU-c:** Conflict with any applicable habitat conservation plan or natural community conservation plan? *Refer to Section 7.22.2.4, Biological Resources*	**Potentially Significant** ***Common Construction*** Temporary effects on existing land uses by activities such as ground clearing, increased traffic, noise, dust, and human activity, as well as by changes in the visual landscape Construction may temporarily physically divide an established community, primarily by cutting off access to roadways or bridges Siting permanent facilities within an established community (e.g., distribution pipelines and other infrastructure) could create physical barriers that could divide the community Siting and construction could result in a permanent change in land use that could conflict with land use plans, policies, or	**7.22 MM-LU-a–c: Mitigate land use impacts** **A. Construction LU Mitigation Measures (CMM-LU-a–c)** 1. Regulatory Compliance 2. Project Siting and Design 3. Traffic Mitigation Plan (CMM-TRA-a,b,d-f: 3)

Impact	Impact Conclusions	Proposed Mitigation
	regulations, depending on the location, configuration, and magnitude of the project	
	Reservoirs and Points of Diversion	**B. Reservoirs and Points of Diversion LU Mitigation Measures**
	Siting of reservoirs or points of diversion and associated facilities may conflict with existing land uses and require changes to the land use designations in local general and specific plans	1. Feasibility Study 2. Minimize Community Disruption due to Hauling/Disposing of Construction Waste 3. Provide Appropriate Land Compensation 4. Project Planning (7.22 MM-TRA-a,b,d–f: B1) 5. Reservoirs and Points of Diversion REC Mitigation Measures (7.22 MM-REC-a,b: B)
	Removal of bridges and roads may result in permanent physical division of an established community	
MINERAL RESOURCES		
Impact MIN-a: Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state? **Impact MIN-b:** Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan	**Potentially Significant** ***Common Construction*** Construction activities could be located in areas with active natural gas, oil, or aggregate production or with the potential to contain untapped reserves of those resources and restrict access Construction demand for aggregate and/or cement for construction projects could exceed local supplies	**7.22 MM-MIN-a,b: Mitigate impacts on mineral resources** **A. Construction MIN Mitigation Measures (CMM-MIN-a,b)** 1. Project Siting and Design 2. Aggregate Use 3. Access to Extraction Sites 4. Implement the California Department of Conservation's Geologic Energy Management Division's (CalGEM) Recommendations
NOISE		
Impact NOI-a: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies **Impact NOI-b:** Exposure of persons to or generation of excessive groundborne vibration or	**Potentially Significant** ***Common Construction*** Construction would result in temporary noise and groundborne vibration from the use of heavy construction equipment (e.g., excavators, bulldozers, pile drivers, jackhammers), drilling, and blasting	**7.22 MM-NOI-a–f: Mitigate noise and vibration impacts** **A. Construction NOI Mitigation Measures (CMM-NOI-a,b,d–f)** 1. Regulatory Compliance

Impact	Impact Conclusions	Proposed Mitigation
groundborne noise levels **Impact NOI-d:** A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project **Impact NOI-e:** For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels **Impact NOI-f:** For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels	Noise-sensitive receptors may be exposed to noise levels in excess of established standards or to a substantial increase in ambient noise Project sites may be located near a public or private airport or airstrip and temporarily expose construction crews to excessive noise levels **Less than Significant** ***New or Modified Facilities*** Operation and maintenance of new or modified facilities likely would not result in exposure of sensitive receptors to or generation of excessive groundborne noise or vibration levels because vibration generated by most activities is relatively minor and would not occur at a perceptible level	2. Noise-Reduction Measures 3. Vibration-Reduction Measures 4. Blasting Operations and Safety Plan (CMM-GEO-a-e: 7) 5. Construction near Airports (CMM-HAZ-a-h: 8) —
Impact NOI-c: A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project	**Potentially Significant** ***Reservoirs and Points of Diversion, Groundwater Wells and Groundwater Storage and Recovery, and Water Treatment Facilities*** Operation and maintenance could generate noise, including permanent or periodic increased ambient noise from intakes and conveyance facilities; use of transformers, generators, fans, groundwater well and other pumps, and alarms	**B. Reservoirs and Points of Diversion, Groundwater Wells and Groundwater Storage and Recovery, and Water Treatment Facilities NOI Mitigation Measures (NOI-a,c,d)** 1. Noise-Reduction Consideration in Project Design and Operations 2. Operational Truck Traffic Noise
POPULATION AND HOUSING		
Impact POP-a: Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)	**Less than Significant** ***New or Modified Facilities*** During construction, non-locals may move to a project area to support these activities; however, any additional need for lodging	—

Impact	Impact Conclusions	Proposed Mitigation
Impact POP-b: Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere **Impact POP-c:** Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere	would be temporary and could likely be met via local accommodations New or modified facilities would not involve construction of new homes or businesses, extension of roads, other infrastructure, or other actions that may directly or indirectly induce substantial population growth in an area Job creation is not expected to cause substantial population growth because new or modified facility projects do not require extensive staff and therefore would add few jobs A small number of people would be displaced by a new reservoir and would not result in a housing shortage or cause increased demand in another community	
PUBLIC SERVICES		
Impact PS-a: Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities or a need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the following public services: fire protection, police protection, schools, parks (see Recreation), or other public facilities	**Less than Significant** ***New or Modified Facilities*** New or modified facilities would not result in increases in housing or in population and therefore would not create a need for additional schools, parks, or other public facilities Construction activities could result in temporary, short-term increased response times for fire, police, and other emergency responders due to increased construction traffic and potential road closures and detours Construction activities could result in temporary increases in the number of fire, police, or emergency medical provider service calls in the vicinity of work sites for emergencies related to construction; but	—

Impact	Impact Conclusions	Proposed Mitigation
	calls are not expected to be large enough or frequent enough to affect response times beyond the regular variation experienced by providers of emergency services	
RECREATION		
Impact REC-a: Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated **Impact REC-b:** Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment	**Potentially Significant** ***Common Construction*** Recreationists could be affected by construction-related traffic, visual impacts, water quality effects, noise, fugitive dust, and exhaust emissions from heavy equipment; restricted access to recreational facilities could result in physical deterioration of alternative locations and facilities	**7.22 MM-REC-a,b: Mitigate impacts on recreation** **A. Construction REC Mitigation Measures (CMM-REC-a,b)** 1. Project Siting and Design 2. Maintain Access to Existing Recreational Facilities during Construction 3. Coordinate with Public and Private Recreation Providers 4. Rehabilitate or Restore Degraded Recreational Facilities or Provide Replacement Recreational Facilities 5. Construction AES Mitigation Measures (CMM-AES-a–d) 6. Construction AQ Mitigation Measures (CMM-AQ-a–e) 7. Construction WQ Mitigation Measures (CMM-WQ-a–j) 8. Construction NOI Mitigation Measures (CMM-NOI-a,b,d–f) 9. Construction TRA Mitigation Measures (CMM-TRA-a,b,d–f)
	Reservoirs and Points of Diversion Larger reservoirs and points of diversion facilities could restrict recreation in the vicinity of diversion because of a need for a safety zone around the facility	**B. Reservoirs and Points of Diversion REC Mitigation Measures** 1. Project Siting and Design 2. Project Planning 3. Coordination with Public Recreation

Impact	Impact Conclusions	Proposed Mitigation
	Reservoirs and points of diversion may alter water levels and flow, which could adversely affect boating and fishing areas, public and private recreational facilities, or waterways used for recreation Reservoirs and points of diversion projects could inundate areas previously used for recreation Displacement of recreationists to other locations could result in accelerated physical deterioration of some recreational facilities over time	Providers 4. Compensate for Impacts on Recreational Facilities 5. Construction WQ Mitigation Measures (CMM-WQ-a–j) 6. Construction BIO Mitigation Measures (CMM-BIO-a–f)
	Water Treatment Facilities If a new wastewater treatment plant were located near an established recreational area, recreationists may choose other recreational locations because of odor from treatment operations; this could result in accelerated physical deterioration of these alternative locations and facilities over time	**C. Water Treatment Facilities REC Mitigation Measures** 1. Water Treatment Facilities AQ Mitigation Measures (7.22 MM-AQ-a–e: C)
	Less than Significant	
	Other Construction Projects Agricultural canal lining or encasement could reduce fishing opportunities by reducing the numbers of sport fish in a canal	—
	Beneficial	
	Reservoirs and Points of Diversion New reservoirs would likely include development of reservoir-associated recreation facilities	—
	Water Treatment Facilities Water treatment facilities could include recreation benefits, such as a visitor center,	

Impact	Impact Conclusions	Proposed Mitigation
	trails, or educational signage ***Other Construction Projects*** Modifications of reservoir boat ramps would allow continued use of an existing recreational facility	
TRANSPORTATION AND TRAFFIC		
Impact TRA-a: Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation, including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to, intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit **Impact TRA-b:** Conflict with an applicable congestion management program, including, but not limited to, level of service standards and travel demand measures or other standards established by the county congestion management agency for designated roads or highways **Impact TRA-d:** Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment) **Impact TRA-e:** Result in inadequate emergency access **Impact TRA-f:** Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities	**Potentially Significant** ***Common Construction*** Construction activities could result in temporary and short-term increases in traffic due to additional vehicles (e.g., construction vehicles, construction workers' personal vehicles) on roads near project sites and relocating roads, which would cause new rerouted traffic at an intersection not designed to accommodate additional traffic Construction activities may result in degradation of roads from haul trucks or trips required for fill transport Temporary relocation, closure, or complete removal of existing bicycle and pedestrian paths and trails could occur during construction Projects requiring in-channel construction activities could temporarily obstruct boat navigation and cause boat traffic delays and construction equipment, such as dredges and cofferdams, could temporarily obstruct boat traffic Construction projects may result in roads being temporary blocked, rerouted, or altered, which could affect emergency access	**7.22 MM-TRA- a,b,d–f: Mitigate transportation impacts** **A. Construction TRA Mitigation Measures (CMM-TRA-a,b,d–f)** 1. Regulatory Compliance 2. Avoid and Minimize Interference with Transportation Networks 3. Traffic Management Plan 4. Restore Damaged Transportation Facilities 5. Waterway Traffic Control Plan 6. Road and Bridge Design

Impact	Impact Conclusions	Proposed Mitigation
	Permanent relocation of road segments could require changes that could increase or introduce a hazard to vehicles traveling on that segment	
	Reservoirs and Points of Diversion Reservoirs could require dredging operations, which would increase traffic related to trucking dredged material to another location for reuse or disposal Operation of reservoirs with recreational facilities could attract a substantial number of recreationists, which could cause periodic traffic congestion as well as unplanned wear and tear on rural roads	**B. Reservoirs and Points of Diversion TRA Mitigation Measures** 1. Project Planning 2. Road Design 3. Feasibility Study (7.22 MM-LU-a–c: B1) 4. Project Siting and Design (7.22 MM-REC-a,b: B1) 5. Project Planning (7.22 MM-REC-a,b: B2)
	Less than Significant	
	New or Modified Facilities Limited additional vehicle trips would be associated with workers commuting to sites to conduct operation and maintenance activities	—
Impact TRA-c: Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks	**No Impact**	
	New or Modified Facilities New or modified facilities would not result in a change in air traffic patterns because no airport facilities are proposed, and demand for air travel would not increase as a result of implementing these types of projects	—
UTILITIES AND SERVICE SYSTEMS		
Impact UT-a: Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board **Impact UT-c:** Require or result in the construction of new storm water drainage facilities or	**Potentially Significant**	
	Common Construction Construction sites could generate stormwater runoff that discharges sediment and other pollutants	**7.22 MM-UT-a,c–g: Mitigate impacts on utilities and service systems** **A. Construction UT Mitigation Measures (CMM-UT-a,c,f,g)**

Impact	Impact Conclusions	Proposed Mitigation
expansion of existing facilities, the construction of which could cause significant environmental effects **Impact UT-f:** Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs **Impact UT-g:** Comply with federal, state, and local statutes and regulations related to solid waste	Wastewater from construction could include wastewater from sanitation facilities used by construction crews or wastewater generated directly from construction-related activities Construction activities could temporarily increase the volume of solid waste (e.g., soil, vegetative material, construction debris) disposed of at landfills Construction activities could temporarily disrupt existing electric and natural gas utilities and telecommunication lines and could damage utility poles or snag suspended utility lines	1. Wastewater Control Measures 2. Water Supply 3. Non-Hazardous Waste Disposal 4. Utility Services 5. Site-Specific Drainage Study
	Reservoirs and Points of Diversion Expansion of existing reservoirs through dredging may result in dredged material that cannot be reused for beneficial purposes and thus would require disposal at an appropriate landfill facility Reservoirs and points of diversion would require State Water Board approval of a new water right or a change of an existing right	**B. Reservoir and Points of Diversion UT Mitigation Measure** 1. Reservoirs and Points of Diversion WQ Mitigation Measures (7.22 MM-WQ-a–j: B)
	Groundwater Wells and Groundwater Storage and Recovery A new groundwater well would require a valid groundwater right, either overlying or appropriative, and depending on the location, the right would need to be consistent with any relevant groundwater sustainability plan (GSP) Groundwater storage and recovery of surface water would capture a new supply that is generally not subject to existing entitlements; therefore, new entitlement	**C. Groundwater Wells and Groundwater Storage and Recovery UT Mitigation Measure** 1. Groundwater Wells and Groundwater Storage and Recovery WQ Mitigation Measures (7.22 MM-WQ-a–j: C)

Impact	Impact Conclusions	Proposed Mitigation
	could be required in the form of water right permits from the State Water Board	
	Water Treatment Facilities	**D. Water Treatment Facilities UT Mitigation Measure**
	Drinking water treatment plants would require a valid water right if drawing surface water or groundwater as a source, and groundwater withdraw may require consistency with a GSP depending on the location	1. Water Treatment Facilities WQ Mitigation Measures (7.22 MM-WQ-a–j: D)
Impact UT-b: Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects **Impact UT-d:** Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed **Impact UT-e:** Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments	**Less than Significant** ***Common Construction*** Construction activities would require a water supply, but the uses for this water during construction would not be of sufficient magnitude or duration to require new or expanded entitlements for water supply Wastewater generated during construction would not likely require construction of new or expanded wastewater treatment facilities or result in a determination by the wastewater treatment provider that it has inadequate capacity; wastewater generated during construction would not affect the ability of a wastewater treatment facility to meet the wastewater treatment requirements of a regional water board	—
	Potentially Significant ***Reservoirs and Points of Diversion*** Reservoirs and points of diversion would require State Water Board approval of a new water right or a change of an existing right	—

Impact	Impact Conclusions	Proposed Mitigation
	Groundwater Wells and Groundwater Storage and Recovery New groundwater well would require a valid groundwater right, either overlying or appropriative, and depending on the location Groundwater storage of surface water would capture a new supply that is generally not subject to existing entitlements; this would require new entitlement in the form of a water right permit from the State Water Board	—

GHG = greenhouse gas; GSP = groundwater sustainability plan; HCP = habitat conservation plan; HAB = harmful algal bloom; NCCP = natural community conservation plan

13.7.23 Ability to Achieve Project Purpose and Goals

The purpose and goals of the project are described in Section 7.1.3, *Purpose and Goals of the Sacramento/Delta Update to the Bay-Delta Plan*. The underlying fundamental purpose of the project is to establish water quality objectives, a program of implementation, and monitoring and special study measures for the reasonable protection of fish and wildlife beneficial uses in the Sacramento/Delta. As described in Section 7.1.3, the proposed Plan amendments were developed in consideration of the purposes and goals for the Sacramento/Delta Update to the Bay-Delta Plan. The regulatory pathway under the revised proposed Plan amendments would similarly meet the purposes and goals as the requirements would be intended to provide an interconnected flow regime from upstream natal Sacramento/Delta tributaries, through the Delta, and out to the ocean along with recommendations to other entities for habitat restoration and other actions to improve ecosystem functions. The requirements would be expected to provide for the frequency, timing, magnitude, and duration of flows that supports functions and processes for the protection of native fishes and would also provide for local cooperative solutions that can provide for better outcomes with lower water supply costs. The requirements also provide for monitoring and special studies measures to inform decision-making. The requirements were designed to provide transparency in decision-making to the regulated community, tribal nations, environmental justice communities, and other stakeholders.

The starting point for the inflow requirements under the regulatory pathway of the revised proposed Plan amendments includes water supply adjustments that would apply to water rights existing as of 2025. As described in Section 13.3, *Revised Proposed Plan Amendments*, the water supply adjustments provide for lowering the required percent of unimpaired flow during all but the wettest hydrologic conditions down to 45 or 35 percent of unimpaired flow, with additional tributary-specific water supply adjustments for three rainfall and municipal supply dominated tributaries (the Mokelumne and Calaveras Rivers and Putah Creek). While the flow-abundance relationships presented in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, and Section 13.5, *Beneficial Environmental Effects*, indicate that the population abundance indices of key indicator species of ecosystem health would be expected to be greater at 55 percent of unimpaired flow (see Chapter 3), requiring 55 percent of unimpaired flow with water supply adjustments would also be expected to provide benefits to native fish species, including increases in abundance indices and frequency of exceeding ecological flow thresholds (see Section 13.5). In addition, the water supply adjustments are designed to reduce water supply impacts and allow more water to be stored in reservoirs on initial implementation which would be expected to assist with maintaining cold water supplies for temperature protection of native cold water fish species. The revised proposed Plan amendments include the possibility of moving up in the range of unimpaired flow under certain conditions and the potential for modifying or removing the water supply adjustments in the future, which could provide additional ecological benefits.

Similar to what is described in Section 9.7.23, *Ability to Achieve Project Purpose and Goals*, the VA pathway provides flow and habitat restoration commitments in the Sacramento/Delta that are intended to provide improved tributary and in-Delta habitat conditions, improved migratory conditions, and increased floodplain inundation, which would promote habitat conditions that favor native fishes over nonnative fishes. The VA pathway provides flexibility for establishing beneficial

habitat conditions for native fishes, addressing scientific uncertainty and changing conditions, and developing scientific information that will inform future management of flows. The VA pathway includes monitoring and evaluation provisions to inform adaptive management of flows and future changes to the Plan. As described in Section 13.5, the VA pathway would be expected to provide ecological benefits in the form of increases in the area of different habitat types (spawning, rearing, floodplain), increased food production and other habitat improvements and some increases in abundance indices of key indicator species under certain hydrologic conditions.

The revised proposed Plan amendments provide for a range of contingencies with the ability to pivot and adjust in response to new information and changed circumstances. The revised proposed Plan amendments, including both the VA pathway and the regulatory pathway as a backstop to the VA pathway that would apply to the HRL water rights in the event the VA pathway is discontinued, provides an approach that considers all of the demands being made and to be made on waters in the Sacramento/Delta and the factors to be considered for establishing water quality objectives in Water Code section 13241. These factors include, but are not limited to, past, present, and probable future beneficial uses and economic considerations. Annual and periodic reviews provide the opportunity to assess and report on progress on implementation of the Bay-Delta Plan and any needed changes to the Plan or its implementation to provide for the reasonable protection of beneficial uses.

13.8 Economic Analysis and Other Considerations

13.8.1 Introduction

Under the Porter-Cologne Water Quality Control Act (Porter-Cologne Act), the State Water Board is required to consider several factors, including economic considerations, when establishing water quality objectives for the reasonable protection of beneficial uses (Wat. Code, § 13241). The need for economic analysis associated with State Water Board actions is also required by Water Code section 13141, which states: "prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of financing, shall be indicated in any regional water quality control plan (Wat. Code, § 13141). The other factors identified in section 13241 of the Porter-Cologne Act are discussed here and elsewhere in this Staff Report, including but not limited to relevant sections in Chapter 2, *Hydrology and Water Supply*, Chapter 6, *Changes in Hydrology and Water Supply*, Chapter 7, *Environmental Analysis*, Chapter 8, *Economic Analysis and Other Considerations*, Chapter 9, *Proposed Voluntary Agreements*, and other sections within Chapter 13, *Revised Proposed Plan Amendments*.

The CEQA environmental analysis also must take into account a reasonable range of environmental, economic, and technical factors (Cal. Code Regs., tit. 23, § 3777, subd. (c)). Under CEQA, economic and social changes are not treated as significant effects on the environment. However, physical changes to the environment as a result of economic and social changes may be significant. Economic and social changes also may be used to determine the significance of physical changes caused by the economic or social change (Cal. Code Regs., tit. 14, § 15064, subd. (e)).

This section describes the economic effects of changes in hydrology and water supply under the revised proposed Plan amendments on agricultural and municipal use.[1]

This section summarizes previous economic analyses described in Chapters 8 and 9 and describes any differences in potential effects under the regulatory pathway or VA pathway. Chapter 8 analyzes the economic effects of changes in hydrology and water supply under the proposed Plan amendments (45 through 65 scenarios) on agricultural and municipal use. Overall, the starting point for the regulatory pathway (55 w/WSAs) would have similar economic effects as those evaluated in Chapter 8; however, as described in Section 13.4, *Changes in Hydrology and Water Supply*, changes in water supply would generally be more similar to the Low Flow Alternative due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, economic effects could also be as high as those identified in Chapter 8.

Potential agricultural and municipal economic effects that may result from changes in water supply under the VA pathway would be similar to the effects described in Section 9.8, *Economic Analysis and Other Considerations*. Economic effects resulting from changes in water supply with

[1] For the purposes of this document, a reference to municipal use includes domestic and industrial uses unless otherwise specified. The terms urban and municipal and industrial (M&I) are also sometimes used to reference municipal type uses.

implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2, *Modeling Approach*.

In addition to the economic effects of changes in hydrology and water supply on agricultural and municipal use, this section describes fisheries and other economic effects, including effects on recreation, ecosystem services, wildlife refuges, and energy (hydropower) production under the revised proposed Plan amendments. This section also summarizes costs associated with other water management actions, habitat restoration and other ecosystem projects, and new and modified facilities, based on information contained within Section 8.3, *Costs Associated with Other Water Management Actions*, Section 8.8, *Costs Associated with Habitat Restoration and Other Ecosystem Projects*, and Section 8.9, *Costs Associated with New or Modified Facilities*, in the final Staff Report. Chapter 8 also identifies example funding sources that could assist water users in conserving or more efficiently using water supplies, including recent funding for agricultural water conservation and municipal water conservation, which is also relevant to the economic analysis of the revised proposed Plan amendments.

Section 8.2, *Economic Profile* describes the economic setting to inform the economic effects discussion in this section. Generally, the area considered in this section corresponds to the study area, as defined in Chapter 2, *Hydrology and Water Supply*. Section 2.8, *Existing Water Supply*, describes the location of the study area in California, which is divided into seven geographic regions based on geography and water supply, including the Sacramento River watershed, Delta eastside tributaries, Delta, San Joaquin Valley, San Francisco Bay Area (Bay Area), Central Coast, and Southern California.

13.8.2 Agricultural Water Supply Economic Effects

As discussed in Section 13.7.4, *Agriculture and Forest Resources*, implementation of the revised proposed Plan amendments could result in surface water and groundwater supply reductions to agricultural users in the study area. This section summarizes SacWAM results for changes in Sacramento/Delta agricultural water supply under the starting point for the regulatory pathway and for the VA pathway and discusses the potential effects on agricultural production. It also describes potential economic effects on farming-dependent industries, such as food processors, and the regional economy (total industry output [sales], income, and employment).

Reductions in Sacramento/Delta water supply to agricultural users would vary by region. Table 13.8-1 presents SacWAM estimates for regional changes in the amount of Sacramento/Delta water supplied to agricultural users under the starting point for the regulatory pathway (55 w/WSAs scenario) and under the VA pathway (VA scenario).

Table 13.8-1. Change from Baseline Conditions: Annual Average Sacramento/Delta Supply for Agricultural Use by Region and Pathway (thousand acre-feet per year)

Region	Sacramento/Delta Supply (TAF/yr)	Change from Baseline	
		55 w/WSAs Scenario	VA Scenario
Sacramento/Delta	5,940	-220 (-4%)	-98 to -211 (-2% to -4%)
San Joaquin Valley	2,445	-60 (-1%)	+48 to -65 (2% to -3%)
San Francisco Bay Area, Central Coast and Southern California	79	-4 (-5%)	+1 (1%)

Source: SacWAM results (see Section 13.4, *Changes in Hydrology and Water Supply*)
The percentages in parentheses represent the estimated reduction in Sacramento/Delta supply.

The estimates presented in Table 13.8-1 show that under existing conditions Sacramento/Delta surface water is supplied for agricultural use primarily in the Sacramento/Delta and in the San Joaquin Valley, although a smaller amount of Sacramento/Delta surface water is also supplied to agriculture in the Bay Area, Central Coast, and Southern California. These estimates show that changes in flow requirements could result in reductions in agricultural water supply for the entire study area under the starting point for the regulatory pathway. These reductions in supply would be much lower compared to the 55 flow scenario analyzed in Chapters 7 and 8. Based on the SacWAM results presented above (Table 13.8-1), changes in Sacramento/Delta water supply to agricultural use under the starting point for the regulatory pathway (55 w/WSAs scenario) would be more similar to those under the Low Flow Alternative (35 and 45 scenarios). However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could be as high as those identified in Section 7.4, *Agriculture and Forest Resources*, and agricultural economic effects could be as high as those identified in Chapter 8.

The VA pathway would also result in a total average annual reduction in Sacramento/Delta surface water supply to agriculture for the term of the VA pathway as shown above in Table 13.8-1, although the effects of these changes would vary by region. For the Sacramento/Delta watershed and San Joaquin Valley regions, Table 13.8-1 shows a range for the possible change in agricultural water supply from baseline under the VA pathway to reflect the potential sources of water provided through unspecified water purchases. Unspecified water purchases could be provided from willing sellers in the Sacramento/Delta watershed or from export reductions. Unspecified water purchases could also be provided through a combination of willing sellers in the Sacramento/Delta watershed and from export reductions. The actual change from baseline would be expected to be within the range shown above. Because it is assumed that unspecified water purchases would not be provided from users in the Bay Area, Central Coast, and Southern California regions, the results for these regions are not reflected as a range.

The overall reduction in agricultural water supply under the VA pathway would be less than the reduction under the starting point for the regulatory pathway. Reductions in agricultural water supply under the VA pathway would be similar to those described in Chapter 9, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway. Under the VA pathway, most of the reductions in Sacramento/Delta surface water supply to agriculture would occur for users within the Sacramento/Delta watershed. The SacWAM results show that Sacramento/Delta water supplies to the Bay Area, Central Coast, and Southern California

could increase slightly on average when compared to baseline. The VA pathway could result in a change in total Sacramento/Delta supplies to the San Joaquin Valley region. The overall effect would be dependent on the sources of the unspecified water purchases, which are not fully known at this time.

Reductions in annual average Sacramento/Delta surface water supplies to agriculture could lead to changes in distribution of crop types and acreage and conversion of important farmland to nonagricultural use, which could also result in agricultural economic effects. Additional discussion is provided below at the regional level. The regional discussions are informed by modeling results presented in Chapters 8 and 9.

In the analysis presented in Section 8.4, *Agricultural Water Supply Economic Effects*, and Section 9.8.2, *Agricultural Water Supply Economic Effects*, changes in crop revenue in the Sacramento/Delta and San Joaquin Valley are estimated using the Statewide Agricultural Production (SWAP) model, for average and dry hydrologic conditions. The SWAP model is an economic decision model that estimates growers' responses to changes in water supply by determining the cropping pattern that maximizes the net returns to agricultural production. The output that is generated for each of the model runs includes cropping acreage by category of crops, total revenue, net revenue (profit), and amount of irrigation water used by source of supply. The output details are generated for each SWAP zone which, when combined geographically, provide totals for: (1) the Sacramento/Delta watershed; and (2) the San Joaquin Valley region. Additional details about the SWAP model and methods can be found in Appendix A3, *Agricultural Economic Analysis: SWAP Methodology and Modeling Results*. The SWAP model results are referenced in the regional discussions below where appropriate and to provide additional regional context.

In the analysis presented in Section 8.4, changes in crop revenue in the Bay Area, Central Coast, and Southern California regions are estimated using the California Sub-Regional Agricultural Analysis (CASRAA) model. The CASRAA model uses an approach similar to that used by the SWAP model to determine cropping patterns and water use. Section 8.4 presents CASRAA model results for baseline conditions and the 35, 45, 55, 65, and 75 scenarios, for average and dry hydrologic conditions. Additional details about the CASRAA model and methods can be found in Appendix A1a, Attachment A1a1, *California Subregional Agricultural Analysis (CASRAA)*. The CASRAA model results are referenced in the regional discussions below where appropriate and to provide additional regional context.

The analysis in this section focuses on agricultural economic effects associated with reductions in Sacramento/Delta surface water supplies. Additional costs could be incurred from reduced groundwater supply to agriculture or to deepen groundwater wells as a response to possible groundwater level declines. The general costs for installing or implementing additional groundwater pumping are described in Section 8.3, and are also summarized in Section 13.8.6.1*, Costs Associated with Other Water Management Actions*.

13.8.2.1 Sacramento/Delta

As shown in Table 13.8-1, annual average reductions in Sacramento/Delta supply for agriculture in the Sacramento/Delta watershed could range from 220 thousand acre-feet per year (TAF/yr) under the starting point for the regulatory pathway (55 w/WSAs scenario) to 98–211 TAF/yr under the VA pathway for the term of the VA pathway. This represents an approximate 4 percent reduction under the 55 w/WSAs scenario and 2–4 percent under the VA pathway. The reductions in annual average

Sacramento/Delta supply to agriculture under the 55 w/WSAs scenario would be lower compared to the 55 scenario and would be more similar to those under the Low Flow Alternative (35 and 45 scenarios). As presented in Section 6.4, *Changes in Surface Water Supply*, the estimated average annual reductions in agricultural water supply in the Sacramento/Delta region would be approximately 3 percent under the 35 scenario and 5 percent under the 45 scenario (see Chapter 6, Table 6.4-1). However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.4, and economic effects could also be as high as those identified in Chapter 8. Changes in Sacramento/Delta water supply under the VA pathway would also result in reduced Sacramento/Delta surface water supply to agricultural users within the Sacramento/Delta watershed. The changes in Sacramento/Delta water supply under the VA pathway would be less compared to the 55 w/WSAs scenario on average across all water year types, for the term of the VA pathway.

Reductions in Sacramento/Delta surface water supplies to agricultural users could lead to changes in distribution of crop types and acreage and conversion of important farmland to non-agricultural use in the Sacramento/Delta, which would also affect crop revenues. The SWAP model results presented in Section 8.4 show that there would be an overall reduction in crop revenue in the Sacramento/Delta watershed under the flow scenarios. If groundwater is not used to offset Sacramento/Delta surface water supply reductions, the SWAP model results estimate that a large portion of the reduction in crop revenue in the Sacramento/Delta is associated with a decline in the production of alfalfa and pasture and rice under the flow scenarios (see Chapter 8, Figures 8.4-2 and 8.4-3). Some other crops could also experience a decline in revenue in this region under the flow scenarios, but to a lesser extent. The SWAP model results presented in Section 8.4 show that changes in crop revenues under the 35 and 45 scenarios (Low Flow Alternative) would be less than under the 55 scenario.

Based on the SacWAM results for changes in Sacramento/Delta water supply to agriculture in the Sacramento/Delta watershed presented above in Table 13.8-1 and in Section 7.4 and Chapter 8, the 55 w/WSAs scenario could also lead to a reduction in crop revenue within the Sacramento/Delta watershed primarily from alfalfa and pasture and rice, but with a much smaller decrease than under the 55 scenario as compared to baseline. These changes under the 55 w/WSAs scenario would be comparable to changes in crop revenue under the Low Flow Alternative. Based on SWAP model results presented in Section 8.4 for the Low Flow Alternative, reductions in crop revenue under the 55 w/WSAs scenario are estimated to be about 1 percent for average year hydrologic conditions, or about 2–3 percent for dry year hydrologic conditions if it is assumed that groundwater would not be available to replace reductions in surface water availability (see Chapter 8, Tables 8.4-4 and 8.4-6). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, economic effects could also be as high as those identified in Chapter 8.

Changes in crop revenue would also occur under the VA pathway. As discussed in Section 9.8.2.1, *Sacramento/Delta*, SWAP model results for changes in crop revenue in the Sacramento/Delta watershed indicate that there could be a decline in crop revenue, both with and without considering the effects of unspecified water purchases. These changes would also be less than under the 55 scenario. As discussed in Section 9.8.2.1, the decrease in crop revenue could be about 0.5 percent when including SWAP model estimated effects of unspecified water purchases, and about 0.3 percent without the unspecified water purchases. A large portion of the estimated decrease in crop

revenue is associated with reduced rice acreage. Some other crops could also experience a decline in revenue in this region, but to a lesser extent. Changes in crop revenue under the VA pathway would be expected to be somewhat higher, but similar to those discussed in Section 9.8.2.1 for the term of the VA pathway, even with the additional flows and changes in water supply under the regulatory pathway for non-HRL water rights added to the VA pathway as described in Section 13.4.2, *Modeling Approach*.

13.8.2.2 San Joaquin Valley

As shown in Table 13.8-1, annual average change in Sacramento/Delta supply for agricultural use in the San Joaquin Valley could range from -60 TAF/yr under the starting point for the regulatory pathway (55 w/WSAs scenario) to +48 to -65 TAF/yr under the VA pathway for the term of the VA pathway. The reductions in annual average Sacramento/Delta supply to agriculture under the 55 w/WSAs scenario would be substantially less than those under the 55 scenario and would be more similar to those under the Low Flow Alternative (35 and 45 scenarios). As presented in Section 6.4, the estimated average annual reductions in agricultural water supply in the San Joaquin Valley region would be approximately 1 percent under the 35 scenario and 5 percent under the 45 scenario (see Chapter 6, Table 6.4-1). As shown above in Table 13.8-1, the average annual reduction in Sacramento/Delta supply to agricultural users within the San Joaquin Valley would be approximately 1 percent under the 55 w/WSAs scenario. However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.4 and economic effects could also be as high as those identified in Chapter 8.

Changes in Sacramento/Delta water supply under the VA pathway would also result in a change in Sacramento/Delta supply to agricultural users in the San Joaquin Valley region. Table 13.8-1 shows that changes in agricultural water supply in the San Joaquin Valley could range from a reduction of 3 percent to an increase of 2 percent under the VA pathway. The overall effect would be dependent on the sources of the unspecified water purchases, which are not fully known at this time. However, any reduction under the VA pathway would be substantially less than under the 55 scenario, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2. The changes in Sacramento/Delta water supply to agricultural users in the San Joaquin Valley under the VA pathway would be less than or similar to the 55 w/WSAs scenario on average across all water year types, for the term of the VA pathway.

Reductions in Sacramento/Delta surface water supplies to agricultural users could lead to changes in distribution of crop types and acreage and conversion of important farmland to non-agricultural use in the San Joaquin Valley, which would also affect crop revenues. The SWAP model results presented in Section 8.4 show that there would be an overall reduction in crop revenue in the San Joaquin Valley under the flow scenarios. If groundwater is not used to offset the water supply reductions, the SWAP model results estimate that for the lower flow scenarios the largest portion of the reduction in crop revenue in the San Joaquin Valley is associated with a decline in the production of almonds and pistachios, with additional reductions in crop revenue for other crops such as alfalfa and pasture, and corn and silage (see Chapter 8, Table 8.4-9). The SWAP model results presented in Section 8.4 show that changes in crop revenues under the 35 and 45 scenarios (Low Flow Alternative) would be less than under the 55 scenario.

Based on the SacWAM results for changes in agricultural water supply to agriculture in the San Joaquin Valley presented above in Table 13.8-1 and in Section 13.7.4 and Chapter 8, the 55 w/WSAs scenario could also lead to a reduction in revenue primarily from almonds and pistachios, alfalfa and pasture, corn and silage, and wheat and field crops, but with a much smaller decrease than under the 55 scenario as compared to baseline. These changes under the 55 w/WSAs scenario would likely be comparable to changes in crop revenue under the Low Flow Alternative. Based on the SWAP model results presented in Section 8.4 for the Low Flow Alternative, reductions in crop revenue under the 55 w/WSAs scenario are estimated to be 0–1 percent for both average year and dry year hydrologic conditions if it is assumed that groundwater would not be available to replace reductions in surface water availability (see Chapter 8, Tables 8.4-9 and 8.4-11). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, economic effects could also be as high as those identified in Chapter 8.

As discussed in Section 9.8.2.2, *San Joaquin Valley*, SWAP model results for changes in crop revenue in the San Joaquin Valley indicate that there could be a decline in crop revenue, both with and without considering the effects of unspecified water purchases. A large portion of the decrease in crop revenue is estimated to occur as a result of reduced pasture acreage, and SWAP model estimates that the reduction in pasture acreage would be greater when considering the possible effects of unspecified water purchases. As discussed in Section 9.8.2.2, the decrease in crop revenue could be about 0.1 percent when including unspecified water purchases, and less than 0.05 percent without the unspecified water purchases. It is expected that changes in crop revenue under the VA pathway would be somewhat higher than but very similar to those discussed in Section 9.8.2.2 for the term of the VA pathway, even with the additional flows and changes in water supply under the regulatory pathway for non-HRL water rights added to the VA pathway as described in Section 13.4.2.

13.8.2.3 San Francisco Bay Area, Central Coast, and Southern California

As shown in Table 13.8-1, annual average changes in Sacramento/Delta supply for agriculture in the Bay Area, Central Coast, and Southern California could range from -4 TAF/yr under the starting point for the regulatory pathway (55 w/WSAs) to +1 TAF/yr under the VA pathway for the term of the VA pathway. For the 55 w/WSAs scenario, these changes would be much smaller than those under the 55 scenario, and less than under the Low Flow Alternative (35 and 45 scenarios) overall for these three regions. As presented in Section 6.4, *Changes in Surface Water Supply*, the estimated average annual reductions in agricultural water supply in the Bay Area, Central Coast, and Southern California regions would be approximately 8 percent under the 35 scenario and 17 percent under the 45 scenario (see Chapter 6, Table 6.4-1). However, as discussed above, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries. For the VA pathway, any reductions in Sacramento/Delta surface water supply to agriculture in these regions would be less than under the 55 w/WSAs scenario and would also be smaller than those under the Low Flow Alternative.

Reductions in Sacramento/Delta surface water supplies to agricultural users could lead to changes in distribution of crop types and acreage and conversion of important farmland to non-agricultural use in the Bay Area, Central Coast, and Southern California, which would also affect crop revenues. The CASRAA results presented in Section 8.4 show that there would be an overall reduction in crop revenue in the Bay Area, Central Coast, and Southern California under the flow scenarios. If groundwater is not used to offset Sacramento/Delta surface water supply reductions, the CASRAA

results estimate that a large portion of the reduction in crop revenue under the flow scenarios is associated with vineyards and alfalfa and pasture in the Bay Area, vineyards and vegetables in the Central Coast, and orchards in Southern California (see Chapter 8, Figures 8.4-8, 8.4-9, 8.4-11, 8.4-12, 8.4-14, and 8.4-15). The CASRAA results presented in Section 8.4 show that changes in crop revenues under the 35 and 45 scenarios (Low Flow Alternative) would be less than under the 55 scenario.

Based on the SacWAM results for changes in Sacramento/Delta water supply to agricultural users in the Bay Area, Central Coast, and Southern California presented above in Table 13.8-1 and in Section 7.4 and Chapter 8, the 55 w/WSAs scenario could also lead to a reduction in crop revenue within the Bay Area primarily from vineyards and alfalfa and pasture, within the Central Coast primarily from vineyards and vegetables, and within Southern California primarily from orchards, but with a much smaller decrease than under the 55 scenario as compared to baseline. These changes under the 55 w/WSAs scenario would be similar to or less than the changes in crop revenue under the low end of the Low Flow Alternative (35 scenario). Based on CASRAA results presented in Section 8.4 for the 35 scenario, reductions in crop revenue under the 55 w/WSAs scenario are expected to be less than 1 percent for both average and dry hydrologic conditions if it is assumed that groundwater would not be available to replace reductions in surface water availability (see Chapter 8, Tables 8.4-14, 8.4-15, 8.4-17, 8.4-18, 8.4-21, and 8.4-22). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.4 and economic effects could also be as high as those identified in Chapter 8.

Although there could be localized impacts in the Bay Area, Central Coast, and Southern California, there would likely be very little to no change in crop acreage in these regions resulting from implementation of the VA pathway. It is unlikely that crop revenues in these regions would be reduced under the VA pathway, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

13.8.2.4 Effects on Farming-Dependent Industries

Providers of agricultural services, food processors, and other farming product–dependent industries such as dairies and livestock could be affected by changes in crop production in both the Sacramento/Delta and San Joaquin Valley. This analysis considers reductions in service opportunities and related employment derived from SWAP model results on food processors, dairies, and livestock enterprises, based on information presented in Section 8.4.2.4, *Effects on Farming-Dependent Industries*, and Section 9.8.2.3, *Effects on Farming-Dependent Industries*.

Overall, economic effects on farming-dependent industries would likely occur under the regulatory pathway. Because changes in Sacramento/Delta water supply to agricultural users in the Sacramento/Delta watershed and San Joaquin Valley would be less under the starting point for the regulatory pathway (55 w/WSAs) than under the 55 scenario and more similar to the Low Flow Alternative (35 and 45 scenarios), changes in crop acreage and resulting effects on farming-dependent industries under the 55 w/WSAs scenario would be less than under the 55 scenario and would be more similar to those under the Low Flow Alternative. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, effects on farming-dependent industries could also be as high as those identified in Section 8.4.2.4.

Economic effects on farming-dependent industries would also likely occur under the VA pathway, for the term of the VA pathway. Overall, economic effects with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights added to the VA pathway, as described in Section 13.4.2. Therefore, economic effects would be very similar to those described in Section 9.8.2.3.

Agricultural Services

As discussed in Section 13.7.4, *Agriculture and Forest Resources*, under the revised proposed Plan amendments, reductions in Sacramento/Delta surface water supply to agricultural users in the Sacramento/Delta watershed would primarily affect production of rice and alfalfa and pasture, although some other crops could also experience a decline in crop acreage. Changes in Sacramento/Delta surface water supply to agricultural users in the San Joaquin Valley would primarily affect production of wheat and field crops, alfalfa and pasture, corn and other silage, and almonds and pistachios. Suppliers for these industries would be most affected.

Food Processing

Some effects on food processing could occur as a result of changes in crop acreage under the revised proposed Plan amendments. Reductions in crop acreage and associated production could therefore adversely affect processing businesses. Economic effects of the starting point for the regulatory pathway (55 w/WSAs) and the VA pathway on food processors would likely be small, but some effects would be expected. For example, the SWAP model results for changes in crop acreage presented in Chapter 7 and Chapter 9 suggest that rice production could decline under the Low Flow Alternative (35 and 45 scenarios) and under the VA pathway. Because changes in water supply under the starting point for the regulatory pathway (55 w/WSAs) would have similar effects as the Low Flow Alternative and because the VA pathway would have similar effects as those described in Chapter 9, there could be an accompanying effect on rice millers in the Sacramento/Delta, although the effects would be smaller than under the 55 scenario. Although some effects are possible, ultimately, and based upon the analysis of flow scenarios in Section 8.4.2.4, the impacts on food processors under either the regulatory pathway or VA pathway could result in very small changes in source production that are well within the normal year-to-year variation that are typically expected by processors. As a result, effects on food processing under both the regulatory pathway and VA pathway would not likely lead to closures of processing facilities and therefore would not be a contributing factor to rural blight (see Section 13.7.3, *Aesthetics,* for additional discussion).

Livestock

Dairy farms, dairy based processed foods, and beef cattle are among the industries highly reliant on irrigated crops in the Sacramento and San Joaquin Valleys. Dairy farms rely on locally grown corn silage and other field crops, alfalfa hay, feed grains, and other locally available byproducts, such as almond hulls and cottonseed meal. The SWAP model results suggest that some crop types that are utilized by livestock could be affected by reductions in crop acreage under the starting point for the regulatory pathway (55 w/WSAs) and the VA pathway, such as alfalfa and irrigated pasture, although effects would be smaller compared to the 55 scenario. Although large amounts of alfalfa and other crops utilized by livestock are grown in the Sacramento/Delta watershed and San Joaquin Valley, the area is a net importer of alfalfa grown in other regions and other states. As a result, these regions could experience an increase in livestock feed costs in some locations due to increased

livestock feed imports, but the effects under the 55 w/WSAs scenario and the VA pathway would be less compared to the 55 scenario. In addition, some cattle operations could substitute other feedstock involving almond hulls or cottonseed meal, or additional imports of hay from other states. The net effect would likely be higher cost of production.

13.8.2.5 Regional Economic Effects

Changes in agricultural production could result in additional economic effects that affect industry output (sales), personal income, and employment. These regional effects are discussed and evaluated in this section, for the Sacramento/Delta watershed and for the State of California.

In the analysis presented in Section 8.4.3, *Regional Economic Effects*, and Section 9.8.2.4, *Regional Economic Effects*, regional economic effects were estimated using the IMPLAN model. The regional economic analyses presented in Section 8.4.3 and 9.8.2.4 were conducted to estimate how changes in water supply and resulting changes of the local agricultural economy would affect regional economic activity in (1) the Sacramento/Delta watershed, and (2) the state as a whole. The regional economic analyses were carried out with IMPLAN, a widely used, proprietary data and modeling software system. The IMPLAN model results are referenced in the discussion below where appropriate and to provide additional context. As described in Section 8.4.3 and Section 9.8.2.4, SWAP model results for crop revenues and expenditures under the flow scenarios were the primary inputs to the regional economic modeling.

As shown in Table 13.8-1, under the 55 w/WSAs scenario, changes in Sacramento/Delta water supply to agricultural use would be much less compared to the 55 scenario, and would be more similar to those under the Low Flow Alternative (35 and 45 scenarios). In addition, changes in crop revenue under the starting point for the regulatory pathway (55 w/WSAs scenario) would be much less than under the 55 scenario and more similar to the Low Flow Alternative. Therefore, under the starting point for the regulatory pathway (55 w/WSAs), regional economic effects would also be much less than the 55 scenario and more similar to the Low Flow Alternative. IMPLAN results for the Sacramento/Delta Regional Model presented in Section 8.4.3.2 estimate a reduction in output of $131 million to $217 million, a reduction in income of $72 million to $121 million, and a reduction in number of jobs of 1,324 to 2,214 under the Low Flow Alternative (35 to 45 scenarios; see Chapter 8, Table 8.4-23). IMPLAN results for the State of California Model estimate a reduction in output of $209 million to $497 million, a reduction in income of $112 million to $266 million, and a reduction in number of jobs of 1,790 to 4,216 under the Low Flow Alternative (35 to 45 scenarios; see Table 8.4-25). However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, regional economic effects could also be as high as those identified in Section 8.4.3.

Under the VA pathway, regional economic effects would be very similar to those presented in Section 9.8.2.4 for the term of the VA pathway. The IMPLAN results presented in Section 9.8.2.4 for the Sacramento/Delta Regional Model suggest reductions of approximately $55 million in economic output, $29 million in labor income, and 552 jobs (517 full time equivalent [FTE] jobs) in the Sacramento/Delta region compared with baseline (see Chapter 9, Table 9.8-5). Most of the effects occur in the agriculture and agricultural support sectors. The IMPLAN results presented in Section 9.8.2.4 for the State of California Model suggest decreases of approximately $54 million in economic output, $19 million in labor income, and 353 jobs (289 FTE jobs) compared with baseline (Table 9.8-6). The IMPLAN results suggest that water purchase compensation could provide a positive economic effect on output, income, and jobs. Regional economic effects with implementation of the

VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

13.8.2.6 Agricultural Economic Effects on Economically Disadvantaged Communities

This section discusses potential agricultural economic effects of the revised proposed Plan amendments on economically disadvantaged communities (DACs). In particular, this assessment considers the extent to which reduced Sacramento/Delta surface water supply and changes in crop acreage could affect agricultural-related employment in and associated with DACs.

Section 8.4.4, *Agricultural Economic Effects on Economically Disadvantaged Communities*, presents IMPLAN model results from the California Statewide Economy analysis for the estimated change in agricultural output, income, and jobs for each flow scenario (35, 45, 55, 65, and 75 scenarios) (see Chapter 8, Table 8.4-27). The IMPLAN results presented in Section 8.4.4 estimate that reduced Sacramento/Delta surface water supplies could lead to losses in agriculture-related income and employment. The majority of effects on agricultural output, income, and employment would be expected in the Sacramento/Delta watershed and San Joaquin Valley regions, though localized effects could also occur elsewhere in California. Many of the agriculture job losses may correspond to agricultural laborers who reside in DACs. The IMPLAN results presented in Section 8.4.4 show that changes in agriculture output, income, and jobs under the 35 and 45 scenarios (Low Flow Alternative) would be less than under the 55 scenario (Table 8.4-27).

Based on the SacWAM results for changes in Sacramento/Delta supply to agriculture presented above in Table 13.8-1, changes in Sacramento/Delta supply to agriculture under the starting point for the regulatory pathway (55 w/WSAs scenario) would be less than under the 55 scenario, and would be more similar to changes under the Low Flow Alternative. Therefore, the 55 w/WSAs scenario would result in a reduction in agriculture output, income, and jobs, but with a much smaller decrease than under the 55 scenario as compared to baseline; the reduction in agriculture output, income, and jobs would be expected to be more similar to the IMPLAN estimated reductions under the Low Flow Alternative. Based on the IMPLAN results presented in Section 8.4.4 for the Low Flow Alternative, the reduction in agriculture output under the starting point for the regulatory pathway (55 w/WSAs) could be approximately $58-139 million, the reduction in income could be $57–136 million, and the reduction in number of jobs could be 861–2,046 (see Chapter 8, Table 8.4-27). The IMPLAN results also identify changes in employment for other categories, including some additional agricultural support jobs and processing jobs that could have some additional employment-related effects relevant to DACs (Tables 8.4-28 and 8.4-29). Changes in employment for agricultural support jobs and processing jobs under the 55 w/WSAs scenario would also be comparable to those estimated by IMPLAN for the Low Flow Alternative. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, economic effects on DACs could also be as high as those identified in Section 8.4.4 for the 65 scenario.

Similarly, potential agricultural economic effects on DACs could occur under the VA pathway, but the estimated change in agricultural output, income, and jobs would be much less under the VA pathway than under the 55 scenario based on results presented in Section 9.8.2.4, *Regional Economic Effects*. The IMPLAN results for the State of California analysis provided in Section 9.8.2.4 estimate a

decrease of approximately $37 million in agriculture output, a decrease of approximately $36 million in agriculture income, and a loss of approximately 548 agriculture-related jobs (see Chapter 9, Table 9.8-6). Farm laborers and communities, including DACs, could be affected. The IMPLAN results suggest that water purchase compensation could result in induced effects; that is, compensation for water purchases could provide a positive economic effect on output, income, and number of jobs. Effects with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to have very similar economic effects as those evaluated in Section 9.8.2.4 for the VA pathway alone, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

13.8.3 Municipal Water Supply Economic Effects

This section describes the potential economic effects of the revised proposed Plan amendments on municipal water providers and is informed by prior analysis of municipal water supply economic effects presented in the Staff Report. Section 8.5, *Municipal Water Supply Economic Effects*, analyzes the potential costs to affected municipal service providers of securing reliable water supplies for the flow scenarios (35, 45, 55, 65, and 75 scenarios), with the focus on (1) cost of developing other water supplies to replace the reduced Sacramento/Delta water supply; (2) the opportunity cost of lost supply if no other supply sources are available; or (3) costs of using other water supplies within existing water portfolios to replace the reduced Sacramento/Delta water supply.

As discussed below, municipal water supply economic effects under the VA pathway would be limited. Municipal water supply economic effects with implementation of the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2. Therefore, effects under the VA pathway would be very similar to those described in Section 9.8.3, *Municipal Water Supply Economic Effects*, which addresses the economic effects on municipal water providers.

As discussed in Section 8.5.1, *Approach to Analysis*, urban water management plan (UWMP) documents, DWR's aggregated 2020 UWMP database, and other local planning documents, such as Integrated Regional Water Management Plans and water district planning documents, were reviewed to determine the types and availability of other water supplies that municipalities would be likely to implement. Forecasted future water supplies up to the year 2030 were used to represent potential availability of additional other water supplies. Based on this information, the analyses of the flow scenarios, the starting point for the regulatory pathway, and the VA pathway indicate that replacement supplies are likely to be available, considering the cost of acquiring or developing these supplies. Business and residential customers would not likely be subject to reduced water service. Water supply is only one variable among many that influence growth and development in the plan area and in California in general. There are many external factors—individual, local, and global—that affect economic outcomes. Therefore, surface water supply changes would not impose barriers to economic development or cause business closures leading to urban decay.

Increasing housing stock and home construction are closely associated with economic growth and development and are also a primary means to addressing urban homelessness. Many strategic planning, financing, infrastructure, and economic drivers factor into community efforts to facilitate and encourage housing development, with adequate water supply being one aspect. Ultimately,

urban water providers can and do take action through planning for growth and water supply to meet those needs by engaging in water supply portfolio strategies. Over time, there is also opportunity to take advantage of favorable economic conditions, should they be present, to encourage and enhance housing construction, while incorporating long-term strategies for residential conservation that reduce per-capita water use. Through the Urban Water Management Plan Act, municipalities already have the planning mechanism and framework in place to accommodate and address future water needs, and lack of water should not be an impediment to growth.

As discussed in Section 13.7.20, *Utilities and Services Systems*, implementation of the revised proposed Plan amendments could result in surface water and groundwater supply reductions to municipal water users. Reductions in Sacramento/Delta water deliveries to municipal users would vary by region. Table 13.8-2 presents SacWAM estimates for regional changes in the amount of Sacramento/Delta water supplied to municipal users under the starting point for the regulatory pathway (55 w/WSAs scenario) and under the VA pathway (VA scenario). These estimates show that changes in flow requirements could result in reductions in municipal supply to all regions under the starting point for the regulatory pathway (55 w/WSAs scenario) and minimal or no impact under the VA pathway. These reductions in supply under the revised proposed Plan amendments would be lower compared to the 55 scenario analyzed in Chapter 7 (Table 7.20-6). Based on the SacWAM results presented below, changes in Sacramento/Delta water supply to municipal use under the 55 w/WSAs scenario are expected to be more similar to those under the Low Flow Alternative (35 and 45 scenarios). However, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore impacts could also be as high as those identified in Section 7.20, *Utilities and Service Systems*.

Under the VA pathway, changes in Sacramento/Delta water supply to municipal use would be expected to be somewhat higher, but similar to those described in Chapter 9 for the VA pathway alone, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2.

Table 13.8-2. Change from Baseline Conditions: Annual Average Sacramento/Delta Supply for Municipal Use by Region and Pathway (thousand acre-feet per year)

Region	Annual Average Total Municipal Supply	Sacramento/ Delta Supply	Change from Baseline	
			55 w/WSAs Scenario	VA Scenario
Sacramento River watershed, Delta eastside tributaries, Delta (Sacramento/Delta)	1,117	584	-33	-11
San Joaquin Valley	1,054	100	-13	3
San Francisco Bay Area, Central Coast, Southern California	5,886	2,391	-325	33
Total	8,057	3,075	-370	25

Sources: Historical water deliveries data (see Section 2.8, *Existing Water Supply*), and SacWAM results (see Section 13.4, *Changes in Hydrology and Water Supply*).

As described in Section 13.7.20, changes in water supply under the revised proposed Plan amendments could result in effects on municipal supply ranging from minimal impacts under the VA

pathway for the term of the VA pathway, to potentially significant impacts under the regulatory pathway. Reductions of Sacramento/Delta supply to municipal uses under the regulatory pathway could result in insufficient water supply for municipal suppliers, and therefore new or expanded entitlements might be necessary. Based on the SacWAM results presented above in Table 13.8-2 and in Chapters 7 and 9, under the VA pathway, municipal water supply economic effects would be expected to be somewhat higher, but similar to those under the VA pathway alone, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2; municipal water supply economic effects would be very similar to those described in Section 9.8.3. Under the starting point for the regulatory pathway (55 w/WSAs), municipal water supply economic effects would be expected to be much less than under the 55 scenario and more similar to those under the Low Flow Alternative (35 to 45 scenarios) described in Section 8.5.

The relative economic costs of obtaining other water supplies depend on the amount of reduced Sacramento/Delta supply, the availability of other water supplies, the amount of water municipalities have in reserve, and the general costs for installing or implementing the other water supplies that are available. In many cases Sacramento/Delta supply represents only a portion (or none) of providers' supply, so the effects on the providers and the municipalities they serve can range from large to small, or none at all, based upon the respective balance between supplies and demand.

In Section 8.5, the costs are estimated as a range representing the extent to which municipal providers may rely on demand management measures and use reserve supplies, if available, versus the cost of acquiring additional water supplies to fully replace the reduction in Sacramento/Delta water supply. The maximum annual cost estimate for acquiring additional water supplies to fully replace the reduction in the Sacramento/Delta water supply is represented by the Upper Bound cost, which is described in Section 8.5.1, *Approach to* Analysis. All municipal water supply and estimated costs are presented as an annual average, meaning that the amortized capital investment cost and operating cost (energy, operation, replacement, and maintenance) are expressed as annual average costs per acre-foot. The Upper Bound cost analysis assumes all reduction in surface water supply would be replaced on an equal basis, without any demand management measures to maximize the use of existing water supplies, and regardless of the municipality's reserve status, or the cost of obtaining new supplies. Additionally, the cost analysis reflects what the providers indicate as their most likely options for other water supplies as an un-prioritized list, meaning that each water supply is equally likely to be selected to replace reduced deliveries. This has the effect of possibly overestimating the cost of water replacement, because providers facing a reduction in one source of supply may prioritize replacement based on least cost first.

Table 13.8-3 shows the estimated Upper Bound cost estimate for acquiring additional water supplies to fully replace the reduction in the Sacramento/Delta municipal supply under the Low Flow Alternative (35 to 45 scenarios) and the VA pathway based on results presented in Sections 8.5 and 9.8.3. Under the starting point for the regulatory pathway (55 w/WSAs scenario), changes in Sacramento/Delta municipal supply would be less compared to the 55 scenario, reducing the replacement water supply needs and the municipal water supply economic effects. Because changes in Sacramento/Delta municipal supply would be more similar to those under the Low Flow Alternative (35 and 45 scenarios), the costs for acquiring additional water supplies to fully replace the reduction in Sacramento/Delta supply would be similar to those under the Low Flow Alternative (35 and 45 scenarios) discussed in Section 8.5. Cost estimates for the Low Flow Alternative thus serve as a surrogate cost estimate for municipalities to replace reduced supply under the starting

point for the regulatory pathway (55 w/WSAs). However, under the regulatory pathway, the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, and therefore municipal water supply economic effects could also be as high as those identified in Section 8.5.

Under the VA pathway, municipal water supply economic effects would be limited. The VA pathway would not be expected to result in substantial changes in Sacramento/Delta supplies for municipal uses because the Sacramento/Delta water supply reductions under the VA pathway would be based on voluntary measures that would be largely or entirely from agricultural supplies or based on groundwater substitution, or reservoir reoperations. Effects would be somewhat higher, but similar to those under the VA pathway alone, even with the additional flows provide by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2; therefore, it is unlikely that municipal users would acquire additional water supplies under the VA pathway.

Table 13.8-3. Upper Bound Annual Average Supply Needs to Replace Reduction in Sacramento/Delta Supplies for Municipal Use (TAF/yr), and Surrogate Estimated Costs for Municipalities to Replace Reduced Supply by Region

	Change in Sacramento/Delta Supplies for Municipal Use (TAF/yr) [a]		Cost Estimate ($/yr)	
Region	55 w/WSAs Scenario	VA Scenario	55 w/WSAs Scenario [b]	VA Scenario [c]
Sacramento River watershed, Delta eastside tributaries, Delta (Sacramento/Delta)	-33 (-6%)	-11 (-2%)	$3,068,000 - $4,784,000	$0
San Joaquin Valley	-13 (-13%)	3 (3%)	$1,677,000 - $5,148,000	$0
San Francisco Bay Area, Central Coast and Southern California	-325 (-14%)	33 (1%)	$160,669,000 - 383,258,000	$0

[a] Source: SacWAM results (see Section 13.4, *Changes in Hydrology and Water Supply*)
[b] Source: Appendix D, *Supplemental Municipal Supply Analysis Information*, and Section 8.5, *Municipal Water Supply Economic Effects*. Surrogate cost estimates are based on cost estimates for Low Flow Alternative (35 to 45 scenarios).
[c] Source: Section 9.8.3, *Municipal Water Supply Economic Effects*.
TAF/yr = thousand acre-feet per year

The actual costs for municipalities to replace reduced Sacramento/Delta surface water supply may differ from the estimates presented above in Table 13.8-3. The response by individual municipalities to reduced Sacramento/Delta supply is expected to vary depending on the extent of reliance on those supplies, the balance between supplies and existing demand, the variety of water sources in their existing water portfolio, ability for water transfers or exchanges, and the extent of availability and access to groundwater. Municipal water conservation and efficiency measures are among management actions all service providers could implement to meet current and future water needs.

As discussed in Section 8.5, this analysis does not evaluate additional costs that could be incurred to deepen groundwater wells as a response to possible groundwater level declines. The general costs for installing or implementing additional groundwater pumping, groundwater recovery and storage, recycled water, water transfers, and desalination are described in Section 8.3, *Costs Associated with Other Water Management Actions*. Lower groundwater levels could occur in localized areas if flows

are provided through groundwater substitution or from reduced incidental recharge from the application of applied irrigation water, which could potentially affect communities in the Sacramento River watershed, Delta eastside tributaries, and San Joaquin Valley regions that rely on groundwater as their primary water supply source. Therefore, it is possible that some municipal water users could incur additional expenses to access lower groundwater levels. If wells are already deep enough to accommodate lowered static water levels, the additional expense is very small. However, if existing wells must be deepened, or new wells drilled, additional capital expense would be incurred. This could potentially also be the case for self-supplied households on domestic wells if the well depth was insufficient to accommodate lowered groundwater levels, should they occur. Chapter 8 provides discussion of costs to construct new wells and to deepen existing wells, which is also summarized below in Section 13.8.6. In some cases, drinking water providers may need to rely on other sources of water that are lower in quality and require additional treatment. A new or expanded drinking water treatment plant may need to be constructed, or an existing plant may need to be modified. Representative and unit costs are discussed in Section 8.9.2, *Water Treatment Facilities,* in the final Staff Report.

13.8.4 Fisheries Economic Effects

This section discusses fisheries economic effects under the revised proposed Plan amendments.

Overall, the revised proposed Plan amendments would be expected to result in economic benefits from increases in native fish populations in the Sacramento/Delta watershed. The following list provides a summary of the major benefits.

- ***Commercial Fisheries***: The health of the Bay-Delta watershed is crucial for Pacific Ocean commercial salmon fisheries, especially Chinook salmon. The value of Chinook salmon landings in 2022 totaled $19.1 million (2023$) in California, compared to $3.5 million in Oregon and $1.7 million in Washington (PFMC 2024). However, over the past 50 years, commercial ocean salmon fisheries have experienced a significant decline. Table 3.4-3 in Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, of the Staff Report indicates significant declines in the natural production of Chinook salmon in the Sacramento and San Joaquin River basins between the Central Valley Project Improvement Act baseline period of 1967–1991 and 1992–2015. The Pacific Fishery Management Council (PFMC) implemented a near full closure of the ocean salmon fishery from 2008 through 2009, full closure of the California ocean salmon fishery in 2023 and 2024, and a full commercial and partial recreational closure of the California ocean salmon fishery in 2025 because of reduced stock size.

  In addition to immediate financial losses during closure years, increased volatility can raise the fishery's financing and insurance costs and reduce their supply of skilled labor, raising average costs per pound harvested and increasing fishery workers' income volatility. Prolonged closures could result in processing facilities closing, which could reduce local demand for fish in fishing-dependent communities even after closure, as well as fishery workers, owners, and operators permanently leaving the fishery. This in turn could reduce the demand for goods and services that other local businesses provide in fishing-dependent communities, resulting in substantial loss in incomes and lasting damage to communities facing a loss in value for much of their existing human and physical capital.

  Several studies have estimated the economic effects of recent fishery closures. For example, one study estimated the total economic damage at $354 million (2023$) in lost industrial outputs

and 2,263 lost jobs in 2008, with even greater damages of $385 million in lost industrial outputs and 2,690 lost jobs in 2009 (Morse and Manji 2009). A second study based on income and employment in 2004–2005 estimated that the combined commercial and recreational salmon fishery closures cost the California fishing industry $163.5 million (2023$) in lost annual income and 1,823 jobs (Michael 2010).

A more natural flow regime would benefit Chinook salmon populations by improving spawning, rearing, and migratory conditions, thereby boosting harvests and reducing commercial fishery closure risks. Increased salmon abundance may also lower commercial fishing production costs and enhance profits and stability for fishing communities.

- ***Recreational Fishing***: Fish that are both native to the Bay-Delta watershed and popular recreational fishing species include Chinook salmon, Sacramento splittail, steelhead, green sturgeon, and white sturgeon. Chinook salmon is a key recreational species in California, and salmon runs in the Bay-Delta watershed are vital to the state's tourism and recreation industry (NMFS 2024). In 2022, marine recreational fishing in California supported 5,799 jobs, $886.2 million in sales (2023$), and $345.1 million in income (i.e., wages and salaries; 2023$). Additionally, marine recreational fishing expenditures in California contributed $528.6 million (2023$) to the California gross domestic product in 2022 (NMFS 2024). However, several data sources such as the Central Valley Angler Survey Database (CDFW 2023) indicate that recreational fishing (angler effort and catch) for native species like Chinook salmon and sturgeon has declined in recent years, impacting tourism and revenue.

  Improved and stabilized populations of native fish species would decrease the likelihood of recreational fishery closures and improve catch rates, and, as a result, increase the value of the recreational fishing experience. As shown in the economic literature, recreational anglers place a high value on recreational fishing in general and on salmon fishing in particular. For example, anglers' willingness-to-pay (WTP) per recreational fishing day on the Sacramento River ranges from $113 to $411 (Tsournos et al. 2016). Similarly, Shaw and Dundas (2021) found that anglers' WTP ranged from $88 to $329 per Chinook salmon caught in Oregon, varying by region. Therefore, preventing closures of salmon fisheries and further native fish population declines is likely to generate substantial benefits to recreational anglers, particularly for anglers less willing to substitute more abundant, nonnative species (e.g., striped bass).

  Other studies demonstrated that anglers' value (WTP) of a recreational fishing day is directly related to catch rates. Larson and Lew (2013) found that anglers' median WTP for a 50 percent (100 percent) increase in silver and king salmon harvest were $29 ($71) and $111 ($311), respectively. The WTP of the two salmon species were shown to be complementary since the WTP for a 50 percent (100 percent) increase in catch rate for both species was $189 ($538). Equivalent reductions in catch rates were found to have generally smaller reductions in WTP compared to equivalent increases in catch rates.

  Rising catch rates may also result in increased angler trip participation. Andrews and Wilen (1988) found that on average, trip participation increased by 1 percent for every 2 percent increase in success/catch rate. Although improved catch rates increase the value of recreational fishing experience, their effect on trip participation is likely to be more modest because there are other factors that more strongly influence angler trip participation (e.g., availability of leisure time, distance travelled, and travel costs).

A more natural flow regime would support healthy fisheries and could improve catch rates and reduce closures, increasing angler satisfaction and participation. Higher fish population sizes would also benefit local businesses reliant on fishing and tourism. For example, tourism-based businesses include guided recreational fishing trips for popular native fish. As of 2021, Bay-Delta recreation and tourism supports nearly 2,300 jobs in the five largest Delta counties and approximately 3,800 jobs across all of California, but these numbers are 26 percent and 28 percent, respectively, lower than 2012 values (DPC 2021).

- ***Non-Use Benefits***: Individuals may derive non-use values from healthy salmon and other native species populations without directly using or interacting with these resources. Non-use values may be held by both users (e.g., recreational anglers) and non-users of a resource (e.g., people who reside outside of the plan area but place value on maintaining and improving fish species in the Bay-Delta watershed). Non-use values may be more difficult to assess than use values because these values are not associated with easily observable behavior. Economic studies that assess the public's WTP for environmental restoration programs typically capture both use and non-use values held by general population.[2]

  Based on a review of nine studies conducted to estimate use and non-use values associated with anadromous fish restoration programs, annual per household WTP values range between $35 and $696 depending on the fish species, geographic location, and population improvement specified (Jones & Stokes Associates 1990; Olsen et al. 1991; Loomis 1996; Douglas and Taylor 1999; Bell et al. 2003; Stoll et al. 2009; Jordan et al. 2012; Loomis 2012; RTI International 2012). These results suggest broad support for ecological restoration and biodiversity improvements, such as those anticipated under the Sacramento/Delta update to the Bay-Delta Plan.

- ***Tribal Uses of Fish***: Numerous cultural and other uses of water by the tribes within California are built on vital and healthy fisheries. Historically, Northwestern Californian tribes such as the Karuk, Yurok, Hoopa, Shasta, and Tolowa were most dependent on salmon as a food source, while salmon was a food source of equal importance to plants or game animals for groups in other areas such as the Plains and Central Miwok, Maidu, Yokuts, Western Mono, Achomawi, Sinkyone, and Kato (Swezey and Heizer 1977). Native fish represent not only a major traditional food source for local tribes, but also a matter of cultural sovereignty and survival (Salter 2003).

  Salmon traditionally accounted for one third of the Plains Miwok diet (Zedler and Stevens 2018) and half of the Karuk diet (^Long and Lake 2018). As recently as the 1960s, Karuk tribal members report having consumed salmon up to three times per day (Reed and Norgaard 2020). During the 1960s and 1970s, salmon consumption decreased from Karuk diets (Norgaard 2005). Today, average salmon consumption per person per year has decreased from 200 kilograms to 2.25 kilograms (^Long and Lake 2018). This decline represents a shift in Karuk diets away from traditional foods and towards those purchased at supermarkets or supplied through government assistance programs such as the Food Distribution Program on Indian Reservations (FDPIR) (Norgaard 2005).

  Having experienced one of the most recent and dramatic dietary shifts among Native American tribes, in 2004 the Karuk Tribe claimed in a federal process that the loss of salmon from their diets was creating artificially high rates of diet-related diseases such as heart disease, high blood pressure, diabetes, obesity, tuberculosis, kidney problems, and stroke. The rates of heart disease

[2] Total WTP values held by non-users of the resource (e.g., individuals who reside outside of the study area and do not participate in recreational fishing or related activities) are, by definition, non-use values.

and diabetes for the Karuk Tribe were estimated at three and four times the national average (39.6 percent and 21 percent), respectively. The associated healthcare costs for diabetes treatment among tribal members were estimated at $3.0 million (2023$) (Norgaard 2005; ^Norgaard 2014). A more natural flow regime that provides for healthy fisheries could help to restore access to traditional foods, thereby supporting better health outcomes and cultural preservation.

- ***Threatened and Endangered Fish Species***: Chapter 3, *Scientific Knowledge to Inform Fish and Wildlife Flow Recommendations*, provides a review and summary of the best available science on flow needs for the protection of fish and wildlife beneficial uses and provides life history information for several threatened and endangered fish species in the Bay-Delta watershed. As discussed in Chapter 3, several Bay-Delta fish species are threatened or endangered, and natural flow regimes are key to their recovery. Based on a review of findings from six valuation studies of threatened and endangered fish species (Weber 2015; Lika 2022; Johnston et al. 2015; Wallmo and Lew 2012; Rudd et al. 2016; Kotchen and Reiling 2000), many people are willing to pay to protect threatened and endangered fish. The included studies estimate the monetary value that households place on restoring endangered and threatened fish populations and habitats, with annual WTP values ranging from $1 to $404 per household depending on the fish species, geographic location, and population improvement specified (Weber 2015; Lika 2022; Johnston et al. 2015; Wallmo and Lew 2012; Rudd et al. 2016; Kotchen and Reiling 2000). A more natural flow regime would be expected to generate economic benefits by supporting habitat restoration and species recovery.

- ***Fish-Dependent Species***: Chinook salmon and other native fish support many fish-dependent species, including Southern Resident killer whales and other predators. Tourism and recreation associated with fish-dependent species can provide economic benefits to local communities and generate substantial non-market use and non-use value to local residents, visitors, as well as non-users of the resource (including local and non-local).

  Economic benefits to local communities from wildlife viewing industries may include job creation and revenues for local business (e.g., charter boats). These industries may also have spillover effects to the regional economy (e.g., Monterey Bay area) (Industrial Economics 2021). The economic value of these industries would be any income exceeding what would have occurred in absence of wildlife presence. For example, killer whales are a target species for California whale watching, particularly in Monterey Bay. In 2005, whale watching generated an estimated $30 million (2023$) in gross revenue ($6.0–$13.5 million net; 2023$) (Pendleton 2006). Killer whales also provide value through opportunistic whale watching, such as recreationists who do not book whale watching tours but may travel or book recreational fishing trips and value seeing killer whales. In 2008, whale watchers spent $118.4 million in California (2023$) (Industrial Economics 2021; O'Connor et al. 2009). A more natural flow regime could help stabilize food sources for these species, by increasing abundance of prey species, including Chinook salmon and other native fish species, thereby enhancing tourism, recreation, and biodiversity-related economic and non-market benefits.

Under the starting point for the regulatory pathway (55 w/WSAs), the flow-related ecological benefits and associated beneficial fishery related economic effects could be lower compared to the 55 scenario. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or

all tributaries, beneficial fishery related economic effects could also be as high as those under the 65 scenario.

Under the VA pathway, flow-related ecological benefits and associated beneficial economic effects would also be expected to the extent that the VA pathway results in a more natural flow regime. However, the changes in streamflow under the VA pathway would be smaller than those under the starting point for the regulatory pathway (55 w/WSAs). Subsequently, fish population improvements and fisheries-related ecological benefits resulting from a more natural flow regime could be smaller under the VA pathway compared to the starting point for the regulatory pathway, for the term of the VA pathway, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2. However, the VA pathway would also provide for non-flow habitat restoration measures on a portion of the Sacramento/Delta tributaries that could result in fisheries-related ecological benefits and associated beneficial economic effects.

13.8.5 Other Economic Effects

Section 8.7, *Other Economic Effects,* in the final Staff Report discusses economic effects that could occur as a result of the Sacramento/Delta update to the Bay-Delta Plan, including effects on recreation, ecosystem services, wildlife refuges, and energy (hydropower) production.

This section discusses other economic effects on recreation, ecosystem services, wildlife refuges, and energy (hydropower) production under the revised proposed Plan amendments and is informed by the discussion provided in Section 8.7.

13.8.5.1 Recreation

As discussed in Section 8.7.1, *Recreation*, in the final Staff Report, the proposed Plan amendments could provide for economic benefits related to recreational opportunities that are supported by healthy rivers and a functioning watershed. Outdoor recreation generates economic benefits to those participating in the activities, both in terms of improved quality of the recreational experience, and in increased opportunities for activities. Section 8.7.1 discusses recreational opportunities associated with healthy rivers and reservoirs, and related beneficial economic effects.

Under the starting point for the regulatory pathway (55 w/WSAs), changes in hydrology within the Sacramento/Delta watershed would be less than those under the 55 scenario and would generally be more similar to those under the Low Flow Alternative. Therefore, beneficial economic effects related to recreation under the starting point for the regulatory pathway would be less than those under the 55 scenario and more similar to those under the Low Flow Alternative. Overall, however, the economic effects of the regulatory pathway on recreational opportunities would likely be small at the outset of Plan implementation. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, beneficial economic effects could also be as high as those identified in Section 8.7.1.

Implementation of the VA pathway could result in changes in streamflow and reservoir levels in the VA tributaries compared to baseline. These changes would be much smaller than the changes that would occur under the 55 scenario, even with the additional flows provided by non-HRL water rights under the regulatory pathway added to the VA pathway, as described in Section 13.4.2. It is

expected that any recreation-related economic effects associated with changes in streamflow and reservoir levels under the VA pathway would be minimal.

13.8.5.2 Ecosystem Services

As discussed in Section 8.7.2, *Ecosystem Services*, in the final Staff Report, ecosystem services are defined as the benefits that humans receive from the natural processes and functioning of ecosystems. Ecosystem services include both market activities (such as timber, food, and fuel), and non-market activities. The revised proposed Plan amendments are intended to provide for the reasonable protection of fish and wildlife beneficial uses in the Sacramento/Delta watershed, which would complement ecosystem services. Under the starting point for the regulatory pathway (55 w/WSAs), since changes in hydrology would be generally less than the 55 scenario and more similar to the Low Flow Alternative, the beneficial economic effects associated with ecosystem services would also be expected to be similar to the Low Flow Alternative. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, beneficial economic effects could also be as high as those identified in Section 8.7.2.

The VA pathway includes a combination of assets over 8 years (with the possibility of extension), including varying amounts of increased flows on certain tributaries, depending on water year type, and non-flow habitat restoration actions targeted at improving spawning and rearing capacity for juvenile salmonids and other native fishes, which would also complement ecosystem services. Beneficial economic effects associated with ecosystem services would also be expected under the VA pathway.

13.8.5.3 Wildlife Refuges

As discussed in Section 8.7.3, *Wildlife Refuges*, in the final Staff Report, wildlife refuges are set aside to protect wildlife habitat and, in some instances, to create a space for public use such as recreational opportunities for hiking, hunting, photography, bird watching, and sportfishing. In the study area, the Sacramento River watershed and San Joaquin Valley are the only geographic regions with wildlife refuges that receive Sacramento/Delta water supplies. Overall, wildlife refuges provide economic benefits related to ecosystem services and recreation.

Reduced Sacramento/Delta water supplies to wildlife refuges could result in reduction in habitat for waterfowl and shorebirds and other species. These changes could also result in some detrimental economic effects. As discussed in Section 13.4, SacWAM results for average annual Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario show limited changes for all water year types that would be assumed to be negligible and are within the expected precision of the model. These changes are very similar to those for the flow scenarios generated using SacWAM version 2025.08.28 and presented in Appendix H1a3, *Sacramento Water Allocation Model Results for Updated Unimpaired Flow Scenarios* and are less than those generated using SacWAM version 2023.06.12 and evaluated in Chapter 6 and Chapter 7 for the flow scenarios. As discussed in Section 13.4, refuge priorities were increased relative to other senior demands to reflect provisions of the December 2025 revised draft Bay-Delta Plan intended to prioritize refuge water supplies. However, while the SacWAM results suggest that changes in Sacramento/Delta water supply to wildlife refuges under the 55 w/WSAs scenario and flow scenarios could be negligible, the analysis of impacts resulting from changes in refuge water supplies is complicated by Reclamation's past practice of reducing water supplies to CVPIA wildlife refuges when it reduces

allocations to Sacramento River settlement contractors and San Joaquin River exchange contractors; therefore, it is possible that reductions in Sacramento/Delta surface water supplies to wildlife refuges could at times be larger than indicated by the modeling. If reductions in Sacramento/Delta supplies to wildlife refuges in the Sacramento River watershed and San Joaquin Valley regions are larger than estimated by SacWAM, the resulting economic effects could also be larger. In addition, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, economic effects could also be as high as those identified in Section 8.7.3. The revised proposed Plan amendments include provisions that prioritize water supplies to refuges that could reduce these economic effects.

There would be no expected change in refuge water supplies as a result of the VA pathway. There would likely be no resulting change in economic effects to wildlife refuges under the VA pathway.

13.8.5.4 Energy

Numerous hydropower generation facilities are located within the Sacramento/Delta watershed. In addition to providing income for facility owners, larger hydropower facilities provide a revenue source that contributes funding for beneficial programs, such as flood-risk protection, water resource monitoring and protection, and fisheries management. Sections 7.8, *Energy*, 9.7.8, *Energy*, and 13.7.8, *Energy,* describe the potential impacts that may result from changes in hydrology or changes in water supply. As discussed in Section 13.7.8, the revised proposed Plan amendments could result in changes in hydropower generation. Changes in hydrology would result in an increase in hydropower generation in the spring and a decrease in summer. Annually, percent change in hydropower generation would be relatively small at most facilities because the total annual unimpaired inflow to the upper watersheds where most hydropower facilities are located would not change and because storage would not be greatly reduced.

Changes in flow under the 55 w/WSAs scenario would be expected to be smaller than the 55 scenario and more similar to the Low Flow Alternative (35 and 45 scenarios). Section 7.8 estimates that under the 45 scenario, the estimated reduction in median annual hydropower generation is 270 gigawatt hours (GWh) (see Chapter 7, Table 7.8-3), which represents a decrease of about 2.0 percent in hydropower generation in the 47 hydropower facilities evaluated for the Sacramento/Delta region. When compared with all the electricity generated in California for 2021 (194,127 GWh, Table 7.8-1), a critically dry year, this annual change (270 GWh) represents a 0.14 percent decrease.

Under the starting point for the regulatory pathway, the largest monthly decrease in estimated hydropower generation would likely occur during July (Figure 7.8-10). Section 7.8 estimates that under the 45 scenario, median hydropower generation would decrease by 116 GWh, which would be approximately 7 percent of the July baseline median generation of 1,679 GWh calculated for the 47 hydropower facilities evaluated for the Sacramento/Delta region.

The main effect of the VA pathway on hydropower generation would be a small increase during the spring and a small reduction during the summer (see Chapter 9, Figure 9.7-2). For the analysis presented in Chapter 9, changes in hydropower generation were extrapolated to estimate the possible effect of unspecified water purchases. The extrapolated percent change in hydropower generation for July – September varied between an increase of 1.4 percent to a decrease of 6.7 percent depending on month and water year type (Table 9.7-9).

Changes in the timing of hydropower production generation, including an increase of hydropower generation in the spring and a decrease in summer, could affect hydropower generation revenues. As discussed in Section 8.7.4, *Energy*, California Independent System Operations (CAISO) data indicate that the price for generated power is typically higher during the summer months compared to the spring months, as shown in Figure 8.7-2. Accordingly, although hydropower effects would be relatively small on an annual basis, the revised proposed Plan amendments could result in a decrease in annual hydropower generation revenues.

As discussed in Section 13.7.8, changes in hydrology under the revised proposed Plan amendments could cause a reduction in summer hydropower generation that would range from minimal for the VA pathway for the term of the VA pathway to more substantial for the regulatory pathway. The starting point for the regulatory pathway would have similar effects as those that were evaluated in Section 7.8; however, as described in Section 13.4, changes in hydrology and water supply would be smaller and more similar to the Low Flow Alternative (35 and 45 scenarios) than those described in Section 7.8 due to the addition of new water supply adjustments that reduce water supply impacts and allow more water to be stored in reservoirs at the outset of Plan implementation. The magnitude of hydropower effects and energy effects under the starting point for the regulatory pathway would likely be less than those described in Section 7.8 and could be similar to those under the Low Flow Alternative due to these refinements, and therefore, effects on hydropower revenues could be less than those described in Section 7.8 and more similar to those under the Low Flow Alternative. However, because the water supply adjustments could be modified after initial implementation and flows could be higher in the range of unimpaired flow in the future on some or all tributaries, impacts could also be as high as those identified in Section 7.8.

To the extent that hydropower generation changes in both overall quantity and timing, there may be an associated change in the use of other energy generators, particularly natural gas-powered facilities to either increase or decrease in operation during the year to balance supply with demand needs for energy. This could result in some additional economic effects associated with energy production costs.

13.8.6 Costs Associated with Other Water Management Actions, Habitat Restoration and Other Ecosystem Projects, and New and Modified Facilities

As discussed in Section 13.7.1, *Approach*, the evaluation of reasonably foreseeable methods of compliance and response actions that may be taken in response to the project are organized into the following categories: (1) changes in hydrology, (2) changes in water supply, (3) habitat restoration and other ecosystem projects, and (4) new or modified facilities that involve construction. This section provides information on costs associated with other water management actions, costs associated with habitat restoration and other ecosystem projects, and costs associated with new or modified facilities. Other water management actions, habitat restoration and other ecosystem projects, and new and modified facilities are categories of reasonably foreseeable methods of compliance and response actions for which the environmental impact mechanisms and impact conclusions would be the same, similar, or somewhat less under the revised proposed Plan amendments and are therefore not repeated in Section 13.7. Section 13.7.1 explains slight variations under the regulatory and VA pathways due to reduced water supply impacts; however, these actions would still be expected to occur in response to changes in hydrology and water supply and could result in potentially significant impacts. This same conclusion would apply for implementation of

the VA pathway for HRL water rights and the regulatory pathway for non-HRL water rights for the term of the VA pathway. Because the potential combination of future actions such as other water management actions and development of new or modified water facilities is unknown, the costs for these actions are discussed generally.

13.8.6.1 Costs Associated with Other Water Management Actions

In response to reduced Sacramento/Delta surface water supplies, water users may choose to modify their water supply portfolios by increasing the use of other sources of water and maximizing the use of existing water supplies. These other water management actions include groundwater storage and recovery, water transfers, water recycling, and water conservation. A description of these other water management actions, including state-wide trends and regional observations, is provided in Section 6.6, *Other Water Management Actions*.

This section summarizes the potential costs for implementation and operation and maintenance of other water management actions as described in Section 8.3, *Costs Associated with Other Water Management Actions*. Actual costs may vary among projects.

Table 13.8-4 provides a summary of other water management actions and the relative cost information for each type. Costs for construction of new and modified facilities are discussed below in Section 13.8.6.3, *Costs Associated with New and Modified Facilities*.

Table 13.8-4. Summary of Other Water Management Actions and Relative Cost Information

Other Water Management Action Type	Cost Information
Groundwater Use	• Groundwater pumping operations and maintenance costs can vary from approximately $100 to $1,000 per AF but are typically less than $200 per AF.
Groundwater Storage and Recovery	• Total cost of a stormwater capture system can vary based on required well depth and the quality of receiving water that must be treated. Recent estimates for a larger scale (over 6,000 AF) system are approximately $590 per AF, with estimates ranging from $500 to $1,000 per AF depending on scale. • A recent study focused on stormwater capture found the median cost of urban projects to be $1,180 per AF.
Water Transfers	• The market price for transferred water can vary widely and is affected by available seller supply and buyer need, supply reliability, transaction volume, duration of lease, location of both seller and buyer, and available transport infrastructure. Municipal purchasers generally pay higher prices to acquire water than other users. • An analysis of transactions demonstrates some regional differences in terms of observed market prices. • In the Sacramento River watershed, historical prices (dating to 2007) averaged around $100 per AF, but were over $500 per AF in 2014 and 2015.
Water Recycling	• Non-potable recycling ranges in cost from $1,500 to $2,100 per AF. • A large-scale indirect potable reuse project (more than 10,000 AF/yr) is similar in cost at $1,600 to $2,000 per AF, and a smaller-scale project can average about $2,300 per AF.

Other Water Management Action Type	Cost Information
Desalination	• Seawater desalination has a median cost of $2,100 per AF for large projects and $2,800 per AF for smaller projects. • Brackish water desalination has a median cost of $1,100 to $1,600 per AF.
Water Conservation and Water Efficiency Measures	• The cost of agricultural water conservation measures varies by scale and scope. Examples of projects related to on-farm irrigation efficiency, improved water transport, and agricultural water re-use summarized in Section 8.3 of the Staff Report identify costs ranging from $471,251 - $3.6 million. • A recent study found that urban water conservation and efficiency are the most cost-effective ways to meet current and future water needs, as compared to developing alternative water supplies. Residential landscape conservation could result in net cost savings of $2,600 - $4,500 per AF. Clothes washers ($190 to $760 in cost savings per AF) and toilets ($190 to $630 saved) are the next highest savings measures by volume. Showerhead conversion would save $2,800 to $3,000 per AF.

AF = acre-foot
Source: Section 8.3, *Costs Associated with Other Water Management Actions*

13.8.6.2 Costs Associated with Habitat Restoration and Other Ecosystem Projects

Section 8.8, *Costs Associated with Habitat Restoration and Other Ecosystem Projects*, in the final Staff Report provides information on relative costs associated with implementing habitat restoration and other ecosystem projects. The actual cost for specific actions can vary widely depending upon local needs, scale of facilities, and type of activity performed. The costs associated with ecosystem projects include outlays of funds for materials and devices, equipment, construction services, transportation, labor, and professional services needed to plan, place, construct, and implement the project. Once in place, the ecosystem projects may require ongoing operation and periodic maintenance, with associated material costs over time. Ecosystem projects may also include monitoring and adaptive management components that may result in additional costs. However, habitat restoration and other ecosystem projects may also result in beneficial economic effects, such as from visitors to these sites. Ecosystem projects have both implementation and ongoing costs that must be acknowledged in consideration with the biological benefits such ecosystem projects would provide.

Table 13.8-5 provides a summary of habitat restoration and other ecosystem projects and relative cost information provided in Section 8.8.

Table 13.8-5. Summary of Habitat Restoration and Other Ecosystem Projects and Relative Cost Information

Project Type	Purpose	Cost Information
Physical Habitat Restoration	Restore tidal, floodplain, and riparian habitats to improve hydrologic connectivity	• Varies significantly depending on size and complexity but is typically on the order of millions of dollars
Fish Passage Improvements	Facilitate fish to pass dams and other barriers and improve survival rate of anadromous fish	• Fish Screens: $5,000 to $80,000 for capital cost, plus $5,000 to $9,500 per cfs in O&M • Fishways: highly dependent on the design, but is typically on the order of millions of dollars • Temperature Control Devices: *example project*: Whiskeytown Reservoir Temperature Control Project for $3 million • Dam Removal: varies widely, from $1,000 (small) to $268.8 million (large) per dam
Predatory Fish Control	Remove or limit non-native predators (e.g., bass) that harm native fish	• Direct removal of predators: tends to be less costly than structural changes • Modifications of physical barrier: dependent on the extent of the modifications, from $100,000 to $4.6 million per site
Aquatic Invasive Species Control	Prevent the introduction and control the spread of aquatic weeds that degrade habitat	• Over $46.8 million spent from 2013–2016 across multiple agencies and projects

cfs = cubic foot per second
O&M = Operations and Maintenance
Source: Final Staff Report Section 8.8, *Costs Associated with Habitat Restoration and Other Ecosystem Projects*

Under the starting point for the regulatory pathway (55 w/WSAs), the costs to implement habitat restoration and other ecosystem projects could be less compared with the proposed Plan amendments if habitat restoration and other ecosystem projects are not implemented in the Sacramento/Delta watershed, or more if the lower numeric inflow requirement resulting from water supply adjustments leads to an overall greater dependence on habitat restoration and other ecosystem projects to improve conditions for native fish. In either case, individual project costs would remain similar to those identified in Table 13.8-5 above.

Under the VA pathway, costs to implement habitat restoration and other ecosystem actions and related activities are identified in the memorandum of understanding (MOU) proposing HRL commitments. Appendix 3 of the MOU proposing HRL commitments identifies that the total cost for implementing the VA pathway is $2,589 million. The MOU proposing HRL commitments identifies funding sources from the state of California, the federal government, and public water agencies. Some of the funding sources are identified as secured funding sources, and some funding sources are identified as unsecured.

13.8.6.3 Costs Associated with New and Modified Facilities

Section 8.9, *Costs Associated with New or Modified Facilities*, in the final Staff Report provides information regarding the costs to modify or build new or modified dams/reservoirs and points of diversion; groundwater wells and groundwater storage and recovery projects; and new or modified drinking water treatment plants including desalination plants and wastewater treatment plants

(WWTPs). Table 13.8-6 provides a summary of new or modified facilities and relative cost information from Section 8.9.

Actual project costs may vary widely depending on technology, location, and capacity.

Table 13.8-6. Summary of New or Modified Facilities and Relative Cost Information

Project Type	Purpose	Capital Cost Information
New or Modified Existing Reservoirs and Points of Diversion	Increase storage and improve water supply reliability	• Reservoirs: $580 to $2,200 per AF; average ~$1,224 per AF. • Points of Diversion: *example project*: $11.3 million for a water intake on the Willamette River (Oregon) and $11.4 million for a river intake pump station on the Clackamas River
Drinking Water Treatment Plants	Treat raw water to produce water that meets drinking water standards	• Varies depending on capacity and treatment technology but is typically on the order of millions of dollars • Desalination (ocean water): $2,100–$2,800 per AF • Desalination (brackish water): $1,100–$1,600 per AF
Wastewater Treatment Plants Water Recycling Facilities	Treat and recycle wastewater for non-potable and potable use	• Non-potable recycling: $1,500–$2,100 per AF • Large-scale indirect potable reuse: $1,600–$2,000 per AF • Small-scale indirect potable reuse: $2,300 per AF
Groundwater Wells, Storage and Recovery	Supplement water supply and facilitate conjunctive use	• Municipal Wells: $1.0–$1.2 million per well • Agricultural Wells: $260,000–$750,000 (median $363,000) per well • Domestic Wells: $3,250–$87,000 (median $20,000) per well • Groundwater Storage & Recovery: $305–$887 per AF (average $576 per AF) • Deepening of existing wells: $35–$84 per foot

AF = acre-foot
Cost information cited as published. When costs were used in the Municipal Water Supply Economic Effects analysis (see Section 8.5 and Appendix D), the costs were adjusted to 2022 dollars using the published Bureau of Labor Statistics Consumer Price Index (CPI-U).
Source: Final Staff Report Section 8.9, *Costs Associated with New or Modified Facilities*

Changes in surface water supply under the starting point for the regulatory pathway (55 w/WSAs) would be expected to be smaller than those under the 55 scenario described in Chapter 6. Therefore, the increased use or accelerated development of new and modified facilities would likely be less under the starting point for the regulatory pathway and the VA pathway compared to the 55 scenario. However, construction of larger water supply projects (e.g., new storage reservoirs, desalination plants) that could occur as a response to changes in water supply would result in the same types of project costs as under the 55 scenario and summarized above in Table 13.8-6.

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